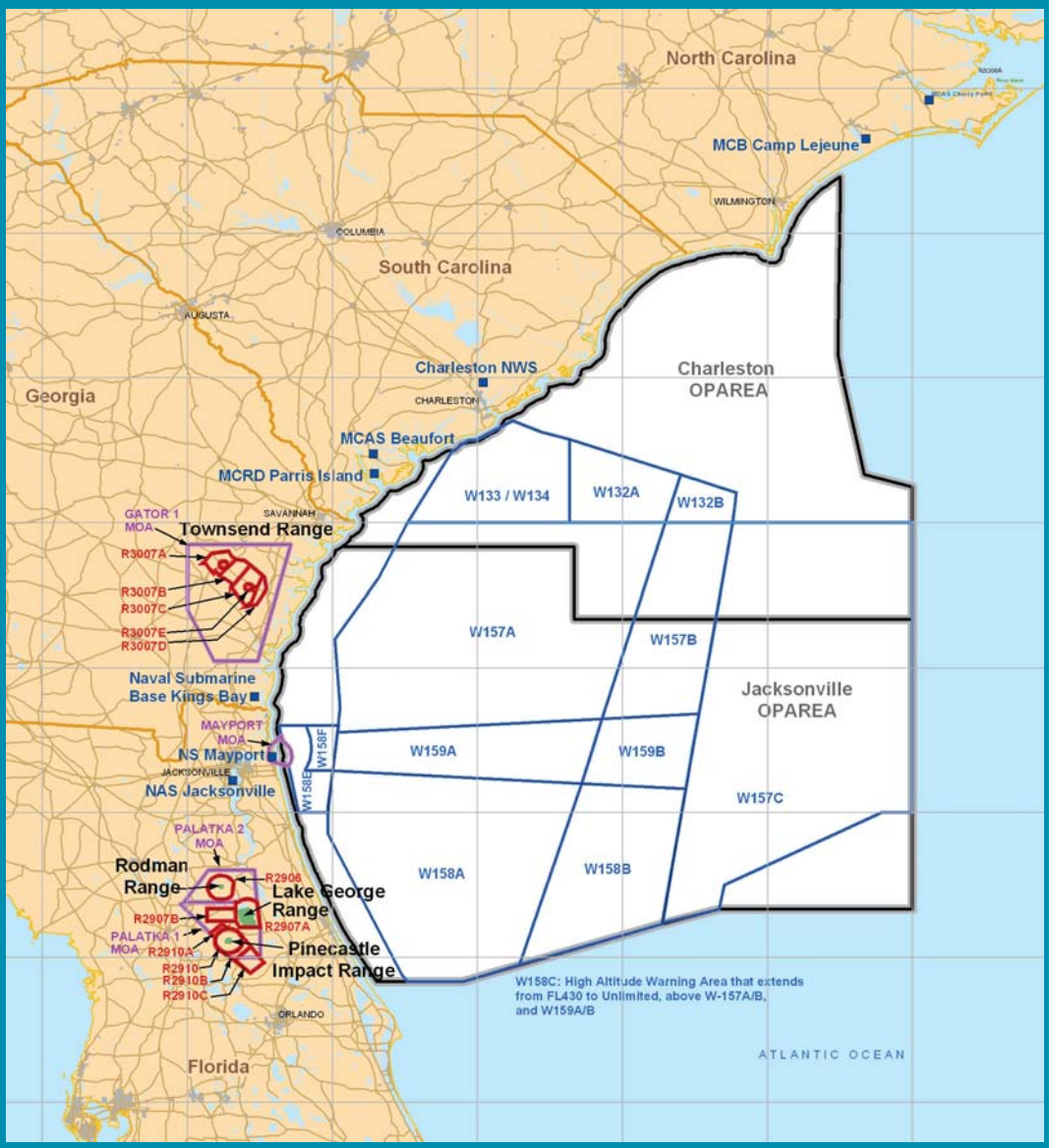
Jacksonville Range Complex Final Environmental Impact Statement/ Overseas Environmental Impact Statement (EIS/OEIS) Volume 1



Prepared by:

United States Fleet Forces

March 2009

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JACKSONVILLE RANGE COMPLEX
FINAL ENVIRONMENTAL IMPACT STATEMENT/ OVERSEAS ENVIRONMENTAL IMPACT STATEMENT

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Abstract:

The Department of the Navy has prepared this Final Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to assess the potential environmental impacts over a 10-year planning horizon associated with Navy Atlantic Fleet training; research, development, testing, and evaluation activities; and associated range capabilities enhancements in the Jacksonville (JAX) Range Complex. The Study Area is composed of the Jacksonville and Charleston operating areas, mean high tide shoreline to three nautical miles offshore, and two inland ranges - Lake George Range and Rodman Range. The potential effects to physical, biological, and man-made environments from the testing and training alternatives were studied to determine how the proposed action could affect these resources. The National Marine Fisheries Service is a Cooperating Agency for this EIS/OEIS.

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LIST OF ACRONYMS AND ABBREVIATIONS

A-A	Air-to-Air
A-G	Air-to-Ground
A-S	Air-to-Surface
AAOC	Associated Area of Concern
AIC	Air Interceptor Control
ACM	Air Combat Maneuvering
AEAU	Alternative Energy and Alternate Use
AFAST	Atlantic Fleet Active Sonar Training
AGL	Above-Ground Level
AIC	Air Intercept Control
AICUZ	Air Installation Compatible Use Zone
ALMDS	Airborne Laser Mine Detection System
AMNS	Airborne Mine Neutralization System
AMW	Amphibious Warfare
AQCR	Air Quality Control Region
ASMFC	Atlantic States Marine Fisheries Commisssion
ASW	Anti-Submarine Warfare
ATC	Air Traffic Control
AUTEC	Atlantic Undersea Test and Evaluation Center
AW	Air Warfare
BDU	Bomb Dummy Unit
BO	Biological Opinion
BOMBEX	Bombing Exercise
CAA	Clean Air Act
CAS	Commercial Air Services
CATEX	Categorical Exclusion
CEQ	Council on Environmental Quality
CETAP	Cetacean and Turtle Assessment Program
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFFC	Commander, United States Navy Fleet Forces Command
CFR	Code of Federal Regulations
CG	Cruiser
CHRIMP	Consolidated Hazardous Material Reutilization and Inventory Management Program
CFMETR	Canadian Forces Maritime Experimental and Test Range
CIWS	Close-In Weapon System
CNA	Center for Naval Analysis
CNAF	Command Naval Air Force
COMPTUEX	Composite Training Unit Exercise
CNO	Chief of Naval Operations
CSAR	Combat Search and Rescue
CSB	Cape San Blas
CSG	Carrier Strike Group
CVN	Nuclear Aircraft Carrier
CVW	Carrier Air Wing
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
CZMP	Coastal Zone Management Plan
dBA	Decibel (A-Weighted)
dBP	Decibel (peak sound level)
dd	Distance Doubled
DDG	Guided Missile Destroyer
DENR	Department of Environment and Natural Resources
DEQ	Department of Environmental Quality
DNL	Day-Night Average Sound Level
DMA	Dynamic Management Area
DoD	Department of Defense
DoN	Department of the Navy
EA	Environmental Assessment
EC	Electronic Combat
EEZ	Exclusive Economic Zone
EFD	Energy Flux Density
EFH	Essential Fish Habitat
EFHA	Essential Fish Habitat Assessment
EGTTR	Eglin Gulf Test and Training Range
EIS	Environmental Impct Statement
EMATT	Expendable Mobile ASW Training Target
EO	Executive Order
EOD	Explosive Ordnance Disposal
ESA	Endangered Species Act
ESG	Expeditionary Strike Group
EW	Electronic Warfare
EWS	Early Warning System
FAA	Federal Aviation Administration
FAC	Fast Attack Craft
FACSFAC	Fleet Area Control and Surveillance Facility
FEIS	Final Environmental Impact Statement
FERC	Federal Energy Regulatory Commission
FFG	Frigate
FFWCC	Florida Fish and Wildlife Conservation Commission
FIAC	Fast Inshore Attack Craft
FIP	Federal Implementation Plan
FIREX	Firing Exercise
FMP	Fishery Management Plan
FNAI	Florida Natural Areas Inventory
FRTP	Fleet Response Training Plan
FRP	Fleet Response Plan
ft	Feet
FY	Fiscal Year
GBU	Guided Bomb Unit
GTFP	Green Turtle Fibropapillomatosis
GUNEX	Gun Exercise
HE	High Explosive
HFAS	High-frequency Active Sonar
HITS	Historical Temporal Shipping
Hz	Hertz
ICMP	Integrated Comprehensive Monitoring Program
IEER	Improved Extended Echo Ranging

IFR	Instrument Flight Rules
IMPASS	Integrated Maritime Portable Acoustic Scoring and Simulator System
IP	Implementation Plan
ISR	Intelligence, Surveillance and Reconnaissance
ISTT	Improved Surface Tow Target
ITA	Incidental Take Authorization
ITS	Incidental Take Statement
IWC	International Whaling Commission
JASSM	Joint Air to Surface Stand off Missile
JAX	Jacksonville
JTFEX	Joint Task Force Exercise
kg	Kilogram
kHz	Kilohertz
lbs	Pounds
L_{dn}	Day-Night Average Sound Level (Formula Version)
L_{dnmr}	Onset-Rate Adjusted Monthly Day-Night Average Sound Level
L_{eq}	1 Second Averaged Equivalent Sound Level
LFA	Low Frequency Active
LHD	Amphibious Assault Ship
LIDAR	Light Detection and Ranging
LNG	Liquid Natural Gas
LSD	Dock Landing Ship
MARPOL	International Convention for the Prevention of Pollution from Ships
MBTA	Migratory Bird Treaty Act
MCM	Mine Countermeasures
MCAS	Marine Corps Air Station
MCB	Marine Corps Base
µg/L	Micrograms Per Liter
µPa	MicroPascals
mg/L	Milligrams per Liter
MEM	Military Expended Material
MFAS	Mid-frequency Active Sonar
MINEX	Mining Exercise
MIO	Maritime Interception Operation
MISSILEX	Missile Exercise
MIW	Mine Warfare
MLTR	Multi-Mission Maritime Aircraft
mm	Millimeter
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
MMO	Marine Mammal Observer
MOA	Military Operating Area
mph	Miles per Hour
MRA	Marine Resource Assessment
MS	Maritime Security
MSAT	Marine Species Awareness Training
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
MSR	Mobile Sea Range
MTE	Major Training Exercise
MU	Management Unit
NAAQS	National Ambient Air Quality Standards
NAS	Naval Air Station
NASA	National Aeronautics and Space Administration
Navy	Department of the Navy; U.S. Navy
NAWQC	National Ambient Water Quality Criteria
NDAA	National Defense Authorization Act
NEPA	National Environmental Policy Act
NEPM	Non-explosive Practice Munition
NEW	Net Explosive Weight
NHPA	National Historic Preservation Act
nm	Nautical Miles
nm^2	Square Nautical Miles
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NODE	Navy OPAREA Density Estimate
NOI	Notice of Intent
NOTAM	Notice-to-Airmen
NOTMAR	Notice-to-Mariners
NPDES	National Pollution Discharge Elimination System
NRC	National Research Council
NRHP	National Register of Historic Places
NSW	Naval Special Warfare
OAML	Oceanographic and Atmospheric Master Library
OASIS	Organic Airborne Surface Influence Sweep
OCE	Officer Conducting the Exercise
OCS	Outer Continental Shelf
OEA	Overseas Environmental Assessment
OEIS	Overseas Environmental Impact Statement
OMCM	Organic Mine Countermeasures
OOD	Officer of the Deck
OPAREAs	Operating Areas
OPFOR	Opposition Force
OPNAVINST	Chief of Naval Operations Instruction
Pa	Pascals
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyls
PIR	Pinecastle Mission Area
PL	Public Law
pm	Particulate matter
PMAR	Primary Mission Area
ppb	Parts per Billion
ppm	Parts per Million
ppt	Parts per Thousand
psf	Pounds per Square Foot
PSW	Precision Strike Weapons
R&D	Research and Development
RAICUZ	Range Air Installation Compatible Use Zone
RAMICS	Rapid Airborne Mine Clearance System
RCD	Required Capabilities Document
RCMP	Range Complex Management Plan
RCRA	Resource Conservation and Recovery Act
RDT&E	Research, Development, Test and Evaluation

RDX	Rapid-Detonating Explosive
RF	Radio Frequency
ROD	Record of Decision
RSG	Range Sustainability Group
RSO	Range Safety Official
S-A	Surface-to-Air
SAB	South Atlantic Bight
SAFMC	South Atlantic Fishery Management Council
SCECAP	South Carolina Estuarine and Coastal Assessment Program
SDB	Small Diameter Bomb
SEL	Sound Exposure Level
SEPTAR	Seaborne Powered Target
SESEF	Shipboard Electronic Systems Evaluation Facility
SFA	Sustainable Fisheries Act
SINKEX	Sinking Exercise of Surface Targets
SMA	Seasonal Management Area
SOP	Standard Operating Procedure
SPL	Sound Pressure Level
SR	State Route
SRI	Santa Rosa Island
S-S	Surface-to-Surface
SSBN	Ballistic Nuclear Submarine
SSC	Naval Warfare Systems Center
SSG	Surface Strike Group
SSN	Nuclear Submarine
SST	Sea Surface Temperature
STW	Strike Warfare
SUA	Special Use Airspace
SURTASS	Surveillance Towed Array Sensor System
SUW	Surface Warfare
SVP	Seasonal Sound Velocity Profile
TALD	Tactical Air-Launched Decoy
TAP	Tactical Training Theater Assessment and Planning
TRIMS	Target and Range Information System
TTS	Temporary Threshold Shift
ULT	Unit Level Training
UNDET	Underwater Detonation
U.S.	United States
USAF	United States Air Force
USACE	United States Army Corp of Engineers
USE	Uncommon Stranding Event
U.S.C.	United States Code
USCB	U.S. Census Bureau
USCG	United States Coast Guard
USCOP	U.S. Commission on Ocean Policy
USEPA	U.S. Environmental Protection Agency
USFF	United States Fleet Forces
USFWS	United States Fish and Wildlife Service
USMC	United States Marine Corps
USWTR	Undersea Warfare Training Range
VACAPES	Virginia Capes
VAST	Virtual At-Sea Training
VBSS	Visit, Board, Search, and Seizure
VFR	Visual Flight Rules
WFF	Wallops Flight Facility
WRSEPA	Water Range Sustainability Environmental Program Assessment
XBT	Expendable Bathythermograph
ZOI	Zone of Influence

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EXECUTIVE SUMMARY

The United States (U.S.) Department of the Navy (DoN, Navy) has prepared this Final Environmental Impact Statement (FEIS)/Overseas Environmental Impact Statement (OEIS) to assess the potential environmental impacts over a 10-year planning horizon associated with Navy Atlantic Fleet training; research, development, testing, and evaluation (RDT&E) activities; and associated range capabilities enhancements in the Jacksonville and Charleston operating areas (OPAREAs), inland ranges and associated airspace, hereafter referred to as the Jacksonville (JAX) Range Complex. The JAX Range Complex geographically encompasses offshore, near-shore, and onshore OPAREAs, ranges, and special use airspace (SUA). Components of the JAX Range Complex encompass 50,090 square nautical miles (nm^2) of sea space and 62,596 nm^2 of SUA off the coasts of North Carolina, South Carolina, Georgia, and Florida, as well as 20 square miles of inland range area in north-central Florida. The geographic scope of this EIS/OEIS includes the airspace; seaspace; and undersea space of the JAX Range Complex, including the area from the mean high tide line, up to and extending seaward from the 3 nm western boundary of the OPAREAs, hereafter referred to as the JAX Study Area. Also included are the inland ranges and associated Restricted Airspace of the Rodman Range and Lake George Range (Figure ES-1).

This FEIS/OEIS has been prepared by the Navy in accordance with the National Environmental Policy Act (NEPA) of 1969 (42 United States Code [U.S.C.] § 4321); the Council of Environmental Quality (CEQ) Regulations for implementing the procedural provisions of NEPA (Title 40 Code of Federal Regulations [CFR] Parts 1500-1508); Department of the Navy Procedures for Implementing NEPA (32 CFR 775); Executive Order (EO) 12114, *Environmental Effects Abroad of Major Federal Actions*; and Department of Defense (DoD) regulations implementing EO 12114 (32 CFR Part 187). The proposed action requires analysis of potential impacts within and outside U.S. territory; therefore, this document was written to satisfy the requirements of both NEPA and EO 12114. The Navy has made changes to this FEIS/OEIS based on comments received during the public comment period. These changes included factual corrections, additions to existing information, and improvements or modifications to the analyses presented in the Draft EIS/OEIS. None of the changes between the Draft and Final EIS/OEIS resulted in substantive changes to the proposed action, alternatives, or the significance of the environmental consequences of the proposed action. There were additional revisions, which are reflected in this Final EIS/OEIS, that were made to amplify information previously provided. These changes included a more detailed description of Maritime Security Operations, the addition of Air to Air Gunnery and Surface to Air Missile exercises to the proposed action, refined acoustic modeling (and harassment totals) for effects resulting from anti-swimmer grenades, and more detailed weapon system data sheets located in Appendix E.

In accordance with 50 CFR § 401.12 the Navy has prepared a separate Biological Evaluation to assess the potential effects from the proposed action on marine resources and anadromous fish protected by the National Marine Fisheries Service (NMFS) under the Endangered Species Act (ESA). In accordance with the Marine Mammal Protection Act (MMPA) (16 U.S.C. §1371[a][5]), the Navy has submitted a request for Letter of Authorization to the NMFS for the incidental taking of marine mammals by the proposed action. The Navy has prepared a separate Consultation Package in accordance with legal requirements set forth under regulations implementing Section 7 of the ESA (50 CFR Part 402; 16 U.S.C § 1536 (c)) for listed species under jurisdiction of the U.S. Fish and Wildlife Service (USFWS). There were additional revisions, which are reflected in this final EIS/OEIS, that were made to amplify information

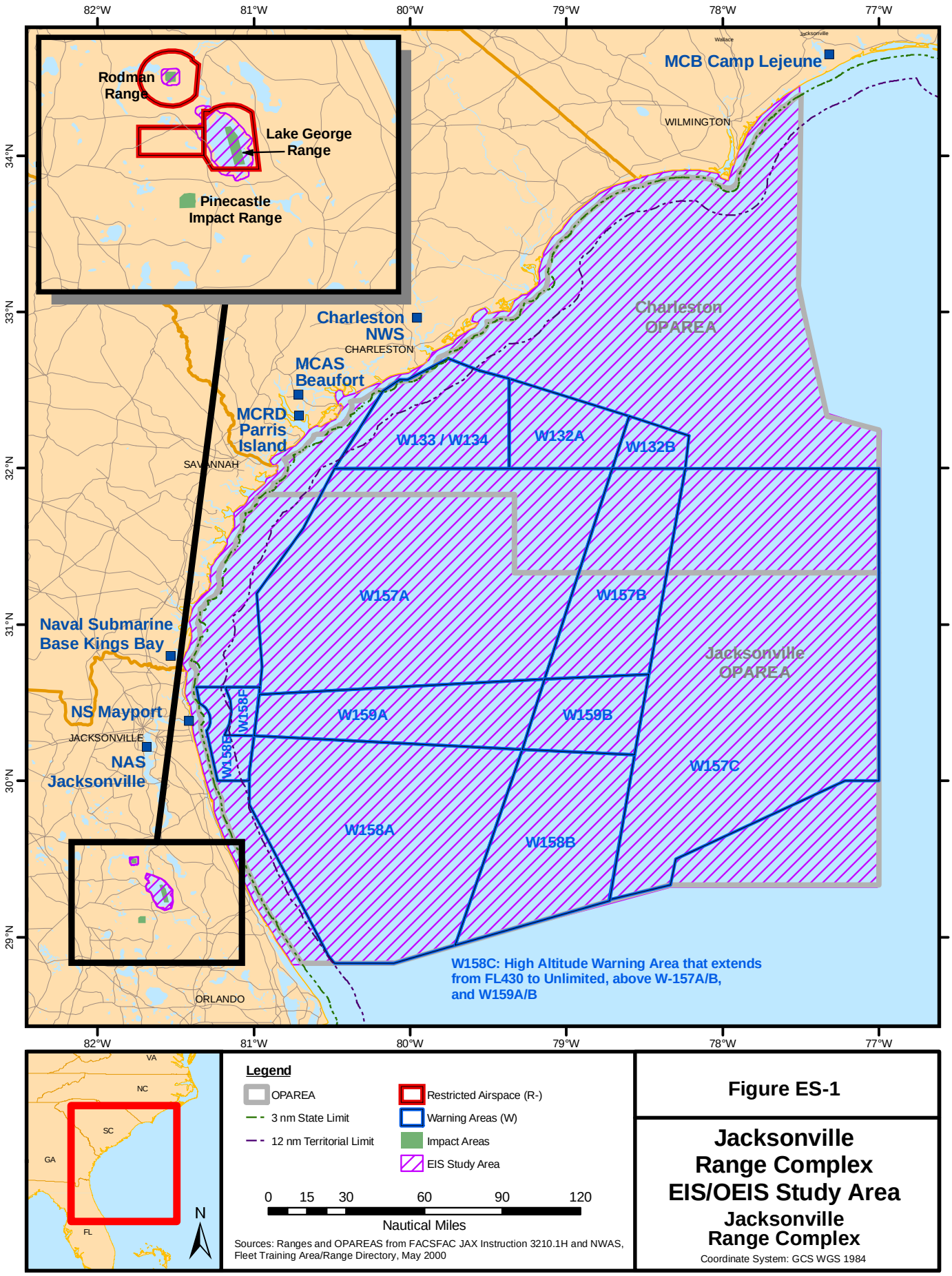

Figure ES-1

Jacksonville Range Complex EIS/OEIS Study Area

Jacksonville Range Complex

Coordinate System: GCS WGS 1984

previously provided. These changes included a more detailed description of Maritime Security Operations, the addition of Air to Air Gunnery and Surface to Air Missile exercises to the proposed action, refined acoustic modeling (and harassment totals) for effects resulting from Anti Swimmer Grenades, and more detailed Weapon System data sheets located in Appendix E.The Record of Decision for this FEIS/OEIS will address any additional mitigation measures which may result from these ongoing regulatory processes.

ES 1.0 Purpose and Need

The purpose for the proposed action is to:

- Achieve and maintain Fleet readiness using the JAX Range Complex to support and conduct current, emerging, and future training operations and RDT&E operations to support the requirements of the Fleet Response Training Plan (FRTP);
- Expand warfare missions supported by the JAX Range Complex; and
- Upgrade and modernize existing range capabilities to enhance and sustain Navy training and RDT&E.

The need for the proposed action is to provide range capabilities for training and equipping combat-capable naval forces ready to deploy worldwide. In this regard, the JAX Range Complex furthers the Navy's execution of its Congressionally mandated roles and responsibilities under Title 10 U.S.C Part 5062. For further information on the purpose and need for the proposed action refer to Chapter 1 of the FEIS/OEIS.

ES 2.0 Description of Proposed Action and Alternatives

The Navy has identified the need to support and conduct current and emerging training and RDT&E operations in the JAX Range Complex. The proposed action does not indicate major changes to JAX Range Complex facilities, operations, training, or RDT&E capacities over the 10-year planning period. Rather, the proposed action would result in relatively small-scale but critical enhancements to the JAX Range Complex that are necessary if the Navy is to maintain a state of military readiness commensurate with its national defense mission.

ES 2.1 Proposed Action

The proposed action is to support and conduct current and emerging training and RDT&E operations in the JAX Range Complex. To achieve this, the Navy proposes to:

- Maintain training and RDT&E operations at current levels if the No Action Alternative is selected.

If either Alternative 1 or Alternative 2 is selected, then:

- Increase or modify training and RDT&E operations from current levels.
- Accommodate mission requirements associated with force structure changes, including those resulting from the introduction of new platforms (aircraft, and weapons systems).
- Implement enhanced range complex capabilities.

The decision to be made by the Assistant Secretary of the Navy (Installations & Environment) is to determine which alternative analyzed in the FEIS/OEIS satisfies both the level and mix of training to be conducted and the range capabilities enhancements to be made within the JAX Range Complex that best meet the needs of the Navy given that all reasonably foreseeable environmental impacts have been considered.

ES 2.2 Alternatives

Alternatives in this FEIS/OEIS were evaluated to ensure they met the purpose and need, giving due consideration to range complex attributes such as: the capability to support current and emerging Fleet tactical training and RDT&E requirements; the capability to support realistic, essential training at the level and frequency sufficient to support the FRTP; and the capability to support training requirements while following Navy Personnel Tempo of Operations guidelines. Three alternatives are analyzed in this FEIS/OEIS:

1. The No Action Alternative – Under the No Action Alternative, training operations and major range events would continue at current levels. Evaluation of the No-Action Alternative provides a credible baseline for assessing environmental impacts of Alternative 1 and Alternative 2 (Preferred Alternative). Vessel movements related to training are part of the proposed action.
2. Alternative 1 – No Action Alternative plus: increase Operational Training, Expand Warfare Missions, Accommodate Force Structure Changes (includes changing weapon systems and platforms and homebasing new aircraft and ships), and implement enhancements, to the minimal extent possible to meet the components of the proposed action. This alternative is composed of all operations currently conducted (No Action Alternative) with modifications to current training or introduction of new training. These would include:

   a) using more commercial aircraft to serve as oppositional forces rather than using Navy aircraft for Air-to-Air Missile Exercise, Surface-to-Air Gunnery Exercises, Air Intercept Control Exercises, and Detect-to-Engage Exercises;

   b) the incorporation of maritime security training into existing training events;

   c) adjusting training levels to ensure that deployment can be stepped up quickly and at multiple locations in response to world events; and

   d) conducting new or modified training associated with the introduction of the new variants of the H-60 helicopter, and new organic mine countermeasure systems.
3. Alternative 2 (Preferred Alternative) – Alternative 1 plus: additional mine warfare training capabilities, and implementation of additional enhancements to enable the range complex to meet future requirements. The Preferred Alternative includes the elimination of high explosive bombs during at sea bombing exercises.

For detailed information on each alternative refer to Chapter 2 of the FEIS/OEIS.

ES 2.3 Alternatives Considered but Eliminated from Further Analysis

Other approaches that were considered but eliminated because they did not meet the purpose and need included:

- No Training Alternative;
- Using alternative range complex locations;
- Conducting simulated training only; and
- Only using practice ammunition within the Jacksonville Range Complex.

These were eliminated from further analysis, because none would be effective in putting into practice the FRTP. Specifically:

- If the Navy did not conduct training exercises along the East Coast, they would not be able to meet its obligations, as identified in Title 10 United States Code, Section 5062.
- The JAX Range Complex is an important component in the available suite of Navy training and testing capabilities. The proximity of the JAX Range Complex to existing naval installations produces important advantages relating to features such as travel times, costs of operations, and personnel tempo of operations that could not be achieved at any other range complex.
- Although simulated training and practice ammunition are widely used, including in many JAX operations, they are no substitute for realistic field conditions. The value of live training provided by actually operating a combat system or handling explosive ammunition cannot be substituted through simulation, particularly as it relates to the physical reaction invoked by the danger, noise, and visual effects associated with these systems. Similarly, individuals and groups must be able to practice and hone their skills in communication, maneuvering, operating systems, repairing equipment, and firing weapons in an environment that is realistic and that replicates the high energy and stress of what they would encounter in an actual combat situation.

ES 3.0 Public Involvement

NEPA requires federal agencies to prepare an EIS for proposed actions that may significantly affect the quality of the human and natural environments. The EIS must disclose significant environmental impacts and inform decision makers and the public of the reasonable alternatives that would avoid or minimize adverse impacts or enhance the quality of the human environment. The Navy is the lead agency for the proposed action. The NMFS is a cooperating agency for this EIS/OEIS.

A notice of intent to develop the Draft EIS/OEIS was published in the Federal Register on January 26, 2007, and in 12 local newspapers in South Carolina, Georgia, and Florida. The newspaper notices were run five times in each newspaper. Four scoping meetings were held (Charleston and Beaufort, South Carolina; Savannah, Georgia; and Atlantic Beach, Florida) for the public to help define and prioritize issues and convey these issues to the agencies through both oral and written comments.

During the scoping process, 13 comments were received; four from government agencies at various levels and nine from non-governmental groups and/or individuals. Commenter's raised concerns about impacts on fish and fishing; harm to cultural resources, marine protected areas, and endangered species; and potential conflicts between boating or shipping and Navy activities. This Draft EIS/OEIS addressed all comments received.

The draft EIS/OEIS was provided to the U.S. Environmental Protection Agency for review and comment in accordance with its responsibilities and to have a notice of availability published in the *Federal Register*. The Navy also placed notices in local newspapers announcing the availability of the draft EIS/OEIS and public hearings. The draft EIS/OEIS was circulated for internal/agency review and made available for general review in public libraries. The public comment period for the draft EIS/OEIS ended on 11 August 2008 and 52 comments were received. Government agencies provided 10 comments, state agencies provided 37 comments, and individuals provided five comments. No comments were received from organizations. This FEIS/OEIS addresses all comments received. For further information refer to Chapter 2.

ES 4.0 Comparison of Alternatives and Effects

The comparison of alternatives presented in Table ES-1 is based on the information and analyses presented in Chapter 3 (Affected Environment and Environmental Consequences). The

environmental stressors associated with each warfare area and operations were evaluated for each resource or issue in assessing potential environmental impacts under each alternative. There were no recordable differences in potential impacts between the alternatives for the following resources and issues.

TABLE ES-1
COMPARISON OF ALTERNATIVES AND EFFECTS

Resource or Issue	Alternatives		
	No Action Alternative	Alternative 1	Preferred Alternative
Marine Communities	Long-term minor impacts to live hard bottom communities from accumulation of NEPM (Section 3.6.3.1)	Slight increase in potential impacts to live hard bottom communities from accumulation of NEPM (Section 3.6.3.2)	Slight increase from Alternative 1 in potential impacts to live hard bottom communities from accumulation of NEPM (Section 3.6.3.3)
Marine Mammals	Under MMPA, no mortality potential exposures, 1,141 non-injurious potential exposures, and 32 injurious exposures. Under ESA, proposed activities may affect listed species (Section 3.7.3.3).	Under MMPA, no mortality potential exposures, 1,159 non-injurious potential exposures, and 31 injurious potential exposures. Under ESA, proposed activities may affect listed species. (Section 3.7.3.4)	Under MMPA, no mortality potential exposures, 94 non-injurious potential exposures, and 2 injurious potential exposures. Under ESA, proposed activities may affect listed species. (Section 3.7.3.5)
Sea Turtles	No mortality potential exposures, 446 non-injurious exposures, and 9 injurious exposures. Under ESA, proposed activities may affect listed species (Section 3.8.3.2).	No mortality potential exposures, 453 non-injurious exposures, and 9 injurious exposures. Under ESA, proposed activities may affect listed species (Section 3.8.3.3).	No mortality potential exposures, 38 non-injurious exposures, and 0 injurious exposures. Under ESA, proposed activities may affect listed species (Section 3.8.3.4).
Fish and Essential Fish Habitat (EFH)	Under MSFCMA, no significant population-level impacts to managed species would occur; impacts would be temporary, minimal, and would not reduce the quality and/or quantity of EFH. Under ESA, underwater explosions may affect one listed species. (Section 3.9.3.1)	Under MSFCMA, no significant population-level impacts to managed species would occur; impacts would be temporary, minimal, and would not reduce the quality and/or quantity of EFH. Under ESA, underwater explosions may affect one listed species. (Section 3.9.3.2)	Under MSFCMA, no significant population-level impacts to managed species would occur; impacts would be temporary, minimal, and would not reduce the quality and/or quantity of EFH. Under ESA, underwater explosions may affect one listed species. (Section 3.9.3.3)

TABLE ES-1 (Continued)
COMPARISON OF ALTERNATIVES AND EFFECTS

Seabirds and Migratory Birds	Under ESA and MBTA, no effect would occur to listed species and no long-term population-level effect would occur to migratory bird populations. (Section 3.10.3.1)	Under ESA and MBTA, no effect would occur to listed species and no long-term population-level effect would occur to migratory bird populations. (Section 3.10.3.2)	Under ESA and MBTA, no effect would occur to listed species and no long-term population-level effect would occur to migratory bird populations. (Section 3.10.3.3)
Biological Resources at Rodman and Lake George Ranges	Under ESA, proposed activities may affect but would not adversely affect listed species. Under MBTA and Eagle Act, no long-term effect would occur to migratory bird populations and no impacts would occur to Bald Eagles. (Section 3.11.3.1)	Under ESA, proposed activities may affect but would not adversely affect listed species. Under MBTA and Eagle Act, no long-term effect would occur to migratory bird populations and no impacts would occur to Bald Eagles. (Section 3.11.3.2)	Under ESA, proposed activities may affect but would not adversely affect listed species. Under MBTA and Eagle Act, no long-term effect would occur to migratory bird populations and no impacts would occur to Bald Eagles. (Section 3.11.3.3)
Atlantic Fleet Active Sonar Training (AFAST)	Potential impacts to resources or issues from AFAST and the Proposed Action combined are less than significant. (Section 3.20)	Potential impacts to resources or issues from AFAST and the Proposed Action combined are less than significant. (Section 3.20)	Potential impacts to resources or issues from AFAST and the Proposed Action combined are less than significant. (Section 3.20)

- Bathymetry, Sediment, and Soils
- Hazardous Materials and Hazardous Waste
- Water Resources
- Air Quality
- Airborne Noise
- Land Use
- Cultural Resources
- Transportation
- Demographics
- Regional Economy
- Recreation
- Environmental Justice
- Public Health and Safety

The potential impacts would generally be temporary, short-term, minor, and/or localized changes to these resources or issues. As defined under NEPA, no significant impacts in U.S. Territory and no significant harm in Non-Territorial Waters to resources or issues were identified considering implementation of mitigation measures described in Chapter 5. In addition, resources were evaluated in accordance with Marine Mammal Protection Act (MMPA). Endangered Species Act (ESA), Migratory Bird Treaty Act (MBTA), Bald and Golden Eagle Protection Act (Eagle Act), and Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA). The potential impacts presented above form the basis for providing choices to the decision maker.

The Atlantic Fleet Active Sonar Training (AFAST) FEIS/OEIS is incorporated by reference in this FEIS/OEIS for active sonar and Anti-Submarine Warfare associated activities as they pertain to the JAX Range Complex. The reader should refer to the AFAST EIS/OEIS (available at http://afasteis.gcsaic.com) for the full description and analysis of active sonar activities along the

East Coast and within the Gulf of Mexico. A summary of the environmental consequences due to sonar activities in the JAX Range Complex is provided by resource area in Section 3.20.

ES 5.0 Mitigation and Monitoring

The Navy recognizes that the proposed action has the potential to impact marine and other resources in the vicinity of training. Chapter 5 describes the Navy's overall mitigation and monitoring approach as well as specific mitigation measures that would be implemented to protect marine mammals, sea turtles, and other resources during training activities. Some of these measures are generally applicable and others are designed to apply to certain geographic areas and/or for specific types of Navy training. Due to the long-term nature of the proposed action, mitigation measures for many elements of the action have been established through previous environmental analyses, consultations, and/or permitting processes.

The Navy believes that a comprehensive approach to mitigation for the JAX Range Complex requires focus on: (1) mitigation by avoidance, in which adverse impacts are avoided altogether by altering the location, design, or other aspect of an activity, and (2) minimization of impacts when avoidance is not feasible. An important complement to the avoidance and minimization of impacts is monitoring to track compliance with take authorizations, impacts on protected resources, and effectiveness of mitigation measures. Taken together, these three elements – avoidance, minimization, and monitoring comprise the Navy's integrated approach to addressing potential environmental impacts.

The Navy is committed to demonstrating environmental stewardship while executing its National Defense Mission and is responsible for compliance with a suite of Federal environmental and natural resources laws and regulations that apply to a wide variety of environments. Consistent with the cooperating agency agreement with the NMFS, mitigation and monitoring measures presented in this FEIS/OEIS focus on the requirements for protection and management of marine resources.

The Navy has provided over $94 million to universities, research institutions, federal laboratories, private companies, and independent researchers around the world. The Navy will continue to fund a significant amount of marine research directly applicable to U.S. Fleet Forces Command training activities.

Two mitigation measures are presented for Rodman Range. The 2005 Integrated Natural Resources Management Plan for Naval Air Station (NAS) Jacksonville includes management actions to provide benefits to threatened and endangered species. The 2006 Gopher Tortoise Management Plan for NAS Jacksonville provides indirect benefits to eastern indigo snake by monitoring the occurrence of burrows on Rodman Range.

Mitigation measures are presented in the FEIS/OEIS for Lake George Range to protect West Indian manatees. The USFWS outlined mitigation measures for the manatee in their concurrence letter dated 7 October 2008 (Appendix C).

ES 6.0 Cumulative Impacts

The proposed action will not make radical changes to the JAX Range Complex facilities, operations, training, or RDT&E capacities. Rather, the actions proposed in alternatives 1 and 2 are incremental increases over the no action alternative that would result in relatively small-scale, but critical, enhancements that are necessary if the Navy is to maintain a state of military readiness commensurate with its national defense mission.

Various types of past and present actions not related to the proposed action have the potential to impact the resources evaluated in this FEIS/OEIS. Twenty projects including, but not limited to,

military activities in other OPAREAs on the Atlantic coast, offshore oil and gas activities along the Atlantic seaboard, maritime traffic, scientific research, and marine ecotourism were analyzed for direct, indirect, and cumulative impacts. The environmental consequences conclusions and incremental contribution and cumulative impacts from past, present, and reasonably future projects and activities for each resource evaluated in this FEIS/OEIS were used in Chapter 6 for summarizing cumulative impacts. Most of the summary conclusions on past, present, and reasonably future actions for the resources evaluated were no adverse impacts and potential for minor, but recoverable, adverse impacts. There were fewer summary conclusions categorized as potential for moderate, but recoverable, adverse impacts. No summary conclusions were characterized as potential for major, non-recoverable, adverse impacts.

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CHAPTER 1 PURPOSE OF AND NEED FOR PROPOSED ACTION

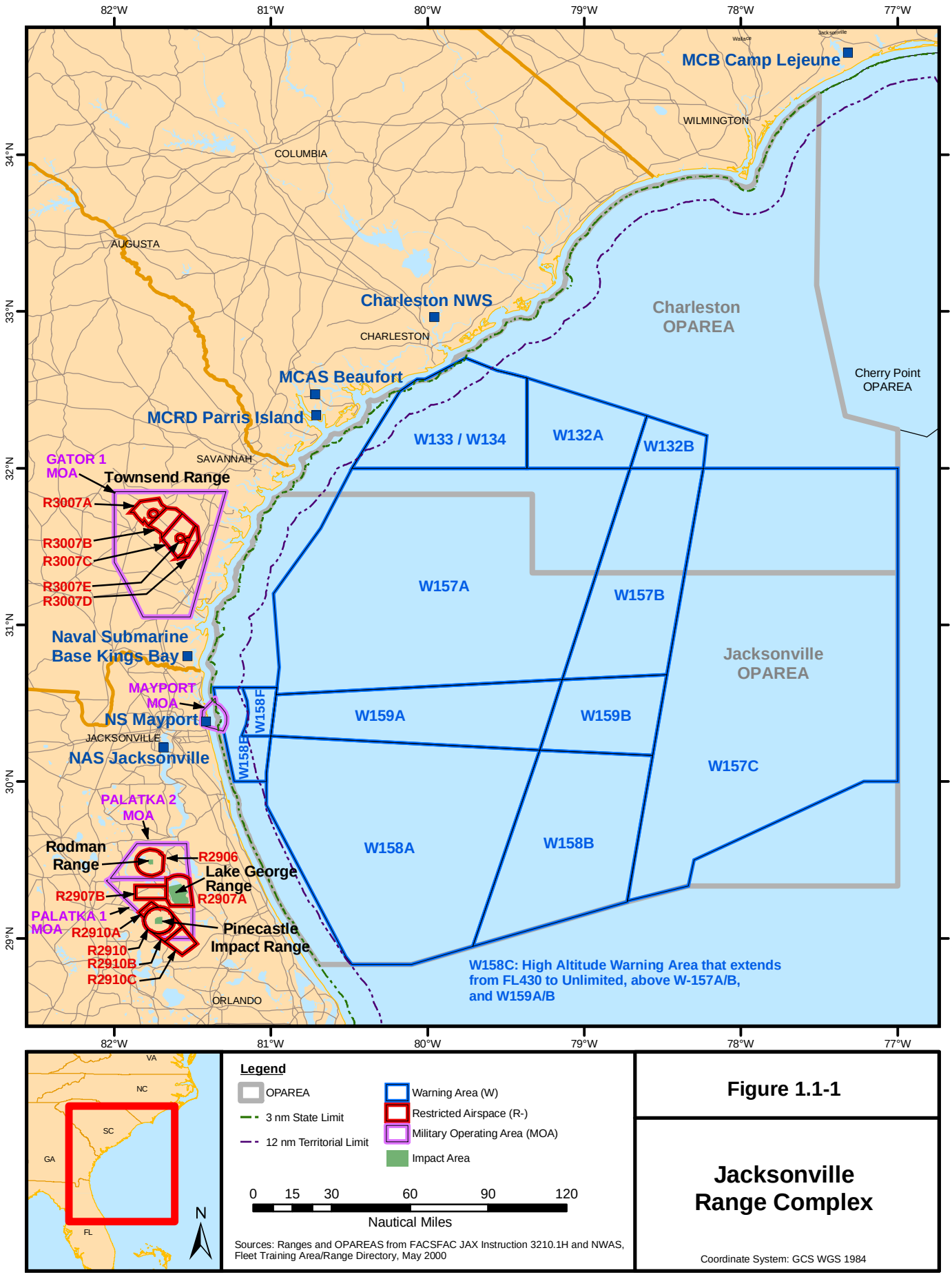
1.1 INTRODUCTION

The United States (U.S.) Department of the Navy (DoN, Navy) has prepared this Final Environmental Impact Statement (FEIS) / Overseas Environmental Impact Statement (OEIS) to assess the potential environmental impacts associated with Navy Atlantic Fleet training; research, development, testing, and evaluation (RDT&E) activities; and associated range capabilities enhancements (including infrastructure improvements) in the Jacksonville and Charleston operating areas (OPAREAs), inland ranges and associated airspace, hereafter referred to as the Jacksonville (JAX) Range Complex. The Navy's mission is to maintain, train, and equip combat-ready naval forces capable of winning wars, deterring aggression, and maintaining freedom of the seas. Title 10 United States Code (U.S.C.) 5062 directs the Chief of Naval Operations to train all naval forces for combat. The Chief of Naval Operations meets that direction, in part, by conducting at-sea training exercises and ensuring naval forces have access to ranges, OPAREAs and airspace where Navy can develop and maintain skills for wartime missions and conduct RDT&E of naval weapons systems. For purposes of this EIS/OEIS, exercises and training do not include combat operations, operations in direct support of combat, or other activities conducted primarily for purposes other than training.

The proposed action is to support and conduct current and emerging training and RDT&E operations in the JAX Range Complex. The decision-maker is to determine both the level and mix of training to be conducted and the range capabilities enhancements to be made within the JAX Range Complex that best meet the needs of the Navy.

The focus of this FEIS/OEIS is the JAX Range Complex airspace, seaspace, undersea space, adjacent shoreline (mean high tide) to the 3 nautical mile (nm) western boundary of the offshore OPAREAs, and inland ranges as depicted in Figure 1.1-1. This complex consists of targets and instrumented areas, airspace, surface OPAREAs, and inland range facilities. The activities analyzed in this FEIS/OEIS include current and future proposed Navy training and RDT&E operations within Navy-controlled OPAREAs, airspace, and ranges, and Navy-funded range capabilities enhancements. The actual study area is further defined in Section 1.5. United States Fleet Forces (USFF) prepared a separate FEIS/OEIS for Atlantic Fleet Active Sonar Training (AFAST) activities along the U.S. east coast and Gulf of Mexico (including the JAX Range Complex) that evaluates the potential impacts of active sonar training on the marine environment. Figure 1.1-2 illustrates the AFAST Study Area as it encompasses all the East Coast range complexes. The analysis in this FEIS/OEIS for active sonar and Anti-Submarine Warfare associated activities as they pertain to the JAX Range Complex is taken from the FEIS/OEIS for AFAST and incorporated into Chapter 3 of this document to assess the impact of the proposed action and other past, present, and reasonably foreseeable actions.

This FEIS/OEIS has been prepared by the Navy in accordance with the National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. § 4321); the Council of Environmental Quality (CEQ) Regulations for implementing the procedural provisions of NEPA (Title 40 Code of Federal Regulations [CFR] Parts 1500-1508); Department of the Navy Procedures for Implementing NEPA (32 CFR 775); Executive Order (EO) 12114, *Environmental Effects Abroad of Major Federal Actions;* and Department of Defense (DoD) regulations implementing EO 12114 (32 CFR Part 187). The provisions of NEPA apply to major federal actions with effects that occur within U.S. territory while EO 12114 applies to major federal actions with effects that occur outside of U.S. territory, including marine waters seaward of the U.S. territorial seas greater than 12 nm offshore. The proposed action requires analysis of potential impacts within and outside U.S. territory; therefore, this document is written to satisfy the requirements of both NEPA and EO 12114.


82°W
81°W
80°W
79°W
78°W
77°W
34°N
33°N
32°N
31°N
30°N
29°N
MCB Camp Lejeune
WILMINGTON
COLUMBIA
AUGUSTA
Charleston NWS
CHARLESTON
Charleston OPAREA
Cherry Point OPAREA
MCAS Beaufort
MCRD Parris Island
SAVANNAH
W133 / W134
W132A
W132B
GATOR 1 MOA
Townsend Range
R3007A
R3007B
R3007C
R3007E
R3007D
W157A
W157B
Naval Submarine Base Kings Bay
Jacksonville OPAREA
MAYPORT MOA
NS Mayport
W158F
W159A
W159B
JACKSONVILLE
NAS Jacksonville
W157C
PALATKA 2 MOA
Rodman Range
R2906
Lake George Range
R2907A
R2907B
W158A
W158B
PALATKA 1 MOA
R2910A
Pinecastle Impact Range
R2910
R2910B
R2910C
ORLANDO
W158C: High Altitude Warning Area that extends from FL430 to Unlimited, above W-157A/B, and W159A/B
VA
NC
SC
GA
FL
N
Legend
OPAREA
3 nm State Limit
12 nm Territorial Limit
Warning Area (W)
Restricted Airspace (R-)
Military Operating Area (MOA)
Impact Area
0 15 30 60 90 120
Nautical Miles
Sources: Ranges and OPAREAS from FACSFAC JAX Instruction 3210.1H and NWAS, Fleet Training Area/Range Directory, May 2000
Figure 1.1-1
Jacksonville Range Complex
Coordinate System: GCS WGS 1984



AFAST Study Area

Figure 1.1-2

Legend

- Range Complex OPAREAs
- Atlantic Fleet Active Sonar Training (AFAST)

N

1:18,580,000

100 50 0 100 200 300 Nautical Miles

150 75 0 150 300 450 Kilometers

Coordinate System: WGS 1984

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1.2 BACKGROUND

The Navy has been training in the area now defined as the JAX Range Complex for national defense purposes for over 60 years. The land, air, sea space, and undersea space of the Complex has and continues to provide a safe and realistic training and testing environment to ensure military personnel are ready to carry out assigned missions in furtherance of its Congressionally mandated duty. The JAX Range Complex is a preferred location for portions of U.S. Atlantic Fleet major training exercises, and provides the training infrastructure and proximity for naval forces homeported in the Jacksonville, Florida area.

1.2.1 Navy Training

1.2.1.1 Navy Operations

The United States maintains its military forces to ensure the freedom and safety of all Americans both at home and abroad. The Preamble of the U.S. Constitution established the principle that the people of the United States will provide for the common defense. Article 1, Section 8 states, "The Congress shall have power to provide for the common defense…provide and maintain a Navy," and "to make rules for the government and regulation of the land and naval forces." To implement these constitutionally mandated duties, Congress provided United States Code Title 10, Section 5062, which states: "The Navy shall be organized, trained and equipped primarily for prompt and sustained combat incident to operations at sea."

The Navy and Marine Corps generally organize their deployed forces into strike groups. The number and composition of individual units comprising a strike group is tailored to meet specific missions and expected threats. A Carrier Strike Group (CSG), consisting of an aircraft carrier and its embarked airwing, several surface combatant ships and submarines, can project power ashore via aircraft or missiles. An Expeditionary Strike Group (ESG), consisting of amphibious ships, surface combatant ships, submarines, and an embarked Marine Expeditionary Unit (MEU),[1] can project power ashore via amphibious landing of men, armor and materiel. Traditionally, a CSG or ESG operates on a two to three-year cycle that begins with major maintenance and work-up training before culminating in a six to eight-month deployment. A Surface Strike Group (SSG), consisting of one to three surface combatant ships for Maritime Security training, is specially organized to conduct a typically short-term, limited objective.

The Joint Chiefs of Staff determine deployment of naval forces based on world-wide requirements and commitments. While the Navy always has several strike groups deployed to provide global naval presence and engagement, the 21st Century security environment has spawned more frequent requests from combatant commanders for additional Navy forces ranging in size from individual units to strike groups. Emergent missions have included major combat, maritime and theater security, homeland defense, support of civil authorities, maritime security/force protection and humanitarian assistance/disaster relief operations. This rapid response of forces to supplement naval forces on routine deployment is referred to as "surge". Surge refers to the capability to quickly deploy Navy assets, sometimes to multiple locations, in response to world events. In order for the Navy to be "surge-ready," it must be able to quickly modify its routine training schedule to allow for earlier certification of units before deploying them.

The Navy developed the Fleet Response Plan (FRP) as a deliberate process to ensure continuous availability of agile, flexible, trained, and ready surge-capable forces. The goal of FRP is a standing

[1] The MEU (Special Operations Capable) is a task organized unit of a type known as a Marine Air Ground Task Force or MAGTF. MAGTFs consist of ground combat, aviation combat, combat logistics, and command and control elements, and vary in size depending on the nature of the intended mission.

ability to deploy six CSGs in a very short time, and one more in stages soon thereafter. FRP addresses all aspects of maintaining these surge-capable Navy forces, including maintenance, manning, deployment schedules, and so on. The JAX Range Complex FEIS/OEIS addresses the training side of FRP—the Fleet Response Training Plan (FRTP), described in more detail below.

1.2.1.2 Why the Navy Trains

Operational requirements for deploying combat ready naval forces world-wide drive and shape training doctrine and procedures. The nature of modern warfare and security operations has become increasingly complex. The threat is global, and the tactics, weapons and forces arrayed against the U.S. military span the gamut from crude to extremely sophisticated. To effectively counter the array of threats, naval forces bring together thousands of sailors and marines, their equipment, vehicles, ships, and aircraft, and often other U.S. services or coalition partners, all of which need to work together as a cohesive team to achieve success. Developing the leadership and management skills to choreograph all these disparate elements, as well as coordinated employment of weapons at the tactical level, requires extensive, challenging training. In particular, modern weaponry presents both tremendous opportunity and challenges. Smart weapons, used properly, are very accurate and actually allow naval forces to accomplish their missions with greater precision and far less destruction than in past conflicts. However, they are very complex and skills honed for optimum employment are perishable. Realistic, regular training provides all elements of the Navy-Marine Corps team, from the individual to the strike group, with the initial combat experience crucial to success and survival in this environment.

The Navy mission in a maritime environment presents unique challenges. CSGs, ESGs and SSGs offer combatant commanders unprecedented flexibility and firepower to defeat or suppress threats world-wide. Naval forces can carry out operations on and below the ocean surface, on land and in the air simultaneously. To optimize all this capability, Navy training activities must focus on achieving proficiency in eight functional areas, known as Primary Mission Areas (PMAR): Air Warfare (AW), Anti-submarine Warfare (ASW), Amphibious Warfare (AMW), Surface Warfare (SUW), Mine Warfare (MIW), Strike Warfare (STW), Electronic Combat (EC), and Naval Special Warfare (NSW). Each training event addressed in the FEIS/OEIS is categorized under one of the PMARs. Appendix D describes each of these PMARs and individual training exercises in greater detail.

1.2.1.3 Fleet Response Training Plan

The Navy designed the FRTP to support the training requirements of a surge-capable fleet that meets FRP goals outlined above. FRTP formalizes the traditional Navy building block approach to training in a way that brings the strike groups to the required level of combat readiness earlier in the training cycle, and sustains that readiness longer. Training proceeds on a continuum, advancing through four phases:

Maintenance Phase is the preferred period during which major shipyard or depot level repair and most personnel turnover occurs. Ships and squadrons will focus on individual and team training. This level of training could involve the aircrew of a single aircraft flying basic instrument or tactics flights, or fire control crews for a ship's anti-aircraft systems employing their weapons in a simulated environment at a weapons school.

Basic Phase continues individual and team training, but the focus shifts to unit level training (ULT), assessment and certification requirements during which all members of the ship or squadron employ their ship or aircraft tactically. This phase is characterized by high volume, short duration individual and unit training exercises. Examples of ULT could include a single destroyer conducting damage control, weapons employment and navigation drills over a two-day underway period, or a two-plane flight of F/A-18s performing defensive maneuvers and weapons delivery training against an opposition force at a nearby bombing range during a two-hour sortie.

Integrated Phase brings all the individual units together as a strike group to synthesize staff actions and coordinate operations in a challenging, multi-warfare environment. Generally, integrated phase training occurs during a limited number of major exercises, each lasting one to four weeks. This phase includes strike group-level assessment and certification prior to deployment. Major exercises for CSGs include multi-ship air defense and anti-submarine warfare exercises, and 10-plane bombing strikes at multiple target sites, all occurring simultaneously in a realistic battle scenario.

Sustainment Phase begins upon completion of the Integrated Phase, lasts through deployment and for several months following return to homeport before the strike group stands down and the individual units begin their maintenance period. Sustainment consists of a variety of training evolutions designed to sustain the combat readiness levels attained in the prior three phases. This phase could include several major training exercises with other U.S. and allied services in a joint/coalition environment, as well as a continuation of individual, unit and integrated level training exercises. A major sustainment exercise could include elements of a CSG and an ESG operating together with units from Air Force and/or allied navies during a 10-day battle problem.

FRTP involves acceleration of the training cycles of multiple strike groups which could entail near-simultaneous execution of similar training events. Deployment schedules must remain flexible and responsive to the nation's security needs. The Navy must ensure that its training areas can support the entire training continuum as needed.

1.2.1.4 Range Complexes

Training must be as realistic as possible in order to provide the experiences important to success and survival. The Navy often employs simulators and synthetic training to provide early skill repetition and to enhance teamwork, but live training in a realistic environment is vital to success. A range complex, such as the JAX Range Complex, is a set of co-located areas of sea space, undersea space, land ranges and overlying airspace designated for military training and testing operations. No single range complex on the east coast can accommodate the entire spectrum of Navy and Marine Corps training and testing. (see Figure 1.1-2) Individual East Coast range complexes serve as "backyard" ranges, supporting Naval forces home based and home ported in multiple locations. Also, the combined capabilities of the VACAPES, Navy Cherry Point, and Jacksonville range complexes are required to support the multiple aspects of integrated, major training events. The result is a system of range complexes, which provides a robust training and testing capability for all naval warfare missions. Range complexes provide a controlled and safe environment with threat representative targets where military ships and aircraft can train in realistic combat-like conditions throughout the graduated buildup needed for combat ready deployment. The integration of undersea ranges and OPAREAs with land training ranges, safety landing fields, and amphibious landing sites are critical to this realism, allowing execution of multi-dimensional exercises in complex scenarios. Also, range instrumentation captures data on the effectiveness of tactics and equipment, providing feedback for constructive criticism. Live-fire training ensures the ability to place ordnance on target with the required level of precision in a stressful environment. Live training, most of it accomplished in the waters off the nation's east and west coasts and the Caribbean Sea, would remain the cornerstone of readiness as the Navy prepares its military forces for a security environment characterized by uncertainty and surprise.

1.2.2 Tactical Training Theater Assessment and Planning Program

In 2004, Commander, U.S. Atlantic Fleet and Commander, U.S. Pacific Fleet funded the Tactical Training Theater Assessment and Planning (TAP) Program to serve as the overarching Fleet training area sustainment program. The purpose of the TAP Program is to support Navy objectives that: 1) promote use and management of ranges (such as the JAX Range Complex) in a manner that supports national security objectives and a high state of combat readiness, and 2) ensure the long-term viability of range assets while protecting human health and the environment. The TAP Program focuses specifically on the

sustainability of ranges, OPAREAs, and SUA that support the FRTP. The TAP Program defined broad geographic areas where the Navy trains, called range complexes. The TAP Program represents the first time the Navy has managed its training areas on a broad, complex-wide basis. One element of the TAP Program is development of the Required Capabilities Document (RCD) (DoN, 2006a), and a companion document, the Range Complex Management Plan (RCMP) (DoN, 2006b). Another TAP Program element is environmental planning documentation (*e.g.*, this EIS/OEIS), which assesses the potential for environmental impacts associated with certain activities/actions conducted within a range complex. These documents are further described below.

The purpose of the RCD is to quantitatively define range complex capabilities required to support Navy mission-essential training in an unconstrained environment over a 10-year planning horizon. The RCD lists range attributes needed to support the eight Navy Primary Mission Areas at three training levels (Basic, Intermediate and Advanced). The RCD uses several factors to determine range capability requirements, including: range attributes, range-related systems; training levels, and Navy Primary Mission Areas.

- Range attributes: These include four range operational elements or training media, namely Airspace, Sea Space, Undersea Space, and Land Area. The geographic breadth of water and land area, water depth and air space needed to conduct specific types of training occurring at the range are detailed in the RCD.
- Range-related systems: These include systems and infrastructure for scheduling, communications, meteorological data, targets, training instrumentation, and opposition force simulation.
- Training levels. Three categories:
  1. Basic, or unit level training, involves a single ship, aircraft, submarine or small unit, not integrated with other operations;
  2. Intermediate training involves integrated expeditionary or carrier strike group or air wing operations as part of a major exercise; and
  3. Advanced training involves multiple strike group and/or services in major, fully integrated, comprehensive and/or joint force exercises.
- PMARs: AW, ASW, AMW, SUW, MIW, STW, EC, and NSW.[2]

The Navy has developed an RCMP for each range complex, including the JAX Range Complex. The RCMP is an integrated sustainment planning and management document that:

- Describes the baseline condition of range complex capabilities, current training and RDT&E operations, environmental documentation/coverage, and encroachment issues;
- Recommends projects and investments based on rigorous assessment of gaps between current range complex capabilities and those required to support the strategic vision; and
- Develops a range complex management structure, outreach plan and investment strategy for long term range sustainment.

RCMPs are developed using the RCD to define the requirements needed to support warfare areas of individual range complexes. The Final Draft RCMP for the JAX Range Complex was completed in 2006. The RCMP iterates the strategic vision for the range complex, which is to provide sustainable and modernized ocean operating areas, airspace, ranges, range infrastructure, training facilities, and resources to fully support Navy training requirements in accordance with the range complex's roles and missions.

[2] A range complex may not provide capabilities for all primary mission areas. The Marine Corps has its own separate RCD that organizes training levels and mission areas differently than the Navy Ranges RCD, but training is conducted in essentially the same way and with a similar outcome.

The roles and missions for the JAX Range Complex include providing training opportunities for six naval warfare mission areas, specifically: AW, SUW, ASUW, MIW, STW, and EC at varying levels of training complexity. RDT&E is conducted in the JAX Range Complex on new aircraft and weapons designed to support each of these six naval warfare missions.

When compared to the Complex's required capabilities, the JAX RCMP (DoN, 2006b) identifies moderate to severe capabilities shortfalls in several warfare mission areas, especially for intermediate and advanced level training. In an attempt to remedy the identified shortfalls, the JAX RCMP makes recommendations for range enhancements, some of which may have an impact on the environment. Those recommended range enhancements that have the potential to impact the environment, as well as current and future training and testing operations that have the potential to impact the environment, are the primary focus of this FEIS/OEIS, and are further described in Chapter 2.

1.3 PURPOSE AND NEED

The purpose for the proposed action is to:

- Achieve and maintain Fleet readiness using the JAX Range Complex to support and conduct current, emerging, and future training operations and RDT&E operations;
- Expand warfare missions supported by the JAX Range Complex; and
- Upgrade and modernize existing range capabilities to enhance and sustain Navy training and RDT&E.

The need for the proposed action is to provide range capabilities for training and equipping combat-capable naval forces ready to deploy worldwide. In this regard, the JAX Range Complex furthers the Navy's execution of its Congressionally mandated roles and responsibilities under Title 10 U.S.C § 5062.

To implement this Congressional mandate, the Navy needs to:

- Maintain current levels of military readiness by training in the JAX Range Complex;
- Accommodate future increases in operational training tempo in the JAX Range Complex and support the rapid deployment of naval units or strike groups;
- Achieve and sustain readiness of ships and squadrons so the Navy can quickly surge significant combat power in the even of a national crisis or contingency operation, and consistent with the FRTP
- Support the acquisition and implementation into the Fleet of advanced military technology. The JAX Range Complex must adequately support the testing and training needed for new platforms (vessels, aircraft and weapons systems); and
- Maintain the long-term viability of the JAX Range Complex while protecting human health and the environment, and enhancing the quality and communication capability and safety of the range complex.

Support to current, emerging, and future training and RDT&E operations, including implementation of range enhancements, entails the actions evaluated in this FEIS/OEIS. These include:

- Increase use of contractor-operated small aircraft that simulate enemy aircraft during training (Commercial Air Services Support for Fleet Opposition Forces and Electronic Warfare Threat Training);
- Increase anti-piracy and maritime interdiction training (Maritime security Surface Strike Group Training);
- Support MH-60R/S helicopter warfare mission areas, and Multi-Mission Maritime Aircraft (MMA) training operations; and
- Conduct MIW training using a temporary mine training area.

1.4 OVERVIEW OF THE JAX RANGE COMPLEX

1.4.1 Summary Description

The JAX Range Complex geographically encompasses offshore, near-shore, and onshore OPAREAs, ranges, and SUA located near the east coast of the United States (see Figure 1.1-1). Together, components of the JAX Range Complex encompass:

- 50,090 nm^2 of sea space;
- 20 square miles of land range area; and
- 62,596 nm^2 of SUA (airspace).

A portion of the JAX Range Complex is not analyzed in this document, as set forth in Table 1.4-1. The specific JAX Range Complex OPAREAs, airspace, and inland ranges addressed in this FEIS/OEIS are also identified in Table 1.4-1. The JAX Range Complex is a portion of the larger AFAST Study Area, depicted in Figure 1.2-1.

TABLE 1.4-1
COMPONENTS OF JAX RANGE COMPLEX

Component Area	Description	Addressed in this FEIS/OEIS?
OPAREAs – Surface Waters	Jacksonville OPAREA: Offshore surface operating area extending southward generally from the Georgia-South Carolina border along the coast of Georgia and Florida for a distance of approximately 200 miles and seaward (east) from approximately 12 nm off the coast for a distance of approximately 250 nm. Charleston OPAREA: Offshore surface operating area extending north-northeast generally from Georgia-South Carolina border along the coast of South Carolina and North Carolina for a distance of approximately 200 miles and seaward (east) from approximately 3 to 12 nm off the coast for varying distances.	Yes
OPAREAs – Subsurface Waters	The subsurface operating area coterminous with the surface waters of the JAX and Charleston OPAREAs, including six submarine transit lanes (Bravo, Zulu, Delta, Foxtrot, Golf, and November).	Yes
Special Use Airspace	SUA: Warning Areas generally overlying the ocean OPAREAs, designated W-132A/B, W-133, W-134, W-157A/B/C, W-158A/B/CE/F, and W-159A/B.	Yes
Navy-operated Land Ranges and Associated SUA	Rodman Range: Air-to-ground training range (non-explosive practice munitions [NEPM] only). Rodman Range includes the SUA designated as R-2906.	Yes
	Lake George Range: Air-to-surface training range (NEPM only). Includes the SUA designated as R-2907 A/B.	Yes
	Pinecastle Impact Range (PIR): Air-to-ground training range (live ordnance and NEPM). PIR includes the restricted SUA designated as R-2910.	No. An EIS has been prepared previously for Navy operations at PIR. The existing EIS is referenced in this JAX Range Complex EIS/OEIS.

TABLE 1.4-1 (Continued)
COMPONENTS OF JAX RANGE COMPLEX

Component Area	Description	Addressed in this FEIS/OEIS?
Other-Service inland ranges and associated SUA – Restricted Airspace	Townsend Range, Georgia, is a U.S. Marine Corps (USMC) range jointly operated by USMC, which operates the land range, the Georgia Air National Guard, which schedules the use of the associated SUA designated as R-3007, and the Navy, which schedules the use of the Coastal MOA encompassing the R-3007 A,B,C,D,E,F airspace.	No. The Marine Corps has responsibility for environmental planning at this range. The Final EA prepared by the Marine Corps is referenced in this JAX Range Complex FEIS/OEIS.
	Avon Park Air Force Range is located in central Florida. The range is owned and operated by the Air Force and is used occasionally by Navy aircraft.	No. Air Force environmental documents will be referenced as appropriate.
	Camp Blanding Training Site - The Florida National guard's primary training area is Camp Blanding, a 73,000-acre facility approximately 20 nm south of Naval Air Station (NAS) Jacksonville. Navy units utilize this facility for a variety of training including; small arms, small boat operations and day and night helicopter flight operations.	No. U.S. Army and Florida Guard environmental documents will be referenced as appropriate.
Shipboard Electronic Systems Evaluation Facility (SESEF)	Navy ships calibrate radar and other electronic equipment within the Northern Right Whale critical habitat in an area referred to as the SESF Range. While utilizing the SESEF facility ships must transit slowly in the vicinity of 30d20', N/081d12'W, approximately 10 miles from shore, to 30d20'N/081d10W, about 13 nm from shore.	Yes. Ships utilizing SESEF emitters and instrumentation will need to remain within radio horizon of the facility, which is located ashore at Naval Station (NS) Mayport.

1.4.2 Mission of the JAX Range Complex

The mission of the JAX Range Complex is to provide sustainable and modernized ocean operating areas, airspace, ranges, range infrastructure, training facilities, and resources to fully support Navy training requirements. The JAX Range Complex provides critical support for Navy operational readiness training and for RDT&E. Training at the JAX Range Complex historically has been diverse, including ship and aircraft maneuvers, gunnery and bombing exercises (BOMBEX), joint training exercises, and RDT&E of new systems or weapons platforms. Numerous commands and their subordinate units across multiple naval warfare areas use the Range Complex. Typical range users include Carrier Strike Groups and Expeditionary Strike Groups, and the component elements of these formations such as naval aviation squadrons, submarine groups, surface forces, and amphibious groups. Less frequent users include Navy commands devoted to specific RDT&E events, and other DoD entities. This FEIS/OEIS considers impacts from typical users of the Range Complex, and also considers less frequent user's training operations similar to typical training activities conducted by principal range users. In addition to its central role in the pre-deployment training of large naval formations, the JAX Range Complex is heavily

utilized as a "backyard" range for advanced and pre-deployment workup training of units with home stations on the southeastern seaboard of the United States. [3]

1.5 SCOPE AND CONTENT OF THE EIS/OEIS

The geographic scope of this FEIS/OEIS (referred to from this point forward as the Study Area) includes the airspace; seaspace; and undersea space of the Jacksonville and Charleston OPAREAs, collectively and Warning Areas, including the area from the mean high tide line, up to and extending seaward from the 3 nm western boundary of the OPAREAs. Also included are the inland ranges and associated Restricted Airspace of Rodman Range and Lake George Range. The Pinecastle Impact Range is a component of the JAX Range Complex not analyzed in this FEIS/OEIS. In 2002, an EIS was prepared for the renewal of authorization to use Pinecastle Impact Range; the Navy is authorized to operate and utilize the range under an Interagency Agreement between the U.S. Department of Agriculture Forest Service, Ocala National Forest, and the Navy. The Navy is preparing a Supplemental EIS (SEIS) to address the modeling effects of the new Range Air Installation Compatible Use Zones (RAICUZ) model and include analysis for the Guided Bomb Units (GBU) and the remaining weapon inventory used. The SEIS is narrowly focused, only assessing the environmental effects and resources at the Pinecastle Impact Range that may have changed as a result of the modeling. The Pinecastle Impact Range EIS and SEIS are incorporated by reference in this FEIS/OEIS (see Section 1.7 for further details).

Figure 1.5-1 depicts the Study Area for this FEIS/OEIS. It is important to note that this FEIS/OEIS will provide an evaluation of current and proposed emerging training and testing activities, force structure (to include new aircraft, vessels, and weapons systems), and associated enhancements as identified in the JAX RCMP.

By Presidential Proclamation 5928, issued December 27, 1988, the United States extended its territorial sea, wherein the United States exercises sovereignty and jurisdiction under international law, from 3 nm to 12 nm in conformity with the United Nations Convention on the Law of the Sea. The Proclamation expressly provides that it does not extend or otherwise alter existing federal law or any associated jurisdiction, rights, legal interests, or obligations. The Proclamation thus did not alter existing legal obligations under NEPA or other federal environmental statutes. As a matter of policy, however, the Navy has elected to apply NEPA to the 12 nm limit established by the Proclamation. Figure 1.1-1 depicts the 12 nm territorial sea established by Presidential Proclamation 5928 as it relates to the JAX Offshore Study Areas.

Impacts to these areas and those portions of the inner sea range within these boundaries are subject to analysis under NEPA. Impacts in the areas outside U.S. territorial waters are analyzed using the procedures set out in EO 12114 and associated implementing regulations.

[3] Access to capable range facilities located in the vicinity of homeports and stations is a critical component of naval readiness. The Navy strives, and in many cases is required by law, to track and where possible limit "personnel tempo," meaning the amount of time our Sailors and Marines spend deployed away from home. Personnel tempo is an important factor in the morale and retention of military personnel and in lessening the impacts to their families. The availability of a "backyard" range is critical to Navy efforts in these areas.

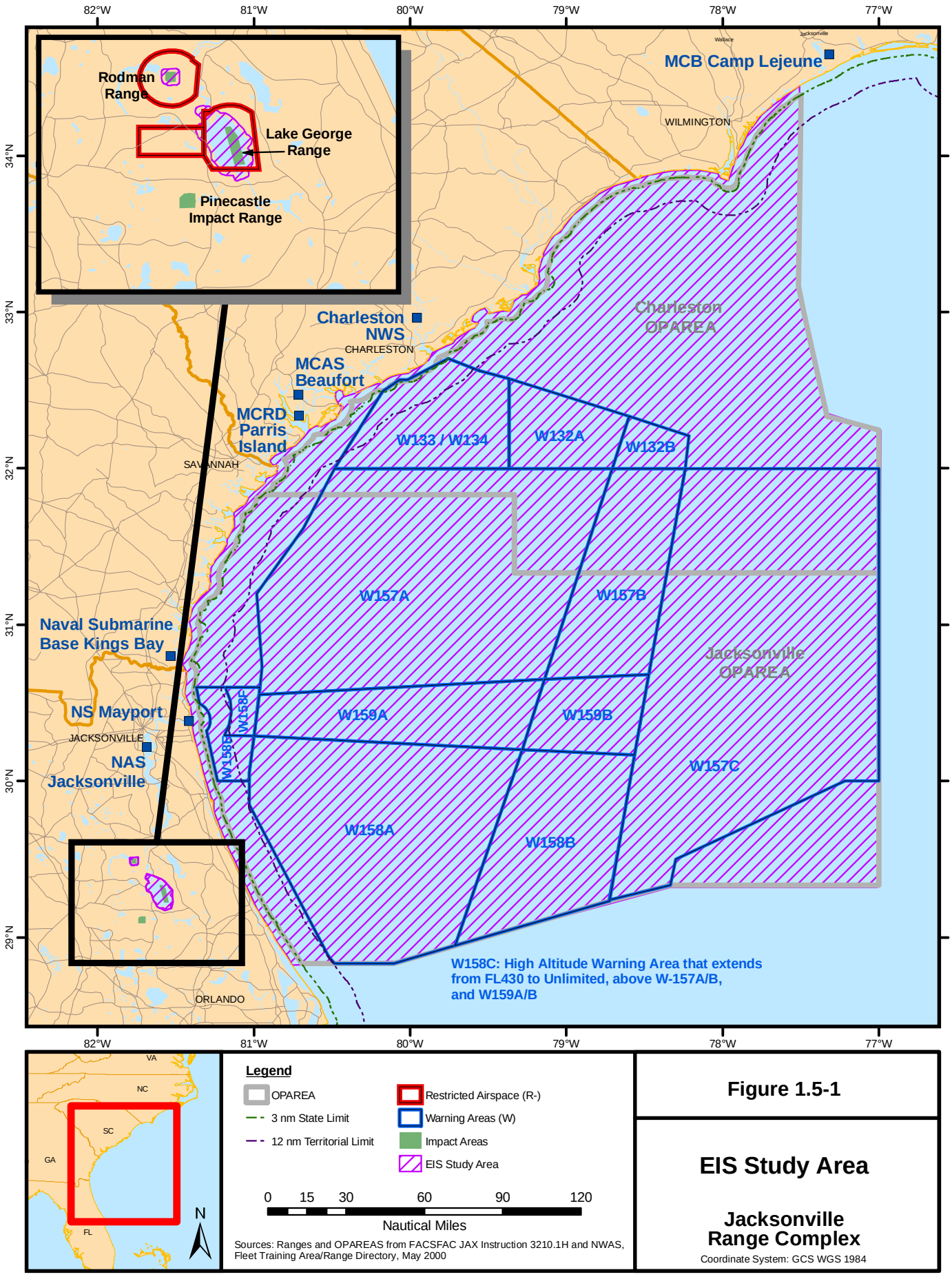


Figure 1.5-1

EIS Study Area

Jacksonville Range Complex

Coordinate System: GCS WGS 1984

1.6 THE ENVIRONMENTAL REVIEW PROCESS

1.6.1 NEPA

In 1969, Congress enacted NEPA, which provides for the consideration of environmental issues in federal agency planning and decision-making. Regulations for federal agency implementation of the act were established by the President's Council on Environmental Quality.

NEPA requires federal agencies to prepare an EIS for proposed actions that may significantly affect the quality of the human and natural environments. The EIS must disclose significant environmental impacts and inform decision makers and the public of the reasonable alternatives that would avoid or minimize adverse impacts or enhance the quality of the human environment. The Navy is the lead agency for the proposed action. The National Marine Fisheries Service (NMFS) is a cooperating agency for this EIS/OEIS. A copy of the Cooperating Agency Agreement is provided in Appendix A.

The first step in the NEPA process is the preparation of a notice of intent (NOI) to develop the Draft EIS (DEIS). A copy of the NOI is provided in Appendix B. The NOI provides an overview of the proposed project and the scope of the EIS. The NOI for this project was published in the *Federal Register* on January 26, 2007, and in 10 local newspapers. The newspaper notices were run five times in each newspaper. The notice included Navy Point of Contact information, a list of information repositories, the project website address (www.JacksonvilleRangeComplexEIS.com), a request for public comments, and the dates and locations of the scoping meetings. The following regional newspapers were used to publish the NOI and scoping meeting locations:

- South Carolina
  - *Charleston Post and Courier*
  - *Island Packet*
  - *Sun News*
- Georgia
  - *The Morning News*
  - *Valdosta Daily Times*
  - *Brunswick News*
- Florida
  - *Florida Times-Union*
  - *St. Augustine Record*
  - *Ocala Star Banner*
  - *Daytona Beach News Journal*

Scoping is an early and open process for developing the "scope" of issues to be addressed in the EIS and for identifying significant issues related to a proposed action. The scoping process for this EIS was initiated by the publication of the NOI in both the *Federal Register* and local newspapers. During scoping, the public helps define and prioritize issues and convey these issues to the agency through both oral and written comments. Scoping meetings were held in four locations (Table 1.6-1).

During the scoping process, 13 comments were received; four from government agencies at various levels and nine from non-governmental groups and/or individuals. Commenters raised concerns about impacts on fish and fishing, harm to cultural resources, marine protected areas, and endangered species, and potential conflicts between boating or shipping and Navy activities. The majority of these comments were either addressed in Chapter 2 and Appendix D by defining Navy operations that occur in the Study Area or in Chapter 3 by assessing the stressors on the various biological resources that occur in the Study Area. Comments regarding sonar training were not addressed in this EIS/OEIS, but are evaluated in the AFAST FEIS/OEIS.

TABLE 1.6-1
LOCATIONS OF SCOPING MEETINGS FOR JAX RANGE COMPLEX EIS/OEIS.

Meeting Date	Location
February 20, 2007	Charleston Citadel Embassy Suites, 337 Meeting Street, Charleston, South Carolina
February 21, 2007	Beaufort Army National Guard Armory, 1 Cavalry Lane, Beaufort, South Carolina
February 22, 2007	Coastal Georgia Center, 305 Fahm Street, Savannah, Georgia
February 23, 2007	Sea Turtle Inn, One Ocean Boulevard, Atlantic Beach, Florida

After scoping, the draft EIS/OEIS was prepared to provide an assessment of the potential impacts of the proposed action and alternatives on the environment. It was then provided to the U.S. Environmental Protection Agency (USEPA) for review and comment in accordance with its responsibilities and to have a notice of public hearing (NOPH) and notice of availability (NOA) published in the *Federal Register* (Appendix B). The Navy also placed the NOPH and NOA in the aforementioned newspapers announcing the availability of the draft EIS/OEIS. The draft EIS/OEIS has been circulated for internal review and comment (distribution list is presented in Chapter 10). The draft EIS/OEIS has been made available for general review in public libraries and other publicly accessible locations. The public comment period for the draft EIS/OEIS ended on 11 August 2008. In addition, public meetings were held to accept public comments at the locations shown in Table 1.6-2.

TABLE 1.6-2
LOCATIONS AND DATES OF PUBLIC MEETINGS FOR JAX RANGE COMPLEX EIS/OEIS

Meeting Dates	Meeting Locations
July 28, 2008	Doubletree Guest Suites– Historic Charleston, Charleston, South Carolina
July 29, 2008	Holiday Inn Beaufort, Beaufort, South Carolina
July 30, 2008	Hyatt Regency Savannah, Savannah, Georgia
July 31, 2008	Hyatt Regency, Jacksonville, Florida

The public meetings were also identified in the NOA and Public Hearing Notice published in the *Federal Register*. A copy of the notice of availability is provided in Appendix B; copies of Agency Correspondence are provided in Appendix C. The DEIS comment - response matrix and summary of public meetings are presented in Appendix F.

This final EIS (FEIS) incorporates, and formally responds to, all public comments received on the DEIS. During the public review process for the DEIS, 52 comments were received; 10 from government agencies, 37 from state agencies, and five from individuals. No comments were received from organizations. Responses took the form of corrections of data inaccuracies, clarifications of and modifications to analytical approaches, inclusion of additional data or analyses, and modification of the proposed action or alternatives. Similar to comments received during the scoping meetings, no comments received on the DEIS required significant revisions in the FEIS. There were additional revisions, which are reflected in this final EIS/OEIS, that were made to amplify information previously provided. These changes included a more detailed description of Maritime Security Operations, the addition of Air to Air Gunnery and Surface to Air Missile exercises to the proposed action, refined acoustic modeling (and harassment totals) for effects resulting from Anti Swimmer Grenades, and more detailed Weapon System data sheets located in Appendix E. The notice of availability of this FEIS was published in the Federal register, in various newspapers, and on the project website. The FEIS will be made available during a 30-day wait period.

Finally, a record of decision (ROD) will be issued, no less than 30 days after the FEIS is made available and published in the Federal Register and local newspapers. The ROD will be a concise summary of the decision made by the Navy from the alternatives presented in the FEIS. Specifically, the ROD will state the decision, identify alternatives considered, and discuss other (non-environmental) considerations that influenced the decision identified. The ROD will also describe the implementation of practical measures

intended to avoid effects from the chosen alternative and explain any decision not to implement any of these measures. If necessary, the ROD will also detail any additional mitigation measures which may result from ongoing regulatory processes. Once these regulatory processes are complete and the ROD is published, the Navy can implement the Proposed Action.

1.6.2 EO 12114

EO 12114, *Environmental Effects Abroad of Major Federal Actions*, directs federal agencies to provide for informed decision making for major federal actions outside the United States, including the global commons, the environment of a non-participating foreign nation, or impacts on protected global resources. An OEIS is required when an action has the potential to significantly harm the environment of the global commons. Global commons are defined as "geographical areas that are outside the jurisdiction of any nation, and include the oceans outside territorial limits and Antarctica. Global commons do not include contiguous zones and fisheries zones of foreign nations" (32 CFR 187.3).

1.7 RELATED ENVIRONMENTAL DOCUMENTS

1.7.1 Documents Incorporated By Reference

In accordance with CEQ regulations for implementing NEPA, the following relevant material to the proposed action is incorporated by reference, with the intent of reducing the size of the document. Several documents address actions applicable to this proposed action for the JAX Range Complex. The following paragraphs provide brief descriptions of the documents incorporated by reference in this EIS/OEIS.

EA: Final Environmental Assessment for the Homebasing of the MH-60R/S on the East Coast of the United States (May 2002) (DoN, 2002c). This environmental assessment (EA) addressed the primary environmental and socioeconomic issues associated with the Navy's proposed action to support the homebasing and operations of new MH-60S and MH-60R helicopters on the east coast of the United States. The MH-60S aircraft type will replace the CH-46D, HH-60H, SH-3H, and HH-1N. The missions assigned to this aircraft will include Combat Search and Rescue (CSAR) and surface ship protection and a new organic mine countermeasures role. The MH-60R aircraft type will replace the SH-60B and SH-60F aircraft. The missions assigned to this aircraft include ASUW, MIW and Naval Gun Fire Support. No significant adverse short-term or long-term impacts were identified as a result of implementing the Navy's preferred alternative, which was to home-base all or most MH-60S Helicopters at Naval Station (NS) Norfolk, Virginia and all or most MH-60R Helicopters at stations in the Jacksonville region.

EIS: Renewal of Authorization to Use Pinecastle Range, Ocala National Forest, Florida (DoN, 2002a). The authorization permits the Navy to continue to use the range for ordnance delivery training for 20 years through issuance of a special use permit by the U.S. Forest Service. The EIS analyzed impacts for a projected level of 10,216 annual aircraft operations. Additional NEPA documentation would be required if the total number of annual aircraft operations exceeded the projection by 10 percent or more. Following issuance of the ROD, the Navy prepared a Supplemental Information Report to "determine if newly developed information with respect to guided bomb units (GBUs) at Pinecastle Range represents significant new information or changed conditions" from those addressed in the 2002 EIS (DoN, 2004). An SEIS is being prepared for Pinecastle Range to provide more current information regarding the effects of GBU operations. The operations analyzed in the 2002 EIS are valid for incorporation by reference into the JAX Range Complex EIS.

Biological Opinion: Continued Use of the Pinecastle Bombing Range (USFWS, 2001). A Biological Opinion (BO) was issued by the U.S. Fish and Wildlife Service (USFWS) for the Navy's continued use of the Pinecastle Bombing Range (*i.e.*, PIR). The BO concluded that the proposed action was not likely to

jeopardize the continued existence of three listed species, the Florida scrub-jay, sand skink, or eastern indigo snake. An Incidental Take Statement was granted for all three species.

EIS: Introduction of F/A-18E/F Super Hornets to the East Coast of the U.S. (July 2003). This FEIS (DoN, 2003) analyzed the impacts of homebasing ten Super Hornet Squadrons and one Super Hornet Fleet Replacement Squadron at several combinations of east coast Navy and Marine Corps air stations along with the impact to nearby training ranges (BT-9, BT-11, Dare County Range, and Townsend Bombing Range). The FEIS analyzed the amount of ordnance typically used at each range. The FEIS concluded there would not be an increase in the amount of ordnance expended at any of the ranges and that there would not be a significant impact to resources at these ranges. An EIS is currently being developed to evaluate a location for an outlying landing field in Virginia or North Carolina.

EIS: Navy Air-to-Ground Training at Avon Park Air Force Range (August 2006). This EIS examined the environmental consequences of the Navy's use of the Avon Park Air Force Range for intermediate and advanced phases of the Navy's Interdeployment Training Cycle (U.S. Navy, 2005). This training includes air-to-ground delivery of high-explosive ordnance as well as other mission activities that do not require the use of high explosive (HE) ordnance: Integrated Strike; Close Air Support; CSAR; ULT normally conducted in conjunction with intermediate and advanced phases of training; and electronic warfare support.

Biological Opinion: Navy Air-to-Ground Training at Avon Park Air Force Range (June 2005). Formal consultation with the USFWS concluded with a BO in June 2005. USFWS provided their opinion for the effects of air-to-ground delivery of HE ordnance, as well as other mission activities that do not require the use of HE ordnance, on the 14 listed species that may occur or are known to occur at the range.

EA: Major Atlantic Fleet Training Exercises (February 2006). This EA (DoN, February 2006) identified and evaluated the potential environmental effects of conducting major U.S. Atlantic Fleet training exercises within 12 nm of the U.S. east coast and Gulf of Mexico coasts. The Navy may conduct up to six major training exercises annually. The purpose and need for conducting the training exercises are to certify naval forces as combat ready to meet U.S.C. Title 10 requirements. The types of exercises evaluated included: air-to-ground bombing; helicopter events; combat search and rescue; amphibious operations, shore fire control party training; and MIW. No significant impacts to the environment along the U.S. east coast or Gulf of Mexico coasts are anticipated as a result of the proposed action.

Overseas EA: Final Comprehensive Overseas Environmental Assessment for Major Atlantic Fleet Training Exercises (February 2006) (DoN, 2006c). This Overseas EA (OEA) identified and evaluated the potential environmental effects of conducting major U.S. Atlantic Fleet training exercises along the U.S. east coast and Gulf of Mexico. The Navy may conduct up to six major training exercises annually. The purpose and need for conducting the exercises is to certify naval forces as combat ready to meet U.S.C. Title 10 requirements. No significant harm to the environment is anticipated as a result of conducting major Atlantic Fleet training exercises along the east coast and Gulf of Mexico coasts of the United States. The types of exercises evaluated included: bombing; naval gunfire; maritime interdiction operations; torpedo exercises; fast attack craft/fast inshore attack craft; combat search and rescue; air-to-air missile exercises; and mine warfare.

OEA: Programmatic Final OEA for Sinking Exercises (SINKEX) in the Western Atlantic Ocean (March 2006) (DoN, 2006e). The OEA provides environmental impact analysis for sinking exercises conducted in the waters of the United States territorial seas in the western Atlantic Ocean. The purpose of the sinking exercise program is to train personnel, test weapons, and study the survivability of ship structures. With the mitigation measures implemented, the OEA concluded the proposed action would cause no significant or long-term adverse impacts to the marine environment. The OEA found no harassment, as defined under the Marine Mammal Protection Act. It also concluded the proposed action would not result

in impacts to National Marine Sanctuaries or Marine Protected Areas, and no adverse effect on Essential Fish Habitat (EFH) (Finding of No Significant Harm 2007).

Final Supplement to the Final Comprehensive Overseas Environmental Assessment for Major Atlantic Fleet Training Exercises (DoN, 2006f)**.** The December 2006 Final Supplemental Overseas Environmental Assessment (OEA) documented a quantitative acoustic exposure effects analysis on marine mammals and sea turtles (Naval Surface Fire Support [NSFS] activities only) related to the proposed use of mid-frequency active sonar sources during 2007 Atlantic Fleet major training (Strike Group) exercises and from NSFS Integrated Maritime Portable Acoustic Scoring and Simulator (IMPASS) training that is ancillary to training exercises in accordance with EO 12114. Threshold criteria were used in the quantitative acoustic exposure effects analysis for both mid-frequency active sonar sources and for small ordnance used during NSFS (IMPASS) activities. Level B harassment was analyzed at 173 decibels (dB) after exposures were estimated at the 190 dB level. In addition to sonar, the Navy modeled NSFS explosive 5-inch rounds using the criteria for Level B harassment.

In cooperation with NMFS, a new scientific approach (risk-function) has been under development and is used in the Final AFAST EIS/OEIS to quantify the potential behavioral effects to marine mammals associated with active sonar use in Atlantic Fleet training activities. The current acoustic methodology used to quantitatively assess potential effects at the permanent threshold shift (PTS) and temporary threshold shift (TTS) levels has remained unchanged and is utilized in the Final AFAST EIS/OEIS. (PTS and TTS refer to a shift in the ability to detect sound within certain acoustic ranges due to a marine mammal's exposure to sound).

Final Supplemental Overseas Environmental Assessment (DoN, 2008)**.** This Final Supplemental OEA analyzed the quantitative acoustic effects for mid-frequency active sonar training events that were scheduled as part of Atlantic Fleet training exercises over the course of one year beginning in Spring of 2008. This document supplements the environmental analysis contained in the Final Comprehensive Overseas Environmental Assessment for Major Atlantic Fleet Training Exercises (DoN, 2006c), focusing on the potential environmental effects from mid-frequency active sonar utilized during Anti-submarine Warfare (ASW) training exercises during the 2008 Atlantic Fleet training exercises beginning in Spring 2008. In its Biological Opinion dated 14 April 2008, NMFS concluded that the anticipated behavioral takes were "not likely to result in jeopardy to the species." In addition, the proposed exercises "are not likely to result in destruction or adverse modification of critical habitat."

Biological Opinion: Sinking Exercises (SINKEX) in the Western Atlantic Ocean (September 2006). Impacts to listed species were analyzed in a biological assessment, and a BO was issued by the National Oceanic and Atmospheric Administration (NOAA) for this action. The BO set forth the NMFS opinion regarding the impact of SINKEXs conducted by the Fleet Forces Command in the western North Atlantic Ocean. A SINKEX is a one or two day event using one or more target vessels. Ordnance is fired at the targets, culminating in the vessel's sinking. The BO determined the exercises were not likely to jeopardize the continued existence of the endangered species in the area nor would they destroy nor adversely modify critical habitat. The BO provided an Incidental Take Statement for sea turtles (NMFS, 2006).

Biological Opinion: Navy Activities off the Southeastern U.S. along the Atlantic Coast (NMFS, 1997). This public record set forth the NMFS opinion regarding the impact of Navy training activities off the southeastern U.S. coast on endangered species (primarily the North Atlantic right whale). The consultation area for this BO is an area of coastal ocean waters between Charleston, South Carolina and Sebastian Inlet, Florida. In accordance with the BO, the Navy is required to avoid transits through the critical habitat, establish a buffer zone around the critical habitat, operate vessels in a cautious manner, post marine mammal lookouts aboard ships, and restrict ordnance drops to a designated area. Other

special restrictions apply during the calving season. The BO also provided an Incidental Take Statement for sea turtles.

Endangered Species Act (ESA) Section 7 Consultation on Mine Warfare Exercises (MINEX) and Explosive Ordnance Disposal (EOD) Unit Level Training at Several Locations Along the East Coast of the United States (October 2002)**.** The NOAA's NMFS issued a BO (NMFS, 2002) for MINEX operations to be conducted indefinitely in three offshore locations: Virginia Beach, Virginia; Onslow Bay, North Carolina; and Charleston, South Carolina. The BO concluded these underwater detonations are not likely to jeopardize the continued existence of loggerhead, Kemp's ridley, green, hawksbill, or leatherback sea turtles. However, NMFS anticipates incidental takes of these species and issued an Incidental Take Statement with mitigation measures to minimize any takes.

The following documents are either draft or are in progress at this time, and are expected to be completed (final version) by the time the JAX Range Complex EIS/OEIS is finalized and a ROD is signed. These documents will be incorporated by reference into the JAX Final EIS/OEIS. These ongoing efforts are of critical importance to military training, and represent the long-term commitment by the Navy to ensure compliance with environmental laws associated with training.

EIS/OEIS: Atlantic Fleet Active Sonar Training (AFAST). The Navy prepared an EIS/OEIS for the use of active sonar and other sources (see Table 3.20-1) of underwater energy during training operations in the East Coast and Gulf OPAREAs of the United States. The types of active sonar analyzed include those using mid- and high- frequencies as well as small explosive charges used in certain ASW devices. AFAST documentation does not include any sources of low frequency sonar. The Navy's ASW and MIW sonars and other acoustic source systems are being studied across a number of environments for myriad Navy training operations in this EIS/OEIS. In addition to incorporating the AFAST EIS/OEIS by reference (see Section 3.20), the JAX Range Complex EIS/OEIS includes a summary of effects from active sonar sources utilized in the JAX Range Complex based on the analysis of effects from the Final AFAST EIS/OEIS (*Record of Decision signed 23 January 2009*).

Final EA: Marine Corps Air Station Townsend, Georgia. The Marine Corps prepared an EA on training operations necessary to achieve and maintain readiness and to upgrade/modernize existing range capabilities for Marine Corps and Navy training and testing at Townsend Bombing Range. This range is an important air-to-ground inert (non-explosive) ordnance training facility. The document will evaluate the relatively small-scale, but critical enhancements to the range. The preferred alternative provides for changes to the mix of Marine Corps/Navy training users, the addition of a moving vehicle target, expansion of the existing strafe pit, and upgrades and improvements to target infrastructure to make them more realistic. (*FONSI was signed October 2008*.)

Final EIS: Introduction of the P-8A Multi-Mission Maritime Aircraft into the U.S. Navy Fleet. The Navy prepared an EIS which evaluated replacing P-3C aircraft at maritime patrol homebases with the P-8A MMA and the associated facilities and functions needed to support the aircraft replacement. The proposed action would, at program's completion, replace 120 P-3C aircraft with a total of 84 P-8A MMA split primarily between east and west coasts. Since aircraft would be replaced at maritime patrol homebases currently supporting P-3C aircraft, Naval Air Station (NAS) Jacksonville is the location to receive the MMA (*Record of Decision 23 March 2009*).

Final EIS for Homeporting of Additional Surface Ships at NS Mayport, Florida. Final EIS for Homeporting of Additional Surface Ships at NS Mayport,Florida. This EIS examined a broad range of options for homeporting various classes of ships at NAVSTA Mayport in order to utilize the available facilities, both pierside and shoreside, in an effective and efficient manner to minimize new construction. The Navy decided to implement Alternative 4, homeporting a single CVN. Alternative 4 involves homeporting one CVN, dredging, infrastructure and wharf improvements, and construction of CVN

nuclear propulsion plant maintenance facilities. There will be no significant adverse environmental impacts associated with the CVN homeporting. That conclusion was based on the data collected and analyzed in the EIS, on interagency consultations, and on the mitigation measures developed as part of that consultation process. (Record of Decision was signed January 2009).

Draft Supplemental EIS for the Authorization to Use Pinecastle Range. After completion of the 2002 FEIS, a new safety modeling program (SAFERANGE) was adopted by the Navy to model the Range Compatibility Zones. The modeling program found that the zones were larger than previously modeled. The SEIS will analyze the environmental effects resulting from the revised zones, the effectiveness of existing mitigation measures, and determine if additional actions or modifications to the Operating Plan are necessary to ensure public safety and range sustainability. The SEIS will also evaluate past, present and reasonably foreseeable future land use and forestry actions from a cumulative impacts perspective. The targets, ordnance, method of delivery (air-to-ground) or volume of munitions utilized at the range are not affected by the revised zones, and therefore, will not be re-analyzed. A Biological Evaluation is being prepared in accordance with the Endangered Species Act for submission to the USFWS (*Record of Decision anticipated December 2009).*

1.7.2 Relevant Environmental Documents Being Prepared Concurrently with this EIS/OEIS

The following document is in progress at this time, and is relevant to Navy training and RDT&E in the JAX Study Area, but will not be completed by the time the JAX Range Complex EIS/OEIS is finalized.

EIS/OEIS: Undersea Warfare Training Range (USWTR). The Navy is preparing an EIS/OEIS that analyzes the potential impacts of installing and operating a USWTR along the east coast. The proposed action includes training involving the use of mid-frequency active sonar at the USWTR. Several sites along the east coast are under consideration for the USWTR, including a site within the VACAPES Range Complex OPAREA. The analyses in this document, as it pertain specifically to the VACAPES Range Complex, will be included in Chapter 6, Cumulative Impacts of the VACAPES Range Complex EIS/OEIS. (Record of Decision anticipated summer 2009).

CHAPTER 2 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

The Navy has identified the need to support and conduct current and emerging training and Research, Development, Testing & Evaluation (RDT&E) operations in the JAX Range Complex (see Chapter 1). This chapter provides detailed information on the proposed action and alternatives analyzed in the Environmental Impact Statement/Overseas Environmental Impact Statement. Over a 10-year planning period the Navy proposes to implement actions within the JAX Range Complex to meet this need by:

- Maintaining baseline training and RDT&E operations at current levels;
- Increasing training and RDT&E operations from current levels as necessary to support the Fleet Readiness Training Plan (FRTP) in furtherance of Title 10 of the U.S.C., Section 5062 (10 U.S.C. 5062), which requires the Navy to be organized, trained, and equipped primarily for prompt and sustained combat incident to the operations at sea;
- Accommodating mission requirements associated with force structure changes including those resulting from the introduction of new platforms (vessels, aircraft, and weapons systems); and
- Implementing enhanced range complex capabilities.

Training is governed by the Navy's FRTP. The FRTP sets a deployment cycle for the Strike Groups that includes three phases: (1) basic, intermediate, and advanced pre-deployment training and certification; (2) deployment; and (3) post deployment sustainment training and maintenance. While several Strike Groups are always deployed to provide a global naval presence, Strike Groups at homebase must be ready to "surge" on short notice in response to directives from the National Command Authority. Surge refers to the capability to quickly deploy Navy assets, sometimes to multiple locations, in response to world events. One objective of the FRTP is to provide this surge capability. The FRTP calls for the ability to train and deploy six Carrier Strike Groups within 30 days following a deployment order and one additional group within 90 days. Planning also includes a surge capability for Surface Strike Groups and Expeditionary Strike Groups.

The proposed action does not indicate major changes to JAX Range Complex facilities, operations, training, or RDT&E capacities. Rather, the proposed action would result in relatively small-scale but critical enhancements to the Range Complex that are necessary if the Navy is to maintain a state of military readiness commensurate with its national defense mission. The decision maker will be asked to weigh any potential impacts resulting from this analysis to select the best alternative to sustain the Navy's mission.

This chapter is divided into two major subsections: Section 2.1 provides a detailed description of the JAX Range Complex. Section 2.2 describes the major elements of the Proposed Action and describes alternatives to the proposed action including the No-Action Alternative.

2.1 DESCRIPTION OF THE JAX RANGE COMPLEX

The portion of the JAX Range Complex considered in this FEIS/OEIS consists of the following components:

- OPAREAs (surface and subsurface waters; Figure 2.1-1 shows the OPAREAs with a surface grid which uses alpha-numeric designations for each block;
- Airspace (warning areas and restricted areas; Figure 2.1-2 shows these areas with their corresponding grid nomenclature);and
- Inland ranges and targets (Figure 2.1-3).

Together these components encompass: 50,090 nm^2 of sea space; 62,596 nm^2 of special use airspace (SUA); and 20 square miles of land range area. The specific OPAREAs, airspace, and ranges included in the JAX Range Complex to be addressed in this FEIS/OEIS are described in the following sections.

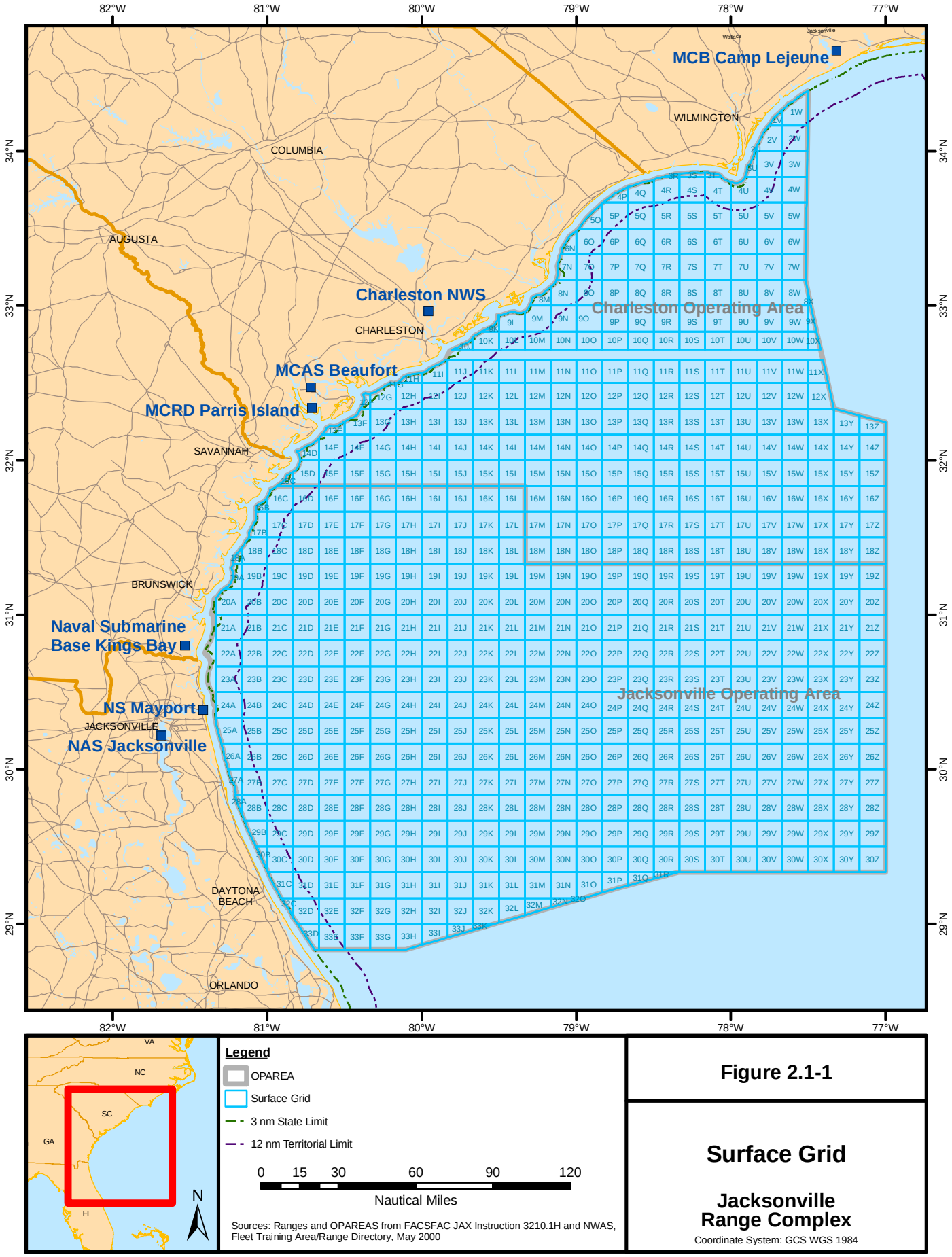


Figure 2.1-1

Surface Grid

Jacksonville Range Complex

Coordinate System: GCS WGS 1984

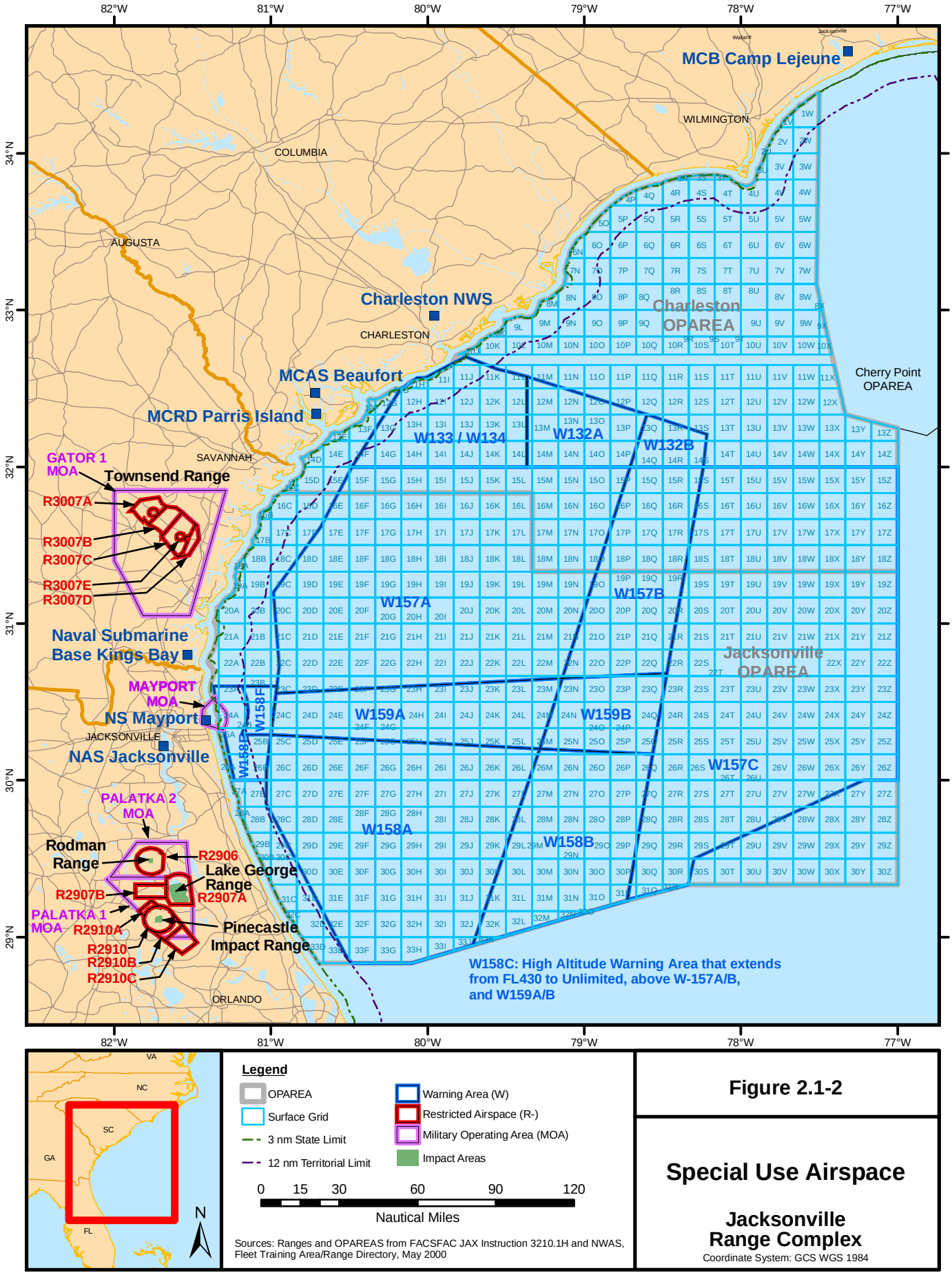


Figure 2.1-2

Special Use Airspace

Jacksonville Range Complex

Coordinate System: GCS WGS 1984

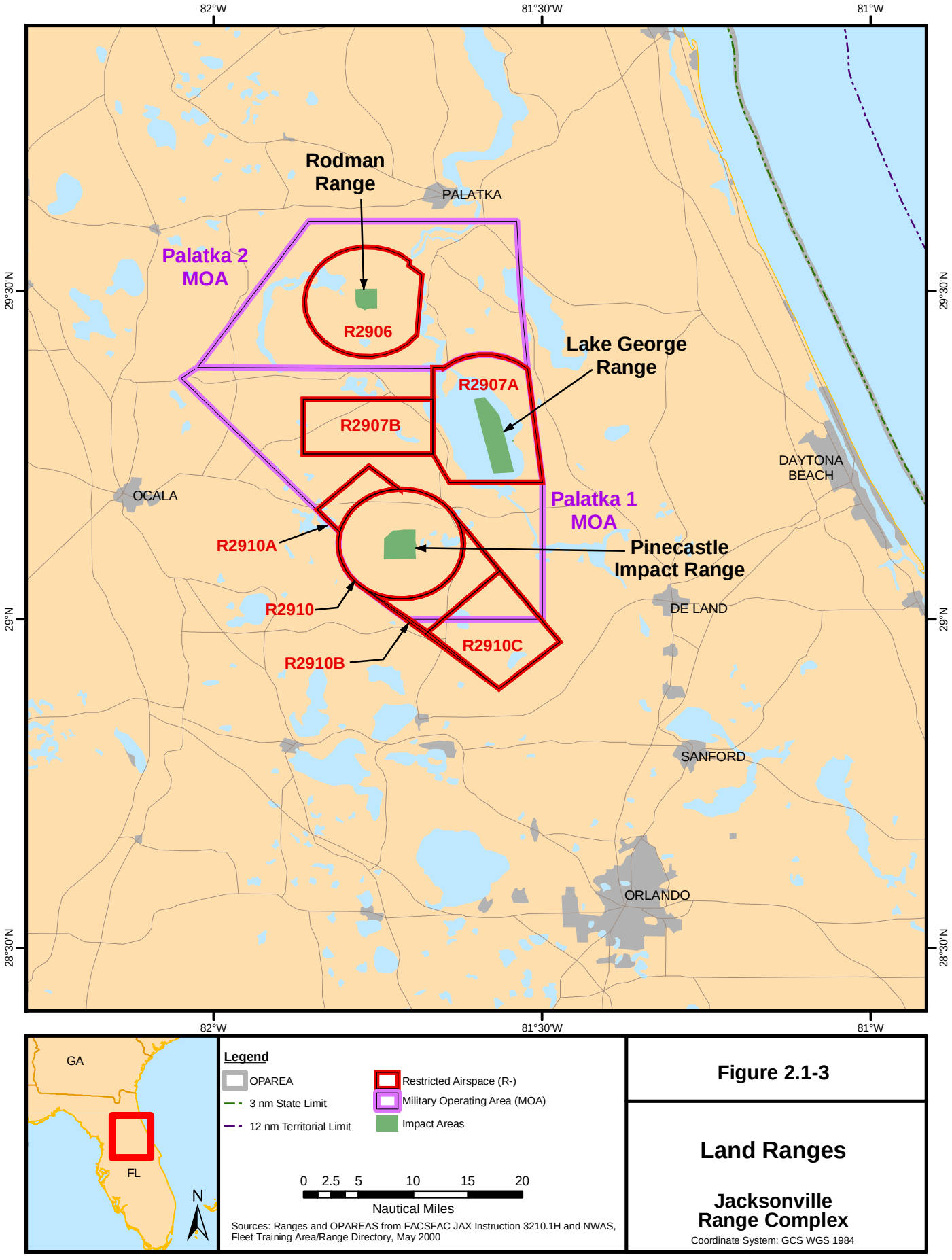


Figure 2.1-3

Land Ranges

Jacksonville Range Complex

Coordinate System: GCS WGS 1984

2.1.1 JAX OPAREA

The offshore JAX OPAREA is a set of operating and maneuvering areas with defined air, ocean surface, and subsurface areas described in detail in Table 2.1-1. The Charleston and Jacksonville OPAREAs together are referred to as the JAX Range Complex.

2.1.2 Special Use Airspace

Restricted Airspace and Warning Areas are components of SUA and are defined by the FAA as follows (FAA Order 7400.8):

Special Use Airspace: Airspace of defined dimensions identified by an area over the surface of the earth wherein activities must be confined because of their nature and/or wherein limitations may be imposed upon aircraft operations that are not part of those activities.

Restricted Airspace: The flight of non-participating aircraft, while not wholly prohibited, is subject to restriction. Restricted Airspace denotes the existence of unusual, often invisible hazards to aircraft (*e.g.*, release of ordnance). Restricted Airspace in the JAX Range Complex considered in this FEIS/OEIS is designated R-2906 and R-2907 (see Table 1.4-1).

Warning Areas: A warning area is airspace of defined dimensions, extending from three nautical miles outward from the coast of the U.S., which contains activity that may be hazardous to nonparticipating aircraft. The purpose of such warning areas is to warn nonparticipating pilots of the potential danger. A warning area may be located over domestic or international waters or both. Warning Areas in the JAX Range Complex considered in this FEIS/OEIS are W-132, W-133, W-134, W-157, W-158, and W-159.

2.1.3 Inland Ranges

The JAX Range Complex includes three inland Navy-operated ranges: the Pinecastle Impact Range, the Rodman Range and the Lake George Range, all are located in north-central Florida (Figure 2.1-3). The Navy also conducts training at the Marine Corps Townsend Range, which is also located in southeastern Georgia, and on the Air Force Avon Park Range located in central Florida. The Townsend and Avon Park ranges provide important areas for air-to-ground bombing and weapons delivery training by naval aircrews. Camp Blanding provides A-G gunnery and flight training. As discussed in Section 1.4.1, the Rodman Range and Lake George Range are the only inland ranges analyzed in this FEIS/OEIS. Details of these two ranges are presented in Table 2.1-2.

TABLE 2.1-1
JAX RANGE COMPLEX AND WARNING AREA DESCRIPTIONS

Component	Description
OPAREAs - Surface Waters	The surface water OPAREAs within of the JAX Range Complex consists of the Charleston OPAREA and the Jacksonville OPAREA (together referred to as the JAX Range Complex in this document), which have a combined area of 50,090 nm^2. The shoreward extent of the OPAREAs is roughly 3 nm from the shore. State territorial sea areas are considered to lay less than 3 nm off the coastline or in bay or inland tidal waters. There are no state territorial waters or beaches used for training within the JAX Range Complex. See Figure 2.1-1 for an illustration of the OPAREAs and the surface grid which subdivides the area. Each subdivision is designated by a letter (west to east with A to Z) and number (north to south with 1 through 33).

TABLE 2.1-1 (Continued)
JAX RANGE COMPLEX AND WARNING AREA DESCRIPTIONS

Component	Description
OPAREAs - Subsurface Waters	This area of the JAX Range Complex is undersea space that underlies and is coterminous with the surface OPAREAs. The volume of undersea space associated with a particular portion of JAX Range Complex varies greatly based on the sea floor depth. The types of underwater environments include: • shallow littoral waters (less than 10 fathoms (60 feet)) • shallow offshore waters less than 100 fathoms (600 feet); • deepwater sloping sea floor and canyons to 1600 fathoms (9,600 feet); • deepwater ocean areas to 2,160 fathoms (13,000 feet). This variety in water depth environments offers a challenging setting for submarine training.
Special Use Airspace - Warning Areas	Warning Areas of the JAX Range Complex are large blocks of SUA generally overlaying the JAX and/or Charleston OPAREAs from the surface to various flight levels up to and including unlimited for certain areas. The shoreward extent of the Warning Areas are roughly 12 nm from the shore, except in the northwest corner of the Charleston OPAREA and W-158 due east of Mayport, Florida, which are roughly 3 nm from shore. Operations conducted in these Warning Areas include all-weather flight training, refueling, test flights, rocket and missile firing, bombing, fleet training, independent unit training, antisubmarine warfare, aircraft carrier, ship and submarine operations, and anti-air and surface gunnery. Conventional ordnance is permitted subject to identified precautions and mitigation measures, see Figure 2.1-2. The Warning Areas of the JAX Range Complex are: W-132A-B: located in the Charleston OPAREA W-133: located in the Charleston OPAREA W-134: located in the Charleston OPAREA W-157A-C: located in the JAX OPAREA W-158A-F: located in the JAX OPAREA W-159A-B: located in the JAX OPAREA
Special Use Airspace – Restricted Airspace	R-2906 is Restricted Airspace over Rodman Range. R-2907a and b are Restricted Airspaces over Lake George Range. See Figure 2.1-3

2.2 PROPOSED ACTION AND ALTERNATIVES

National Environmental Policy Act implementing regulations (40 CFR § 1502.14) and Navy procedures (32 CFR Part 775) provide guidance on the consideration of alternatives to a federal proposed action and require rigorous exploration and objective evaluation of all reasonable alternatives. Each of the alternatives must be feasible and reasonable in accordance with CEQ regulations (40 CFR §§1500-1508) and Navy guidance (32 CFR Part 775). Reasonable alternatives must meet the stated purpose and need of the proposed action in this case and must be practical or feasible. Alternatives that are outside the scope of what Congress has approved or funded must still be evaluated if they are reasonable because the EIS may serve as the basis for modifying the congressional approval or funding in light of NEPA's goals and policies.

TABLE 2.1-2
JAX RANGE COMPLEX INLAND RANGE DESCRIPTIONS

Component	Description
Rodman Range	Rodman Range is located approximately 57.5 miles south of Jacksonville, Florida. The range supports air-to-ground training utilizing sub-caliber inert practice bombs (training devices that are smaller than real ordnance items but with similar characteristics such as ballistic properties and accuracy). No live ordnance or gunnery is authorized. The range and surrounding areas are largely forested. The southwest quadrant of the range area is open and contains a single impact area. There are six landing zones for rotary-wing aircraft operations on the Rodman Range. These are situated in various open areas of the range. The Rodman Range includes the restricted SUA designated as R-2906.
Lake George Range	Lake George Range is located on Lake George in north-central Florida. The Navy operates the range under an easement with the State of Florida which has jurisdiction over the lake waters. The present agreement expires in 2014. There are four impact targets on the range, all of which are located on the lake surface. These consist of the North Target, Center Target, and South Target, and a set of four Mine Laying Exercise (MINEX) Splashdown Points. The Lake George Range includes restricted SUA designated as R-2907 A/B.

2.2.1 Proposed Action

The proposed action is to support and conduct current and emerging training and RDT&E operations in the JAX Range Complex. To achieve this, the Navy proposes to:

- Maintain training and RDT&E operations at current levels if the No Action Alternative is selected. Vessel movements related to training are part of the proposed action.

If either Alternative 1 or Alternative 2 is selected, then:

- Increase or modify training and RDT&E operations from current levels as necessary in support of the FRTP.
- Accommodate mission requirements associated with force structure changes, including those resulting from the introduction of new platforms (aircraft, and weapons systems).
- Implement enhanced range complex capabilities.

The decision-maker for this FEIS/OEIS will decide both the level and mix of training and testing, and range capability enhancements, that best meet Navy requirements within the JAX Range Complex. The following sections discuss the Navy's alternatives with respect to the components that make up the proposed action.

2.2.2 Alternatives

Alternatives in this FEIS/OEIS were evaluated to ensure they met the purpose and need, giving due consideration to range complex attributes such as: the capability to support current and emerging Fleet tactical training and RDT&E requirements; the capability to support realistic, essential training at the level and frequency sufficient to support the FRTP; and the capability to support training requirements while following Navy Personnel Tempo of Operations guidelines[4].

Three alternatives are analyzed in this FEIS/OEIS:

1) The No Action Alternative – Current Operations to include surge consistent with the Fleet Readiness Training Plan;

[4] PERSTEMPO is defined by the Navy as time away from homeport, as tracked at the unit level.

2) Alternative 1 – No Action Alternative plus: increase Operational Training, Expand Warfare Missions, Accommodate Force Structure Changes[5] (including training resulting from the introduction of new platforms), and implement enhancements, to the minimal extent possible to meet the components of the proposed action. This alternative is composed of all operations currently conducted – the No Action Alternative – with modifications to current training or introduction of new training. These would include:

   a) using more commercial aircraft to serve as oppositional forces rather than using Navy aircraft for Air-to-Air Missile Exercise, Surface-to-Air Gunnery Exercises, Air Intercept Control Exercises, and Detect-to-Engage Exercises;

   b) the incorporation of Maritime Security training into existing training events;

   c) adjusting training levels to ensure that deployment can be stepped up quickly and at multiple locations in response to world events; and

   d) conducting new or modified training associated with the introduction of the new MH-60R/S helicopter, and new organic mine countermeasure systems; and

3) Alternative 2 – Alternative 1 plus: additional mine warfare training capabilities, and implementation of increases in operations to enable the range complex to meet future requirements. The Preferred Alternative includes the elimination of high explosive bombs during at sea bombing exercises.

2.2.3 No Action Alternative – Description of Current Training Operations within the JAX Range Complex

2.2.3.1 Baseline Training Operations

The No Action Alternative is required by regulations of the Council on Environmental Quality (CEQ) as a baseline against which the impacts of the proposed action are compared. For the purposes of this EIS/OEIS, the No Action Alternative serves as the baseline level of operations on the JAX Range Complex, representing the regular and historical level of training and testing activity necessary to maintain Navy readiness. Consequently, the No Action Alternative stands as no change from current levels of training and testing usage.

Training operations in the JAX Range Complex range from unit level exercises to integrated major range training events. The scope of operations can consist of air combat maneuvers or ordnance delivery at land and water targets by a single aircraft, to Joint Task Force Exercises (JTFEX) which may involve thousands of participants over a period of two weeks.

A description of the training operations typically conducted on the JAX Range Complex is shown in Table 2.2-1. Each military operation described in this FEIS/OEIS meets a requirement established by the FRTP. RDT&E events that are similar to training activities conducted in the JAX Range Complex are accounted for in the total events for each warfare area. Training or range enhancements discussed in the Range Complex Management Plan (DoN, 2006b) that do not involve environmental resources are not included in the analysis of this FEIS/OEIS. A more detailed summary of each of the training operations, including vessels, aircraft and weapons systems involved in each event type, and ordnance expended and duration of each event type, is provided in Appendix D.

[5] Force Structure Changes include changing weapon systems and platforms and homebasing new aircraft and ships.

TABLE 2.2-1
JAX STUDY AREA TYPICAL OPERATIONS INCLUDED IN THIS EIS/OEIS[A]

Range Operation	Description	Training Area
MINE WARFARE (MIW)		
Mine Laying	Airborne mine-laying training uses two types of training operations: Mine Exercises (MINEX) and Mine Readiness Certification Inspections. In the typical mining training profile, MINEXs usually involve a single aircraft sortie planting several non-explosive training mineshapes in the water. The aircrew drops a series of (usually four) training shapes in the water.	Lake George Range
Mine Countermeasures	Mine Countermeasure (MCM) exercises train forces to detect, identify, classify, mark, avoid, and disable (or verify destruction of) sea mines using a variety of methods, including air, surface, and sub-surface assets.	Charleston and JAX OPAREAs
Mine Neutralization	Mine Neutralization operations involve the detection, identification, evaluation, rendering safe, and disposal of underwater unexploded ordnance that constitutes a threat to ships or personnel.	Charleston OPAREA (North and South UNDET Areas)
SURFACE WARFARE (SUW)		
MISSILEX (A-S)	MISSILEX (A-S) (Live Fire) trains aircraft or helicopter crews in the delivery of optical, infrared seeking or laser guided missiles (Hellfire and Maverick) at surface targets.	W-157A (Area 4X) and W-159 (Area 5X)
GUNEX (A-S)	GUNEX (A-S) trains aircraft or helicopter crews to attack at sea surface targets.	W-132, W-133, W-134, W-157, W-158
GUNEX (S-S)	GUNEX (S-S) trains ship gun crews by firing against surface targets at sea.	W-159A (AA, BB, CC)
BOMBEX (Sea)	BOMBEX (Sea) allows aircrews to train in the delivery of bombs against maritime targets.	W-158 (31J), W-157A/B, W-158A/B
Laser Targeting	MISSILEX (A-S) (Laser Only) trains aircraft or helicopter crews in the delivery of optical, infrared seeking or laser guided missiles at surface targets. This operation does not result in live missile fire, only discrimination of the target and illumination of the target with a laser.	W-157, W-159
Maritime Security (MS) to include Visit, Board, Search, and Seizure/Maritime Interception Operations (VBSS/MIO)- Ship and Helo; anti-piracy operations; and special operations forces	VBSS/MIO: Crews from Navy helicopters and surface ships identify, track, intercept, board and inspect foreign merchant vessels suspected of not complying with United Nations/allied sanctions and/or conflict rules of engagement. The boarding party will be delivered from a surface ship via Rubber-hull Inflatable Boat (RHIB) or similar small craft if the target vessel is non-hostile, or via helicopter if hostile. This training event is non-firing. See Appendix D for more descriptions.	JAX and Charleston OPAREAs

TABLE 2.2-1 (Continued)
JAX STUDY AREA TYPICAL OPERATIONS INCLUDED IN THIS EIS/OEIS

Range Operation	Description	Training Area
VBSS/MIO-Helicopter	Non-firing ULT & major exercise events. Each event involves three helicopters (two at low altitude and one at high altitude) and a target vessel, Navy Special Warfare personnel fast-rope from one helicopter to the target vessel .	W-157A (Area 4X) and W-159A (Area 5X)
Fast Attack Craft/Fast Inshore Attack Craft (FAC/FIAC)	Non-firing major exercise event only. Typically involves multiple ships prosecuting multiple targets (High Speed Maneuverable Seaborne Targets or other small craft).	JAX and Charleston OPAREAs
AIR WARFARE (AW)		
ACM	ACM is the general term used to describe an air-to-air (A-A) event involving two or more aircraft, each engaged in continuous proactive and reactive changes in aircraft attitude, altitude, and airspeed. No live weapons are fired during ACM operations.	W-157A
Air Intercept Control	Surface ships and fixed wing aircraft train in using their search radar capability to direct strike fighter aircraft toward threat aircraft.	JAX and Charleston OPAREAs
ACM Chaff Exercise	Chaff exercises train shipboard personnel and helicopter crews in the use of chaff to counter missile threats. Training and testing events not necessarily dedicated events, but combined with other exercises.	Charleston and JAX OPAREAs
ACM Flare Exercise	Trains aircraft personnel in the use of flares for defensive purposes when countering heat-seeking missile threats. Training and testing events not necessarily dedicated sorties, but may be combined with other exercises.	Lake George Range
MISSILEX (A-A)	MISSILEX (A-A) are training operations in which air-to-air missiles are fired from aircraft (live and non-explosive) against unmanned aerial target drones such as BQM-34 and BQM-74.	W-132, W-133, W-134, W-157, W-158
MISSILEX (S-A)	These operations train surface ship crews in defending against airplane and missile attacks with the ship's missiles. Missile firing ships, including guided missile cruisers, frigates, and destroyers, armed with surface-to-air missiles are required to engage each of three different presentations of aerial threats once per FRTP. Targets include unmanned drones.	JAX and Charleston OPAREAs
GUNEX (S-A)	GUNEXs (S-A) are conducted by surface ships with 5-inch, 76mm and 20mm Close In Weapons Systems. Targets include unmanned drones as well as targets towed behind aircraft.	JAX OPAREA (AA, BB, CC)
GUNEX (A-A)	GUNEX Air-to-Air training operations in which guns are fired from aircraft against towed aerial target banner.	W-157A/W-133 (Area 2X)
Detect-to-Engage	Shipboard personnel use all shipboard sensors (search and fire control radars and Electronic Support Measures (ESM)) in the entire process of detecting, classifying, and tracking enemy aircraft and/or missiles up to the point of engagement, with the goal of destroying the threat before it can damage the ship.	W-132, W-133, W-134, W-157, W-158

TABLE 2.2-1 (Continued)
JAX STUDY AREA TYPICAL OPERATIONS INCLUDED IN THIS EIS/OEIS

Range Operation	Description	Training Area
AMPHIBIOUS WARFARE (AMW)		
Firing exercise (FIREX) with Integrated Maritime Portable Acoustic Scoring and Simulator System (IMPASS)	FIREXs with IMPASS are training operations that direct naval gunfire to strike land targets and support military operations ashore. This training is conducted at-sea using a buoy system that simulates a land mass that a ship fires on using IMPASS	JAX OPAREA (BB, CC)
STRIKE WARFARE (STW)		
BOMBEX (A-G)	BOMBEXs (Land) allow aircrews to train in the delivery of bombs against ground targets.	Rodman Range
Combat Search and Rescue (CSAR) and Convoy Operations	CSAR operations train rescue forces personnel the tasks needed to be performed to affect the recovery of distressed personnel during war or military operations other than war.	Rodman Range
ELECTRONIC COMBAT (EC)		
EC Operations	Air or ship crews attempt to control critical portions of the electronic spectrum used by threat radars, communications equipment, and electronic detection equipment to degrade or deny enemy attacks.	W-132, W-133, W-134, W-157, W-158, JAX and Charleston OPAREAs
Chaff Exercise	Exercises train aircrews the use of chaff to counter enemy threats by creating radar reflective false targets. Chaff may also be used offensively by aircrews or shipcrews to hide inbound striking aircraft or ships.	JAX and Charleston OPAREAs
Flare Exercise (Aircraft Self-Defense)	Fixed-wing aircraft and helicopters deploy flares to disrupt threat infrared missile guidance systems to defend against an attack.	Lake George Range
OTHER EVENTS		
Shipboard Electronic Systems Evaluation Facility Utilization (SESEF)	SESEF operations test ship antenna radiation pattern measurements and communication systems.	5-15 nm east of NS Mayport
Precision Anchoring	Precision Anchoring occurs to fulfill qualification requirements during the training cycle. Ship will drop anchor as close as possible to a designated anchorage area. There are several practice anchor drops and the final drop is graded by the Afloat Training Group out of NS Mayport. This training event is conducted approximately 3 nm from shore.	NS Mayport
Small Arms	Training with anti-swimmer grenades (MK3A2, 8 oz HE). Not all events use explosive rounds in the exercise.	Charleston OPAREA (North and South UNDET Areas)

[A] Anti-Submarine Warfare (ASW) training takes place in the JAX Study Area and is analyzed separately in the AFAST EIS/OEIS. Potential effects are summarized in Section 3.20 of this document.

The levels of operations (see Table 2.2-4) described are derived from data collected during the development of the JAX Range Complex Management Plan (RCMP) (DoN, 2006b) as documented in the Operations Data Book (DoN, 2006c), data from the Navy's Target and Range Information Management System (TRIMS), personal interviews with naval operators and subject matter experts, and other operations data logs. These data are considered to be an accurate representation of the training activities

normally conducted within the JAX Range Complex and provides the basis for comparing alternatives and potential environmental impacts.

Table 2.2-2 summarizes the portion of major exercises performed in the JAX Range Complex. Training events during a Carrier Strike Group (CSG) and Expeditionary Strike Group (ESG) for Composite Training Unit Exercise (COMPTUEX) include many of the same events listed individually in Table 2.2-4, but are conducted together with multiple ships, submarines and/or aircraft versus individually as with ULT. The number of events occurring in the major exercises is accounted for under their corresponding descriptions in Table 2.2-4. All major warfare areas are performed in major exercises within the JAX Range Complex; however, ASW and MIW training using active sonar platforms are being analyzed in the Atlantic Fleet AFAST FEIS/OEIS and summarized in Section 3.20 of this document.

TABLE 2.2-2
MAJOR EXERCISES IN THE JAX RANGE COMPLEX

Operation	Warfare Area	Description	Training Area(s)
Carrier Strike Group (CSG) Composite Training Unit Exercise (COMPTUEX)	STW, SUW, EC, Non-lethal engagement, MIW	The CSG COMPTUEX is a major at-sea training event that represents the first time before deployment that an aircraft carrier and its carrier air wing integrate operations with surface and submarine units in an at-sea environment. During a CSG COMPTUEX, participants are presented with event-driven mini-battle problems and an event-driven Final Battle Problem. A CSG COMPTUEX typically lasts 21 days, with training events conducted along the east coast at multiple Range Complexes and inland ranges including Charleston/JAX. The majority of CSG COMPTUEX events occur in the Charleston/JAX Range Complex, with a smaller portion of events occurring in the Navy Cherry Point and Virginia Capes Range Complexes.	Charleston and JAX OPAREAs and Rodman Range (inland)
Expeditionary Strike Group (ESG) COMPTUEX	SUW, STW, EC, Non-lethal engagement, MIW	The ESG COMPTUEX is a major at-sea training event that represents the first time before deployment that Navy amphibious ships and Marine Corps units conduct integrated operations in an at-sea environment. The ESG COMPTUEX is an intermediate training exercise that focuses on ensuring interoperability and integration of participating units, with a focus on maritime and amphibious operations. It provides the opportunity for training with complex weapons tactics and employment against multiple threats in a demanding target-identification environment. An ESG COMPTUEX typically lasts 21 days, with training events conducted along the east coast at multiple Range Complexes and inland ranges including the Charleston OPAREA and Rodman Range within the JAX Range Complex. Roughly half of the training events conducted in an ESG COMPTUEX occur in the JAX Range Complex and half in the Cherry Point Range Complex.	Charleston and JAX OPAREAs and Rodman Range (inland)
Joint Task Force Exercise (JTFEX)	SUW, STW, EC, Non-lethal engagement, MIW	A JTFEX would be scheduled after a CSG COMPTUEX and is an advanced training event that often includes other DoD services and/or Allied forces. Training events in a JTFEX are non-scripted, scenario-driven battle problems that focus on mission planning and strategy, and on the orchestration of integrated maneuvers, communication, and coordination. The Strike Group is presented with a threat-driven scenario involving multiple threats that require advanced target-identification and rules of engagement. A JTFEX typically lasts 10 days, with training events conducted along the east coast at multiple Range Complexes and inland ranges; therefore, only a portion of a JTFEX would occur in a given Range Complex. Like the CSG COMPTUEX, The majority of Atlantic Fleet JTFEX events occur in the JAX Range Complex, with a smaller portion of events occurring in the Cherry Point Range Complex.	Charleston and JAX OPAREAs and inland ranges

Under the No-Action Alternative, training operations and major range events would continue at current levels. Under this alternative, the JAX Range Complex would not accommodate an increase in training operations due to proposed force structure changes, and it would not implement enhancements identified in the RCMP (DoN, 2006b). Evaluation of the No-Action Alternative in this FEIS/OEIS provides a credible baseline for assessing environmental impacts of Alternative 1 and Alternative 2 (Preferred Alternative).

As discussed in Sections 1.5 and 1.7, training and RDT&E operations conducted at Pinecastle Impact Range were analyzed in a separate EIS for the Renewal of Authorization to Use Pinecastle Impact Range, Ocala National Forest, Florida. The Pinecastle EIS is incorporated by reference in this JAX Range

Complex FEIS/OEIS. A Supplemental Pinecastle EIS is currently being prepared to update the range footprint analysis. Operations analyzed in the Pinecastle EIS will remain constant; implementation of the No Action Alternative proposed in this JAX Range Complex FEIS/OEIS would not affect the analyses or conclusions of the Pinecastle EIS or Supplemental EIS for the Pinecastle Range.

2.2.4 Alternative 1 – Increase and Modify Operational Training, Expand Warfare Missions, Accommodate Force Structure Changes, and Enhance Range Complex Capabilities

Alternative 1 is a proposal designed to meet Navy and DoD current and near-term operational training and RDT&E requirements. If Alternative 1 were to be selected, in addition to accommodating training operations currently conducted (*i.e.*, those described in the No Action Alternative), training operations would be increased or modified, and force structure changes such as introduction of MH-60R/S and Organic Mine Countermeasures (OMCM) systems would be accommodated, and range complex capabilities would be enhanced under this alternative.

Under Alternative 1, training and RDT&E operations would be increased or modified as identified in Tables 2.2-3 and 2.2-4. Force structure changes (new platforms) to be implemented would include the introduction of the MH-60R/S Seahawk Multi-Mission Helicopter. Force structure changes, mine countermeasures, associated with new weapons systems would also include limited capability to support new weapon systems.

2.2.4.1 Proposed Increases in Training Operations

The Navy proposes to increase training from current baseline levels at the JAX Range Complex by 10% for most operations to accommodate short-term national security contingencies and provide planners with flexibility to develop realistic battle problems for major fleet training exercises.

2.2.4.2 Expand Warfare Missions

Conduct Maritime Security (MS) Surge Surface Strike Group (SSG) (Independent Deployment) Training. Maritime Security Surge operations are addressed in the FRP, and are in turn discussed in this document to ensure that our ability to respond to emergent requirements, such as the rise in piracy and the global war on terrorism, is maintained. The Navy proposes to use JAX Range Complex for preparing surface ships and embarked air, special forces and Marine Corps units for deployment as MS SSGs. The Global War on Terror brought increased requests from US combatant commanders for rapid short-term Navy support for contingencies such as maritime security, maritime interception, homeland defense, information operations and special operations. Quite often, groups smaller than CSGs or ESGs can adequately respond to these contingencies if properly configured and trained.

Each fleet maintains a number of ships ready to deploy on short notice. After receiving a request, it can tailor a one to three ship MS SSG, also referred to as Independent Deployers, from among these 'surge-capable units' that can best accomplish the mission. Preparing these Independent Deployers includes a mix of classroom, synthetic and live training events. Live training ensures proficiency in multi-unit

procedures and autonomous operations by means of anticipated region-specific scenarios. The Navy does not expect MS SSG training to significantly alter the overall type and quantity of operations currently conducted in JAX Range Complex.

Conduct Surface-to-Air Missile (MISSILEX (S-A)) Training. The Navy proposes to conduct up to eight MISSILEX (S-A) events annually in the OPAREAs. In these air defense exercises, surface ships launch surface-to-air missiles with either high explosive or non-explosive warheads at target drones simulating enemy aircraft. Once a required training event, the Navy suspended live missile training launches from all surface ships except aircraft carriers in 2004. However, it continues to conduct MISSILEX (S-A) test and evaluation events in the northern part of VACAPES OPAREA off-shore from the Goddard Flight Facility, Wallops Island, VA. If the Navy decides to reinstate MISSILEX (S-A) training events, it will conduct most of them in the VACAPES OPAREA, but needs the operational flexibility to train in JAX and Charleston OPAREAs, as well. Here, participants could include cruisers (CG) or destroyers (DDG) launching SM-2 Standard Missiles, or large amphibious ships (LHA or LHD) launching NATO Sea Sparrow missiles. The targets are BQM-74 drones, launched from either G-1 Commercial Air Services aircraft or the Mobile Sea Range. Lack of a missile launch platform at either MCAS Cherry Point or MCB Camp Lejeune precludes use of the BQM-34 drone, which requires a land-based launch platform. Since the BQM-34 is the target of choice for the Rolling Airframe Missile (RAM), the Navy will restrict launches of these missiles to the VACAPES OPAREA.

Navy does not anticipate any underwater detonations to result from these renewed MISSILEX (S-A) events due to missiles with high explosive warheads that fail to detonate near the target. Both the SM-2 and NATO Sea Sparrow missiles have self-destruct mechanisms that will cause the missiles to explode after a pre-set period of flight time. Appendix D has detailed information about these training activities.

2.2.4.3 Accommodate Mission Requirements Associated with Force Structure Changes

As part of Alternative 1, the Navy proposes to provide range support and services at the JAX Range Complex that are required to accommodate new aircraft, systems, and weapons associated with force structure changes. These include:

Conduct MH-60R/S Training. The Navy proposes to conduct the MH-60R/S training missions in the JAX Range Complex in accordance with the recent restructuring of Navy helicopter forces around the two linchpin airframes, the MH-60S and MH-60R. The MH-60R squadrons will be consolidated at NS Mayport and NAS Jacksonville. An additional 52 Hellfire missile capable airframes are expected in the JAX Range Complex in the coming years (DoN, 2002).

MH-60R Seahawk Multi-Mission Helicopter. This is the Navy's new primary maritime-dominance helicopter, replacing the SH-60B and SH-60F aircraft. Greatly enhanced over its predecessors, the MH-60R features a glass cockpit (multi-function digital display) and significant mission system improvements, which give it unmatched capability as an airborne multi-mission naval platform. These improvements include: upgraded mission and flight displays; improved Flight Control Computer; and an Integrated Self Defense suite.

Upgraded sensors include: (1) Electronic Support Measures (ESM); (2) Airborne Low Frequency Sonar,[6] (3) Multi-mission Radar Upgrade (including intelligence, surveillance and reconnaissance); (4) Forward Looking Infrared; and (5) a weapons suite including torpedoes and Hellfire missiles.

The MH-60R is designed to operate from the Navy's frigates, destroyers, cruisers and aircraft carriers. Its missions include:

- Surface Warfare (SUW)
- Electronic Warfare (EW)
- Maritime Interception Operations (MIO)
- Non-Combat Operations/Maritime Law Enforcement
- Fleet Support Operation/Search and Rescue

MH-60R helicopters would train both from land bases as well as from ships at sea as part of helicopter squadrons when deploying from shore-based airfields, as well as on ship-based platforms at-sea.

In 2002, the Navy prepared an Environmental Assessment for the Proposed Homebasing of New MH-60S Helicopters and MH-60R Helicopters on the East Coast of the United States (DoN, 2002). See Section 1.6, Related Documentation for a summary of this document incorporated by reference. In relation to the JAX Range Complex, the Finding of No Significant Impact identified Jacksonville Fleet Concentration Area (which includes NS Mayport and NAS Jacksonville) as the homebase for all or most of the MH-60R helicopters. These new aircraft will be assigned to four MH-60R squadrons that will deploy aboard aircraft carriers and are based at NAS Jacksonville, and, three Expeditionary squadrons that will deploy aboard FFG/DDGs/CGs, plus one Fleet Replacement Squadron, and one Reserve Squadron at NS Mayport. The total number of MH-60R helicopters is projected to be 105.

MH-60S Multi-Mission Combat Support Helicopter. These missions will include OMCM (described in detail below), CSAR, special operations, logistics support, SUW, MIO, and search and rescue. Naval Station Norfolk will host all 100 airframes destined for the Atlantic Fleet, distributed between five carrier airwing (CVW) squadrons, three expeditionary squadrons, and one fleet replacement squadron.

Most MH-60S ULT operations will occur in the VACAPES Range Complex close to its homebase of NS Norfolk. With few exceptions, the MH-60S will only train in the JAX Range Complex when participating in a major exercise. For CSG exercises, JAX Range Complex is the venue of choice for OMCM and CSAR events involving the MH-60S. A CVW squadron will deploy as an entire squadron when part of a CSG, whereas an expeditionary squadron will deploy one or two plane detachments aboard frigates, destroyers, cruisers and amphibious ships in support of an ESG.

Conduct training with OMCM Systems. The introduction of OMCM systems enables an update to tactics, techniques, procedures, and training for airborne MCMs. Alternative 1 facilitates training in MCM capability during major exercise events. During a major exercise, multi-purpose helicopters (MH-60S) would take off from ships engaged in the exercise and practice "clearing" an area within the Charleston OPAREA or JAX OPAREA before entry of the Strike Group. The MH-60S would fly at low altitude in the area to be cleared and would utilize mine hunting sonar (AQS-20). No mineshapes would be involved. Training would be conducted to establish and maintain proficiency. Potential effects associated with the

[6] ALFS utilizes mid-frequency sonar. Sonar component of this training is analyzed separately in the Atlantic Fleet Active Sonar Training (AFAST) EIS/OEIS.

active sonar components are analyzed separately in the AFAST FEIS and summarized in Section 3.20 of this document.

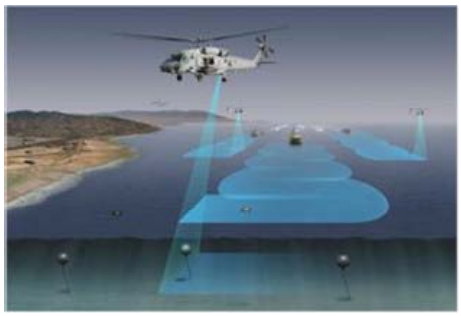
Airborne Mine Neutralization System (AMNS). AMNS will be used by MH-60S helicopters during proposed mine countermeasures and mine neutralization training, provides the capability to localize, identify, and neutralize bottom and moored mines directly from the mine countermeasures helicopter. The aircraft hovers at a safe distance from the target and lowers an expendable, self-propelled neutralizer device into the water. Once released, the neutralizer travels to the target position to commence a search for the target. It relays depth, position, and sensor (sonar and video) information to the operator in the helicopter via a fiber-optic cable. The cable is also used to send control and guidance commands to the neutralizer. Once the target is localized and identified as a mine, the expendable neutralizer is positioned so that its shaped-charge will detonate into the vulnerable area of the mine. A successful mine neutralization attempt will render the mine inoperable either by rupturing its case or preferably by sympathetic detonation of the mine charge. However, during MIW training in the JAX and Charleston OPAREAs, only non-explosive training neutralizers would be used. With non-explosive training AMNS neutralizers, once the mine shape is acquired the neutralizer floats to the surface on command by an aircrew to simulate the mine neutralization. The unit has a ballast section where the charge usually sits that fills when descending and empties upon command to allow the unit to surface. Potential effects associated with the active sonar component of AMNS are analyzed separately in the AFAST FEIS/OEIS and summarized in Section 3.20 of this document.

A/AWS-2 Rapid Airborne Mine Clearance System (RAMICS) is a non-towed system designed to neutralize floating and near-surface mines. RAMICS is a MK-44 Bushmaster II cannon with a laser Light Detection and Ranging (LIDAR) targeting fire control system that fires a flat-nosed 30 mm armor-piercing non-explosive super-cavitating projectile. A hovering MH-60S helicopter uses the LIDAR to reacquire a mine previously located with a separate mine hunting system. Once the target is reacquired, an onboard fire control subsystem automatically tracks it and aims the gun, firing the 25 projectiles in bursts. A successful neutralization will disable the mine at a safe distance from the helicopter. Training targets are expendable non-explosive bottom and moored mineshapes.

AN/AES-1 Airborne Laser Mine Detection System (ALMDS) is a non-towed (airborne) mine hunting system designed to rapidly detect, classify and locate near-surface floating or moored mines. A pod mounted on the MH-60S pylon contains the laser LIDAR system used to detect mines. An operator on the helicopter identifies potential mines from the laser images on a video monitor and marks their exact locations. A separate mine neutralization system is needed to disable or destroy mines once identified.



MH-60S Helicopter with RAMICS



Airborne Laser Mine Detection System

Organic Airborne and Surface Influence Sweep (OASIS). OASIS is a self-contained, high speed, shallow water magnetic and acoustic influence sweeping device. OASIS will be towed by an MH-60S helicopter. The mine sweeping system emulates the magnetic and acoustic signatures of ships and submarines.



OASIS



AN/AQS-20

AN/AQS-20. This minehunting system is an underwater towed body, containing a high resolution, side-looking, multi-beam sonar system used to look for mines along the ocean bottom. The AN/AQS-20 can be towed by an MH-53 or MH-60S helicopter using a small diameter electromechanical cable. An operator on board the helicopter can view mines with a video monitor. Once identified, the exact location is determined and subsequent deployment of mine neutralizing systems can disable or destroy the mine. Potential effects associated with the active sonar component of AQS-20 are analyzed separately in the AFAST FEIS/OEIS and summarized in Section 3.20 of this document.

Conduct Multi-Mission Maritime Aircraft (MMA) Training. The selected replacement for the P-3C Orion is the P-8A Poseidon MMA, which will be a long-range SUW, intelligence, surveillance and reconnaissance (ISR) aircraft capable of broad-area, maritime and littoral operations. Planned initial operational capability for the MMA is fiscal year 2013 (FY13). If purchased the east coast complement of P-8s will be based at NAS Jacksonville. Training conducted in the range complex will encompass all aspects of the MMA aircraft, from pilot familiarization to system and sensor training.

2.2.4.4 Enhanced Range Complex Capabilities

Increase Commercial Air Services Support for Fleet Training. The Navy proposes to increase the number, type and operation of commercial air services (CAS) within the JAX Range Complex. These contractor owned and operated supersonic and subsonic aircraft carry a variety of electronic threat emitters, perform aircraft maneuvers and flight profiles that mimic enemy aircraft, provide air-to-air refueling capabilities and tow and stream targets used for surface-to-air gunnery training. Their use enhances the following range capabilities:

1) Opposition Force (OPFOR) aircraft against naval aircraft and ships in air defense events (Air Intercept Control [AIC] and Detect to Engage), and sometimes intercept aircraft for AIC events;
2) Threat missile and aircraft profiles against naval aircraft and ships in electronic combat events;
3) Refueling tanker support during major exercises;
4) Tow aircraft for target banners in surface-to-air gunnery exercises.

Increased use of CAS to support fleet training would not substantially increase aircraft numbers, emissions, time spent in the warning areas, or alter current airspace usage. Rather, CAS would displace fleet assets now used to support fleet training events listed in Table 2.2-3, and greatly increase the overall quality of fleet training by making it a dedicated mission in specially equipped aircraft for the CAS aircrew.

TABLE 2.2-3
TRAINING ELEMENTS AFFECTED BY COMMERCIAL AIR SERVICES

Training Event	Baseline Sorties/Events	Proposed Sorties/Events	Percentage Increase
Electronic Combat (aircraft)	108	120	10%
Electronic Combat (ships)	56	61	10%
GUNEX (S-A)	21	24	10%
Air Intercept Control	150	150	0%
Detect to Engage	77	85	10%

2.2.5 Alternative 2 – Increases and Modifications in Operational Training, Accommodate Force Structure Changes, and Implement Enhanced Mine Warfare Training Capability (Preferred Alternative)

Alternative 2, the Preferred Alternative, includes implementation of Alternative 1 with additional increases in operations, eliminating use of explosive munitions during at sea BOMBEX (see Table 2.2 4), and MIW training in the JAX and Charleston OPAREAs (see Figure 2.2-1) for enhanced mine countermeasures and neutralization training during major exercises. The Navy proposes to conduct mine hunting and sweeping operations in the same general area used for other major exercise events. Since water depth there is too deep for routine retrieval of submerged objects, these operations would take place without target mineshapes. The Navy further proposes to conduct mine neutralization operations in the areas currently designated for UNDET training. That water depth is much shallower, thereby allowing placement of expendable non-explosive mineshapes to simulate mine threats. MIW training involves deployment and recovery of inert mineshapes.

Under Alternative 2, the Navy proposes to eliminate all BOMBEX training events that involve dropping explosive (live) ordnance on targets at-sea. The at-sea target in these exercises is usually a flare or smoke float. All use of explosive munitions during at sea BOMBEX would be eliminated, these events typically take place in area 31J (see Figure 2.2-4).

As the nature of naval warfare has evolved, the primary operating environment for Navy Strike Groups has shifted from open ocean with its relatively low mine threat, to areas much closer to shore where mines are most effective. In response, the Navy is proposing to develop a mine countermeasures and neutralization capability to embed in its CSGs and ESGs (see description of Organic Mine Countermeasures systems in Paragraph 2.2.4.3 above) and to improve the quality of the MIW training events in major exercises. Currently, most MIW events during major exercises in the JAX and Charleston OPAREAs are table top exercises (*e.g.,* exercises conducted on paper only). The CSG Mine Warfare Commander and his staff are presented with a mine problem for which they must plan a solution using all available MCM assets. However, typically the event does not involve any helicopters, ships, or submarines actually executing the plan. The obvious shortfalls of this process is that neither the mine warfare commander nor MCM units derive the benefit of working together to execute the plan, feedback on the plan's efficacy, and the opportunity to respond to real-world contingencies that inevitably arise to complicate any plan. As CSGs begin to embark with OMCM-configured MH-60S helicopters, fleet exercise planners intend to increase the amount of live MIW training events during major exercises, up to three two-week events in the JAX and Charleston OPAREAs.

A typical CSG major exercise MIW event would simulate two mine threat scenarios: an open ocean environment and a channel or near-shore embayment with limited egress (also known as a "simulated choke point"). Up to four MH-53E and three MH60S helicopters would deploy to the exercise area one to two weeks before strike group arrival, operate from a ship participating in the exercise, and prepare a safe transit and operating area for the CSG. In the deep water training areas, the helicopters would

execute the MCM plan with their mine hunting (AQS-20A and AQS-24A) and mine sweeping (MK-103, MK-105 and OASIS) systems. Although lack of target mineshapes in the area somewhat compromises the quality of training, the participants still benefit from the live exercise. The aircrews would practice deploying their equipment in an operational environment, flying search patterns in proximity with other units, familiarizing the operators with system procedures, and recovering the equipment. In addition, the system operators would use the sonar mine hunting gear for bottom mapping-detecting, identifying and mapping mine-like objects on the ocean floor for future reference and comparison with other bottom maps. The mine warfare commander and his staff would get experience planning a large-scale operation, coordinating all the assets involved in executing the plan, and responding to emergent situations. In the shallow UNDET area, the Navy would insert several (approximately 27) non-explosive expendable bottom or moored mineshapes so the MH-60S helicopters could exercise their mine neutralization equipment (non-explosive AMNS and RAMICS), and deployed Explosive Ordnance Disposal personnel could train using live explosives to neutralize mineshapes. Mine shapes utilized in these events (RAMICS and AMNS) are temporarily placed and removed at the end of the exercise. For these exercises one mine is used per sortie. These systems and operations are described further in Section 2.2.4.3, Table 2.2-4 and Appendix D. Potential effects associated with the active sonar component of AQS-20 and AQS-24A are analyzed separately in the AFAST FEIS/OEIS and summarized in Section 3.20 of this document.

If the Preferred Alternative were to be selected, all components of the proposed action (*i.e.*, increase in training and RDT&E operations, force structure changes, and implementation of enhancement recommendations) would be achieved based on the goal of meeting the purpose and need of the proposed action to the maximum extent possible by optimizing training throughput to support future contingencies.

2.2.6 Summary of Operational Parameters for all Alternatives

A summary of the Navy's proposed operational data for the No Action Alternative, Alternative 1, and Alternative 2 (Preferred Alternative) are presented in Table 2.2-4. The No-Action Alternative data are based on numbers of events and sorties currently performed on a yearly basis, with the incorporation of data to allow for the occasional surge of operations. Descriptions of weapons systems are presented in Appendix D and Appendix E.

A brief description of each range operation, along with general information regarding location of the operations was provided in Table 2.2-1. Table 2.2-4 summarizes additional details for each operation, including: vessel/aircraft (platform); types and quantities of ordnance used; and detailed locations where the operation would take place.

Table 2.2-5 is a summary of annual Navy operations and related potential stressors to be analyzed for all three alternatives based on the data presented in Table 2.2-4. These parameters are analyzed in Chapter 3 as potential stressors on the environment. Table 2.2-6 summarizes the various ordnance types for each training area within the Study Area. The table compares numbers of rounds for the three alternatives. Table 2.2-7 lists the explosive ordnance proposed for each alternative by training area and includes the net explosive weight (NEW) for each high explosive.

As discussed in Sections 1.5 and 1.7, training and RDT&E operations conducted at Pinecastle Impact Range were analyzed in a separate EIS for the Renewal of Authorization to Use Pinecastle Range, Ocala National Forest, Florida. The Pinecastle EIS is incorporated by reference in this JAX Range Complex FEIS/OEIS. A Supplemental Pinecastle EIS is currently being prepared to update the range footprint analysis. Operations analyzed in the Pinecastle EIS will remain constant; implementation of the No Action Alternative, Alternative 1, or Alternative 2 proposed in this JAX Range Complex FEIS/OEIS would not affect the analyses or conclusions of the Pinecastle EIS or Supplemental EIS for the Pinecastle Impact Range.

2.2.7 Alternatives Considered but Eliminated from Further Analysis

2.2.7.1 No Training Alternative

If the Navy did not conduct training exercises along the East Coast, they would not be able to meet its obligations, as identified in Title 10 United States Code, Section 5062, which requires the Navy to be "organized, trained, and equipped primarily for the prompt and sustained combat incident to operations at sea." Without proper training, U.S. combat forces would not be capable of deploying at a level of readiness necessary to respond to "real world" contingency situations as have recently occurred in the eastern Mediterranean and the Arabian Sea, or potential future threat situations in the China Sea and Sea of Japan. Additionally, RDT&E supports the Title 10 mandate because it provides the Navy the capability of developing weapon systems and ensuring their safe and effective implementation for the Atlantic Fleet. For these reasons, an alternative that would decrease military training from current levels or eliminate training altogether would not meet the purpose and need of the Proposed Action. The CEQ requires an EIS to include an alternative of No-action. The CEQ defines "No-action" as no change from current activities. This alternative has been eliminated from further consideration in the EIS/OEIS.

2.2.7.2 Alternative Range Complex Locations

No single range complex on the east coast can accommodate the entire spectrum of Navy and Marine Corps training and testing. To maintain a high level of combat readiness for naval forces at best value to the U.S. taxpayer, the Navy and Marine Corps homeported their forces in multiple concentration areas rather than a single area, in part to ensure the surrounding training and testing areas could support their specific needs. The result is a system of range complexes, each optimized to support the limited set of warfare areas that predominate in that locale. Taken as a whole, this system of ranges provides a robust training and testing capability for all naval warfare missions, but no one range complex can cover them alone.

As discussed in Section 1.2.1.2, naval forces need to train for a wide variety of operations conducted on and below the ocean surface, on land and in the air. Beyond these broad categories, the Navy needs access to training areas with some very specific attributes. For example, the wide ranges of Navy and Marine Corps mission areas call for an equally wide variety of very different land ranges.

- Amphibious training requires a military beach that opens directly to maneuver areas and live fire ranges.
- Aircraft strike training requires an array of air-to-ground bombing ranges, each overlain with SUA that separates military aircraft and ordnance from civil aircraft.
- Small boat riverine operations need a stretch of inland water adjacent to land targets suitable for live fire.

Again, no single range complex on the east coast has all of the geographic attributes required to support the entire spectrum of Navy and Marine Corps training and testing. A second consideration is that there are two broad levels of training that differ in complexity and requirements: unit-level training and major exercises. Generally, these two levels of training differ in their requirements for the size of the training area, distance from home base, and sophistication of range support.

Unit Level Training (ULT). As discussed in Section 1.2.1.3, high-volume, short-duration training exercises by individual ships and aircraft characterize ULT. The size of the training area is relatively smaller and range support requirements for ULT are not as great as with large-scale, major exercises.

In Fleet concentration areas, backyard ranges best meet these needs. Backyard ranges are training or testing areas close enough to base that an aircraft can launch from its home airfield, conduct its mission, and return to base during a single sortie. For a surface ship or submarine, the backyard range is the ocean operating area just outside its homeport where it can conduct an array of ULT events on a one- or two-day

underway period. To displace training and testing areas for ULT events beyond the geographic reach of a backyard range would require thousands of sailors and marines to deploy for even the simplest training, incurring an inordinate expense, both in cost and time away from home, and would quickly degrade the combat readiness of the entire Fleet.

The Navy and Marine Corps have concentration areas near the Northeast (undersea RDT&E), VACAPES (most Atlantic Fleet surface ships, strike/fighter and mine warfare aircraft, missile and aircraft RDT&E), Cherry Point (Marine Forces Atlantic), and Jacksonville (air and surface anti-submarine warfare) Range Complexes. Consolidating training and testing support for all of these disparate mission areas, currently spread across the entire Atlantic seaboard, is highly impractical from a geographic standpoint.

Major Exercises. USFF conducts six to eight large-scale major exercises (JTFEX/COMPTUEX) every year, and each involves thousands of participants, multiple ships and aircraft, and elaborate range support requirements over a period of one to four weeks. Ideally, the venue for a major exercise would not require more than a couple of day's transit time for most participants, unlike ULT which requires training venues much closer to the home ports/home bases. Of greater importance is access to large, relatively unencumbered ocean operating areas, multiple strike targets, and specialized range attributes to support the battle scenario, such as a large military beach, opposition forces, and/or electronic combat simulators. No single east coast range complex offers the whole package of range attributes to adequately support all major exercises from start to finish.

The JAX Range Complex possesses a number of features that make it an indispensable component of the Navy's East Coast system of ranges.

- Jacksonville, Florida has been a fleet concentration area since before World War II, and today has the largest Atlantic Fleet assemblage of ships, aircraft and personnel. Also, nearby Naval Submarine Base Kings Bay hosts the Atlantic Fleet ballistic missile submarines. The JAX Range Complex is, by default, the backyard range for all warfare missions conducted by these forces. The local infrastructure built up over the years - piers, airfields, fuel depots, maintenance facilities, support personnel, *etc*., makes supporting a high volume of training operations relatively easy, an advantage that disappears if most training is done remotely. Conversely, the cost of moving either the homeport or the ULT venues for all these forces is simply cost prohibitive.
- Large fixed-wing patrol aircraft and helicopters launching from the airfields at either NAS Jacksonville or NS Mayport can easily and quickly access offshore training areas without interacting with the extremely busy east coast commercial jetways. This situation is ideal for the high volume of daily training flights from the Navy P-3C and single SH-60B/MH-60R FRS and pilot replacement squadrons homeported in the Jacksonville area.
- Weather in the Jacksonville area is often more favorable for large scale major exercises than in the northern regions, particularly during the winter months when persistent low pressure systems can curtail Strike Group at-sea training in the VACAPES and Navy Cherry Point Range Complexes. At these times, a higher percentage of training events can occur in this southern OPAREA with minimum impact on training schedules and time-at-sea restrictions.
- The Atlantic Undersea Test and Evaluation Center (AUTEC) at Andros Island, Bahamas, has an array of underwater instrumented ranges and scoring capabilities, making it a possible site for training Atlantic Fleet submarines and Anti-Submarine Warfare (ASW) ships and helicopters as well as testing new undersea warfare systems. AUTEC is close enough to Jacksonville, Florida that its ships and submarines can make the transit in one day, and Jacksonville-based ASW helicopters can self-deploy to AUTEC in a matter of hours. However, AUTEC does not meet the current requirement for shallow water ASW.

- Rodman Range is in a fairly remote, unencroached location. This provides the extreme level of darkness necessary for training NAS Jacksonville-based helicopters in combat search and rescue, another Navy mission whose capability is centered here.

As a consequence to these historical and natural features that have made Jacksonville Florida and environs a fleet concentration area and preferred venue for major exercises, the Navy invested much money and effort in building the range infrastructure that supports these homeported units and training activities. Examples include:

- An extensive network of air-to-ground ordnance delivery ranges in the Jacksonville Range Complex provides backyard ranges for Navy and Marine Corps F/A-18s and H-60 based at MCAS Beaufort, NAS Jacksonville and NS Mayport. Pinecastle Range is the only Navy bombing range on the east coast authorized for live, high explosive ordnance, while Townsend Range and Rodman Range are restricted to non-explosive, non-explosive bombs. Aerial mine-laying with non-explosive shapes is authorized at Lake George Range. Nearby Avon Park Air Force Range (largest air-to-ground bombing range east of the Mississippi River) provides additional capabilities. While these important assets support local ULT training, these ranges also support STW training and pre-deployment certification during major exercises. The multiple target sets offer strike groups the opportunity to plan and conduct simultaneous, time-sensitive strike missions with live and non-explosive ordnance.
- Shipboard Electronic Systems Evaluation Facility for calibrating all combat systems of all classes of surface ships and submarines. The SESEF range is in the JAX OPAREA, just offshore of NS Mayport.

Over the years, a commercial/industrial/government support base and regulatory framework developed alongside these investments that are now mutually supporting. Also, the Navy negotiated important agreements and established standard operating procedures (SOP) and safety processes. Examples include Memorandums of Agreement between the Navy and the Federal Aviation Administration (FAA) regarding safe control and routing of aircraft, as well as lease agreements between the Navy and states/Non-Governmental Organizations regarding the use of land for military training purposes. In today's fiscal and regulatory environment, replicating these capabilities in a different location is not realistic.

In summary, the JAX Range Complex is a vital component of the Atlantic Fleet system of range complexes, necessary and critical to ensure that naval forces are prepared and certified ready for overseas deployment and combat operations. Other locations do not provide reasonable alternatives for required training purposes/activities described above, and as a result, alternative training locations were eliminated from further consideration.

2.2.7.3 Conduct Simulated Training

Under this alternative, only simulated training would be conducted using computer models and classroom training. While computer simulation and classroom training are currently used by the Navy and effective training tools, they cannot exclusively replace live training because they do not replicate the atmosphere or experience that live training provides. The value of live training that is provided by actually flying an aircraft, operating a combat system such as a shipboard gun or missile launch, or handling explosive ammunition simply cannot be substituted through simulation, particularly as it relates to the physical reaction invoked by the danger, noise, and visual effects associated with these systems. Additionally, simulation cannot replicate the environment provided during coordinated training and major exercises, where multiple ships, submarines and aircraft, and hundreds or thousands of men and women are participating in training activities in a coordinated fashion to accomplish a common military objective. Strike Groups must be able to practice and hone their skills in communication, maneuvering, operating systems, repairing equipment, and firing weapons in an environment as realistic, and replicates the high

energy and stress, of what they would encounter in an actual combat situation. Because of the need to train as we fight, this alternative would fail to meet the purpose and need of the Proposed Action in that it would not sufficiently prepare our naval forces for combat. Therefore, this alternative is not evaluated in this FEIS/OEIS.

2.2.7.4 Practice Ammunition Use

An alternative that would rely entirely on non-explosive, practice ammunition use within the JAX Range Complex would not achieve the necessary levels of proficiency in firing weapons in a high stress and realistic environment. Non-explosive, practice ammunition is utilized throughout the JAX Range Complex, and provides opportunity to implement a successful, integrated training program while reducing the risk and expense typically associated with live ammunition. As such, practice ammunition is already utilized extensively to enhance combat performance in the Navy's training program. However, while it is an essential component of training, practice ammunition cannot be used exclusively to train safely in an inherently unsafe combat environment. Consequently, this alternative fails to meet the purpose and need of the proposed action. Therefore, this alternative was not carried forward for analysis.

2.2.8 Comparison of Alternatives and Effects

The comparison of alternatives presented in Table 2.2-8 is based on the information and analyses presented in Chapter 3 (Affected Environment and Environmental Consequences). The environmental stressors associated with each warfare area and operation were evaluated for each resource or issue in assessing potential environmental impacts under each alternative. There were no recordable differences in potential impacts between the alternatives for the following resources and issues.

- Bathymetry, Sediment, and Soils
- Hazardous Materials and Hazardous Waste
- Water Resources
- Air Quality
- Airborne Noise
- Land Use
- Cultural Resources
- Transportation
- Demographics
- Regional Economy
- Recreation
- Environmental Justice
- Public Health and Safety

The potential impacts would generally be temporary, short-term, long-term, minor, and/or localized changes to these resources or issues. As defined under NEPA, no significant impacts in U.S. Territory and no significant harm in Non-Territorial Waters to resources or issues were identified considering implementation of mitigation measures described in Chapter 5. In addition, resources were evaluated in accordance with Marine Mammal Protection Act (MMPA). Endangered Species Act (ESA), Migratory Bird Treaty Act (MBTA), Bald and Golden Eagle Protection Act (Eagle Act), and Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA). The potential impacts presented below provide the basis for providing choices to the decision-maker. The Preferred Alternative (Alternative 2) includes the elimination of high explosive bombs during at sea bombing exercises.

TABLE 2.2-4
CURRENT AND PROPOSED OPERATIONS IN THE JAX STUDY AREA

Range Operation	Platform	System or Ordnance[7]	No Action Alternative	Alternative 1	Alternative 2	Location
MINE WARFARE (MIW)						
Mine Laying	P-3C P-8	BDU-45, MK-76 or BDU-48 (NEPM)	10 sorties[8] (40 bombs)	10 sorties (40 bombs)	10 sorties (40 bombs)	Lake George Range Figure 2.1-3
Mine Countermeasures[9]	MH-53E[10]	MK-103	12 sorties	12 sorties	40 sorties	Amber Strait and Kaiser Carrier OPAREA[11] Figure 2.2-1
		MK-105	12 sorties	12 sorties	40 sorties	
		AQS-14A & AQS-24A	54 sorties	54 sorties	160 sorties	
	MH-60S[12]	OASIS	none	18 sorties	54 sorties	
		AQS-20A	none	54 sorties	162 sorties	
Mine Neutralization[9,13]	MH-60S	AMNS (NEPM)[14]	none	9 sorties[15]	27 sorties	Charleston OPAREA (10L and 12I) Figure 2.2-1
		RAMICS	none	9 sorties[15]	27 sorties	
	EOD	20 pounds (Lbs) charges	18 events	12 events	12 events	Charleston OPAREA (10L and 12I) Figure 2.2-1

[7] Shaded cells include HE ordnance proposed (i.e., ordnance typically used in combat or possessing same of similar explosive filler as combat ordnance).
[8] A sortie is a single training or RDT&E flight conducted by one aircraft identified by a take-off and a final landing.
[9] Major exercises only; assum carrier strike group COMPTUEX MIW events per year; neither Alternative 1 nor Alternative 2 would include deploying mineshapes.
[10] During major exercise mine warfare events, four MH-53E would fly two 3-hr missions/day for 10 days.
[11] These are synthetic geography for training purposes.
[12] During major exercise mine warfare events, three MH-60S would fly three 2hr missions/day for 10 days.
[13] Non-explosive, expendable moored mineshapes used for targets.
[14] NEPM = non-explosive practice munitions that have no explosive filler but may contain spotting charges or signal cartridges for impact locating purposes
[15] Mineshapes are not used under Alternative 1

TABLE 2.2-4 (Continued)
CURRENT AND PROPOSED OPERATIONS IN THE JAX STUDY AREA

Range Operation	Platform	System or Ordnance	No Action Alternative	Alternative 1	Alternative 2	Location
SURFACE WARFARE (SUW)						
MISSILEX (A-S)[16]	P-3C and P-8A	AGM-65 Maverick (HE)	3 sorties (3 missiles)	3 sorties (3 missiles)	3 sorties (3 missiles)	W-157A and W-159A (Missile Laser Training Area) Figure 2.2-2
	MH-60R/S, SH-60B, HH60-H	AGM-114 Hellfire (HE)	30 sorties (30 missiles)	70 sorties (70 missiles)	70 sorties (70 missiles)	
GUNEX (A-S)[17]	H-60 (all models)	.50 cal machine gun	70 sorties (112,000 rounds)	70 sorties (112,000 rounds)	70 sorties (112,000 rounds)	W-132, W-133, W-134, W-157, W-158 Figure 2.1-2
	H-60 (all models), MH-68 (U.S. Coast Guard [USCG])	M-240 (7.62 mm) machine gun	84 sorties (192,000 rounds)	84 sorties (192,000 rounds)	84 sorties (192,000 rounds)	
	SH-60B, MH-60R, MH-68 (USCG)	.50 cal rifle	14 sorties (140 rounds)	14 sorties (140 rounds)	14 sorties (140 rounds)	W-157, W-158 Figure 2.1-2
GUNEX (Surface-to-Surface) (Boat)	Harbor Defense Boats (Boston Whalers)[18]	.50 cal guns	96 events (40,000 rounds)	96 events (44,000 rounds)	96 events (44,000 rounds)	Charleston OPAREA UNDET North and South Figure 2.2-3
		M-60 and M-240 (7.62 mm)	96 events (44,800 rounds)	96 events (49,300 rounds)	96 events (49,300 rounds)	
		M-19 (40 mm NEPM)	96 events (11,520 rounds)	96 events (12,700 rounds)	96 events (12,700 rounds)	
GUNEX (Surface-to-Surface) (FAC/FIAC)	CG, DDG, FFG	none	9 events	9 events	9 events	JAX and Charleston OPAREAs Figure 2.1-1(

[16] Laser or infra-red target on barge. Both Hellfire and Maverick missiles detonate at or just below the water's surface.
[17] Target: MK-58 Marine Marker (smoke float) or non-expendable surface targets (QSR 35 Seaborne Powered Target, High Speed Maneuverable Surface Target, or remote-controlled Jet Ski).
[18] NECC small boat live-fire gun qualifications and training; 32 training days/year with 2-4 training events/day

TABLE 2.2-4 (Continued)
CURRENT AND PROPOSED OPERATIONS IN THE JAX STUDY AREA

Range Operation	Platform	System or Ordnance	No Action Alternative	Alternative 1	Alternative 2	Location
SURFACE WARFARE (SUW) (....continued)						
GUNEX (Surface-to-Surface) (Ship)	CG, DDG[19]	5" gun	28 events (737 rounds)	31 events (810 rounds)	31 events (810 rounds)	JAX OPAREA (Surface Gunnery Areas AA, BB, CC) Figure 2.2-3
	FFG[20]	76 mm gun	52 events (871 rounds)	58 events (960 rounds)	58 events (960rounds)	
	CG, DDG, FFG[21]	.50 cal machine gun	40 events (96,240 rounds)	44 events (105,800 rounds)	44 events (105,800 rounds)	
		25 mm machine gun	40 events (24,000 rounds)	44 events (26,400 rounds)	44 events (26,400 rounds)	
Bombing Exercise (BOMBEX) (A-S)[22]	P-3C, P-8A[23]	MK-82 (500 lbs HE bomb)	6 events (24 bombs)	6 events (24 bombs)	0	W-158A (31J) Figure 2.2-4
	F/A-18[24]		9 events (36 bombs)	9 events (36 bombs)	0	
	P-3C, P-8A	MK-82(I), BDU-45 (500lb NEPM)	0	0	36 events (144 bombs)	W-157A/B W-158A/B Figure 2.2-4
	F/A-18		45 events (180 bombs)	45 events (180 bombs)	90 events (360 bombs)	

[19] Targets: High Speed Maneuvering Surface Target, MK-33 SEPTAR, trimaran or radar reflective surface balloon (killer tomato)
[20] High Speed Maneuvering Surface Target or radar reflective surface balloon (killer tomato)
[21] Targets: 55 gallon drum, balloon (weather, Mylar, or target) or FAST
[22] Targets are typically smoke floats. An event consists of one or more aircraft dropping one or more bombs on a target in closely timed intervals.
[23] Event = 1 P-3 or P-8 dropping 4 bombs
[24] Event = a flight o F/A-18s, each dropping 2 bombs

TABLE 2.2-4 (Continued)
CURRENT AND PROPOSED OPERATIONS IN THE JAX STUDY AREA

Range Operation	Platform	System or Ordnance	No Action Alternative	Alternative 1	Alternative 2	Location
SURFACE WARFARE (SUW) (....continued)						
BOMBEX (A-S)	F/A-18[29]	MK-83 (1,000 lbs HE bomb)	3 events (12 bombs)	3 events (12 bombs)	0	W-158A (31J) Figure 2.2-4
		MK-83(I) (1,000 lbs NEPM)	0	0	3 events (12 bombs)	W-157A/B W-158A/B Figure 2.2-4
	F/A-18[25]	MK-84 (2,000 lbs HE bomb)	1 event (1 bomb)	1 event (1 bomb)	0	W-158A (31J) Figure 2.2-4
	P-3C, P-8A[26]	MK-20 (cluster bomb, HE)	4 events (4 bombs)	4 events (4 bombs)	0	W-158A (31J) Figure 2.2-4
	F/A-18[29]	MK-20 (cluster bomb, NEPM)	13 events (51 bombs)	13 events (51 bombs)	13 events (51 bombs)	W-157A/B W-158A/B Figure 2.2-4
	F/A-18[27]	MK-76 (25 lbs NEPM with small smoke charge)	13 events (129 bombs)	13 events (129 bombs)	13 events (129 bombs)	W-157A/B W-158A/B Figure 2.2-4
Laser Targeting[28]	H-60	Hellfire Laser Fire Control System	248 sorties	275 sorties	275 sorties	W-132, W-133, W-134, W-157, W-158
	P-3C	Maverick Laser Fire Control System	24 sorties	28 sorties	28 sorties	W-132, W-133, W-134, W-157, W-158

[25] Event = 1 F/A-18 dropping 1 bomb
[26] Event = 1 P-3 or P-8 dropping 1 bomb
[27] Event = a flight o F/A-18s, each dropping 5 bombs
[28] Laser targeting only; no missile fired. Laser target mounted on a barge.

TABLE 2.2-4 (Continued)
CURRENT AND PROPOSED OPERATIONS IN THE JAX STUDY AREA

Range Operation	Platform	System or Ordnance	No Action Alternative	Alternative 1	Alternative 2	Location
SURFACE WARFARE (SUW) (....continued)						
Maritime Security (MS) to include Visit, Board, Search, and Seizure/Maritime Interception Operations (VBSS/MIO)- Ship and Helo; anti-piracy operations; and special operations forces.	Rigid Hull Inflatable Boat or similar small boat, and CG, DDG, FFG, LPD or LSD	none	82 events	90 events	90 events	JAX and Charleston OPAREAs Figure 2.1-1
MS to include VBSS/MIO-Helicopter	H-60	None	54 events	60 events	60 events	W-157A (Area 4X) and W-159A (Area 5X) Figure 2.1-2
AIR WARFARE (AW)						
Air Combat Maneuvers (ACM)[29]	F/A-18	Captive carry missiles or telemetry pods	1,132 sorties	1,245 sorties	1,245 sorties	W-157A (Area 3X, 4X) Figure 2.2-5
MISSILEX (A-A)[30]		AIM-7, AIM-9, AIM-120 (30% HE, 70% NEPM)	20 sorties (6 HE, 14 NEPM)	22 sorties (7 HE, 15 NEPM)	22 sorties (7 HE, 15 NEPM)	W-132, W-133, W-134, W-157, W-158 Figure 2.1-2
MISSILEX (Surface-to-Air)	CG, DDG LHA, LHD[31]	SM-2 (HE) Sea Sparrow (HE)	0 events (0 missiles)	8 events (8 missiles)	8 events (8 missiles)	JAX and Charleston OPAREAs Figure 2.1-1

[29] No ordnance released during ACM exercises. About 50% of aircraft carry telemetry pods that provide time-space-position information for post-event feedback.
[30] All exercises involve actual missile launch. Captive carry operations are considered ACM. Targets are BQM-74E (33%) or Tactical Air Launch Decoys (67%).
[31] SM-2 launched from CG/DDG; Sea Sparrows launch from LHA/LHD; target would be BQM-74 launched from Gulfstream aircraft or surface vessel. These missiles explode 30-60 feet above surface.

TABLE 2.2-4 (Continued)
CURRENT AND PROPOSED OPERATIONS IN THE JAX STUDY AREA

Range Operation	Platform	System or Ordnance	No Action Alternative	Alternative 1	Alternative 2	Location
Air Intercept Control[32]	F/A-18, E-2C, CVN, CG, DDG, LHA, LHD	Air Search and fire control radars	32 events (150 sorties)	32 events (150 sorties)	32 events (150 sorties)	W-132, W-133,W-134, W-157, W-158 Figure 2.1-2
Detect-to-Engage[33]	CG, DDG, FFG, LHA, LHD, LPD, LSD, CVN		77 events	85 events	85 events	
GUNEX[34] (S-A)	CG, DDG	5" gun (inert)	4 events (88 rounds)	5 events (100 rounds)	5 events (100 rounds)	JAX OPAREA (Surface Gunnery Areas AA, BB, CC) Figure 2.2-3
	FFG	76 mm gun (inert)	7 events (168 rounds)	8 events (192 rounds)	8 events (192 rounds)	
	CG, DDG, FFG	20 mm Close-in Weapons System	10 events (18,900 rounds)	11 events (20,800 rounds)	11 events (20,800 rounds)	
GUNEX (A-A)	F/A-18	20 mm cannon	45 sorties (7,500 rounds)	47 sorties 8,250 rounds	47 sorties 8,250 rounds	W-157A/W-133 (Area 2X) Figure 2.1-2
STRIKE WARFARE (STW)						
BOMBEX (A-G)	F/A-18	MK-76, BDU-45, BDU-48, MK-106 (NEPM)	25 sorties (100 bombs)	25 sorties (100 bombs)	25 sorties (100 bombs)	Rodman Range Figure 2.1-3
CSAR and Convoy Operations	SH-60F, HH-60H, MH-60S	Blank MG ammunition, chemical lights	146 events[35]	146 events	146 events	Rodman Range Figure 2.1-3

[32] AIC can have 2-6 aircraft per intercept; for purposes of analysis, use aircraft per intercept; E-2 aircraft may participate in AIC sorties. Commercial Air Services (CAS) could provide threat aircraft, intercept aircraft, or both.
[33] CAS could provide threat aircraft or simulated missile.
[34] Targets are banners towed by CAS aircraft for (S-A) and live fire against banner target towed by F/A-18 aircraft for (A-A).
[35] 101 events for Unit level training, an event equals a single sortie. 45 events for major exercises, an event is composed of two H-60 helicopters while three F/A-18 aircraft are at high altitude providing close air support if needed.

TABLE 2.2-4 (Continued)
CURRENT AND PROPOSED OPERATIONS IN THE JAX STUDY AREA

Range Operation	Platform	System or Ordnance	No Action Alternative	Alternative 1	Alternative 2	Location
Amphibious Warfare (AMW)						
FIREX (Surface-to-Surface) with IMPASS	CG, DDG	5" gun (IMPASS)[36]	10 events (390 HE rounds; 310 NEPM rounds)	10 events (390 HE rounds; 310 NEPM rounds)	10 events (390 HE rounds; 310 NEPM rounds)	JAX OPAREA (Surface Gunnery Areas BB and CC) Figure 2.2-3
ELECTRONIC COMBAT (EC)						
EC Operations[37]	EA-6B, F/A18G	AN/ALQ-218, AN/ALQ-99, AN/USQ-113	108 sorties	120 sorties	120 sorties	W-132, W-133, W-134, W-157, W-158 Figure 2.1-2
	CG, DDG, FFG,CVN, LHD, LPD, LSD	SLQ-32	56 events	61 events	61 events	JAX and Charleston OPAREAs Figure 2.1-1
Chaff Exercise	CG, DDG, FFG, LCC, LHA, LHD, LPD, LSD	MK-214 (seduction chaff)	50 events (300 canisters)	56 events (336 canisters)	56 events (336 canisters)	JAX and Charleston OPAREAs Figure 2.1-1
	CG, DDG, FFG, LCC, LHA, LHD, LPD, LSD	MK-216 (distraction chaff)	16 events (96 canisters)	18 events (108 canisters)	18 events (108 canisters)	JAX and Charleston OPAREAs Figure 2.1-1
	H-60	RR-181/AL	8 sorties (8 canisters)	9 sorties (9 canisters)	9 sorties (9 canisters)	JAX and Charleston OPAREAs
	F/A-18[38]	R-144, R-129	377 sorties (3,770 canisters)	415 sorties (4,150 canisters)	415 sorties (4,150 canisters)	W-157A (Area 3X, 4X) Figure 2.2-5
Flare Exercise	F/A-18[39]	MK-46 MOD 1C, MJU-8A/B, MJU-27A/B, MJU-32B, MJU-53B, SM-875/ALE	12 sorties (60 flares)	14 sorties (70 flares)	14 sorties (70 flares)	W-157A (Area 3X, 4X) Figure 2.2-5
	H-60		56 sorties (1,680 flares)	80 sorties (2,400 flares)	80 sorties (2,400 flares)	Lake George Range Figure 2.1-3

[36] 70 rounds per event (39 high explosive rounds and 31 non-explosive rounds).
[37] Major exercises only. CAS could provide threat fire control radar simulation.
[38] Typically not a stand-alone exercise, rather usually conducted in association with air combat maneuvering (ACM) exercise. About a third of ACM exercises include release of chaff.
[39] Typically not a stand-alone exercise, rather usually conducted in association with ACM. About 1% of ACM exercises include release of flares.

TABLE 2.2-4 (Continued)
CURRENT AND PROPOSED OPERATIONS IN THE JAX STUDY AREA

Range Operation	Platform	System or Ordnance	No Action Alternative	Alternative 1	Alternative 2	Location
OTHER EVENTS						
Shipboard Electronic Systems Evaluation Facility Utilization (SESEF)	CG, DDG, FFG	Radio and radar only	1,937 tests[40]	2,130 tests	2,130 tests	5-15 nm east of NS Mayport Figure 2.2-5
Precision Anchoring	CG, DDG, FFG	None	168 anchorages	168 anchorages	168 anchorages	3 nm offshore at NS Mayport Figure 2.2-5
Small Arms	Harbor Defense Boats	MK3A2 Concussion anti-swimmer grenades (8 oz HE)	96 events (80 rounds)	96 events[41] (80 rounds)	96 events (80 rounds)	Charleston OPAREA UNDET North and South Figure 2.2-1

[40] SESEF testing requires no analysis as there are no munitions or military expendable materials used.
[41] Not all of the 96 small arms training events include the use of live MK3A2 grenades, only a portion of them. There will be a total of 80 grenades used per year.

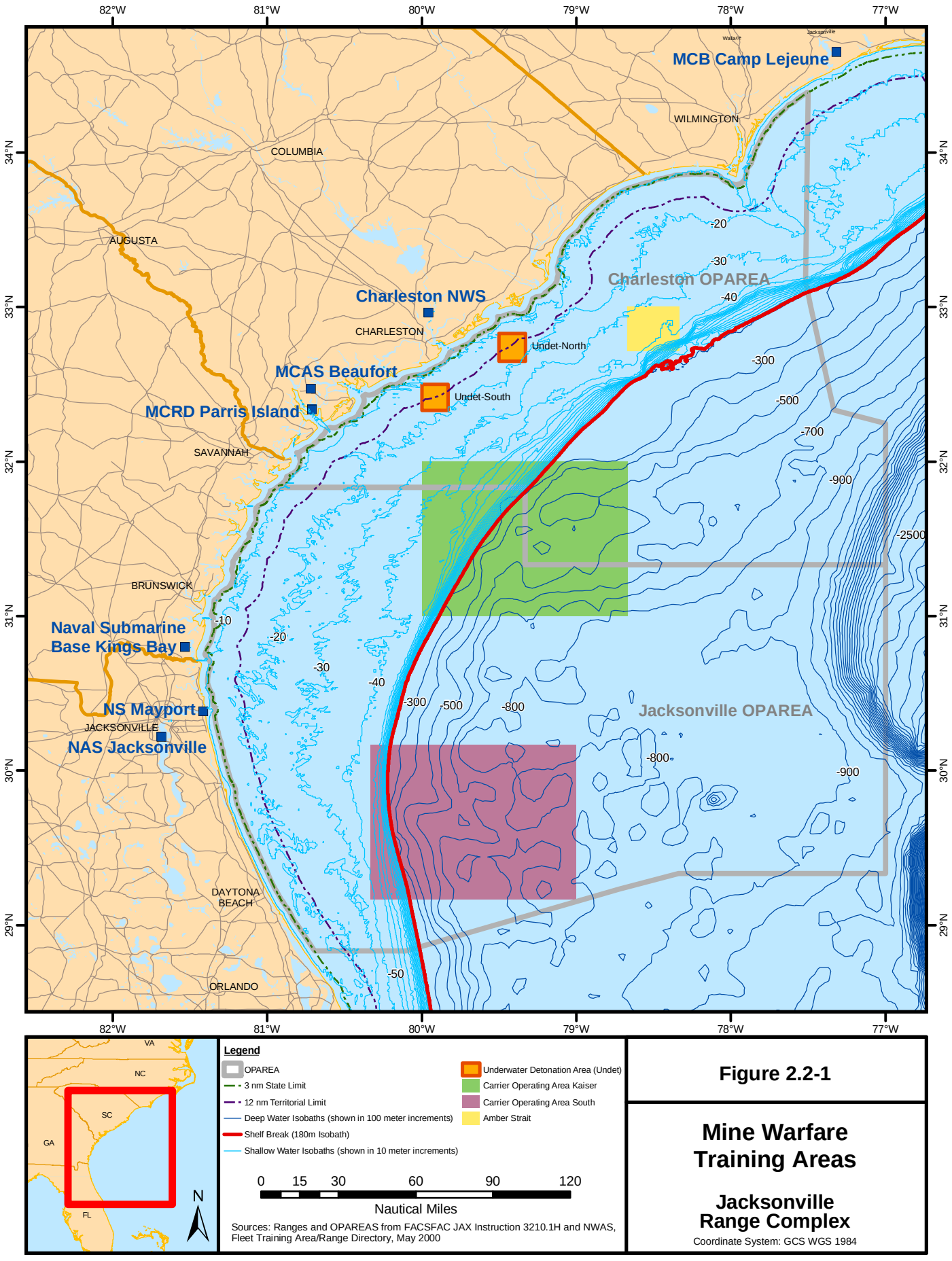


Figure 2.2-1

Mine Warfare Training Areas

Jacksonville Range Complex

Coordinate System: GCS WGS 1984

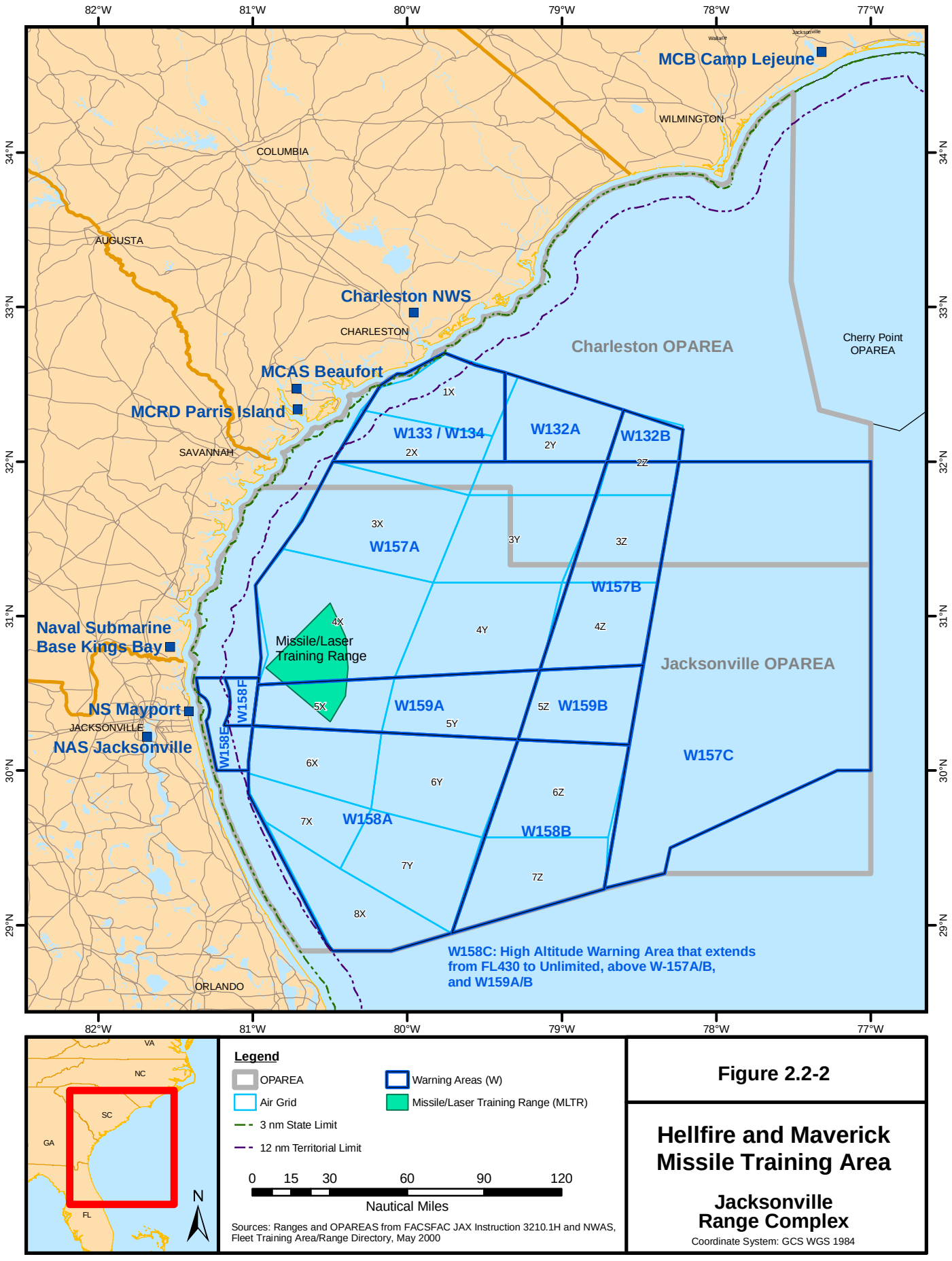


Figure 2.2-2

Hellfire and Maverick Missile Training Area

Jacksonville Range Complex

Coordinate System: GCS WGS 1984

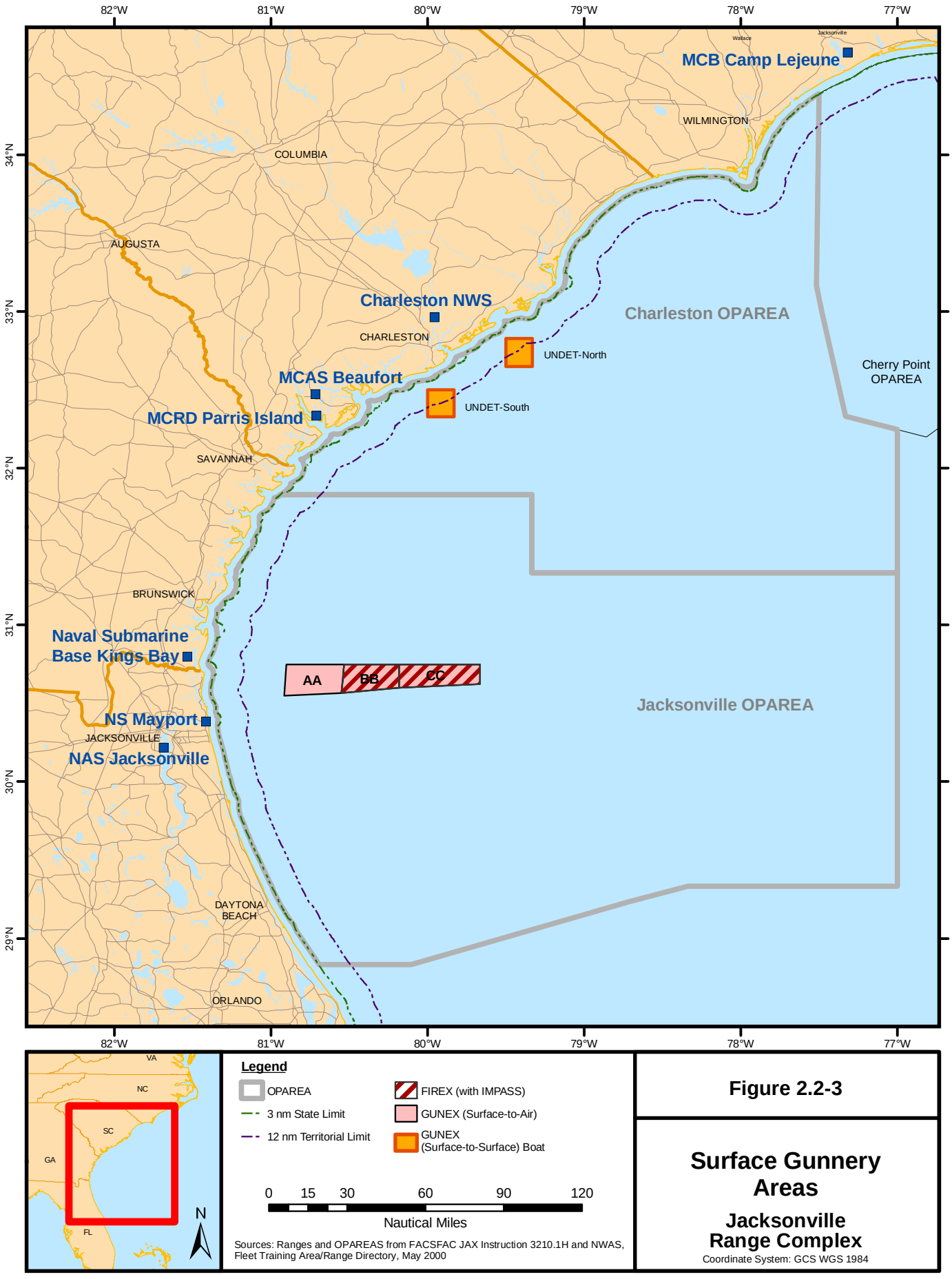


Figure 2.2-3

Surface Gunnery Areas

Jacksonville Range Complex

Coordinate System: GCS WGS 1984

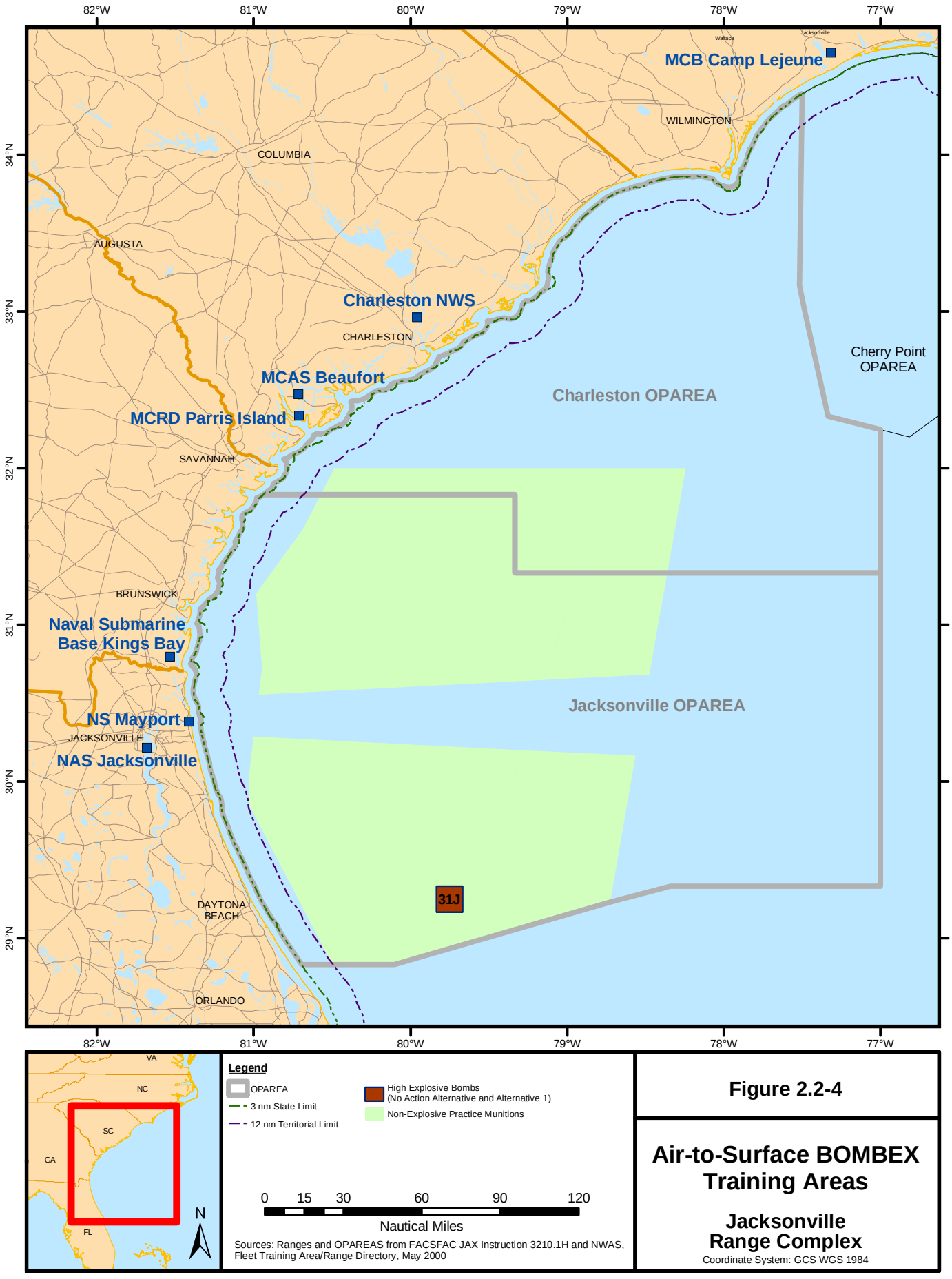


Figure 2.2-4

Air-to-Surface BOMBEX Training Areas

Jacksonville Range Complex

Coordinate System: GCS WGS 1984

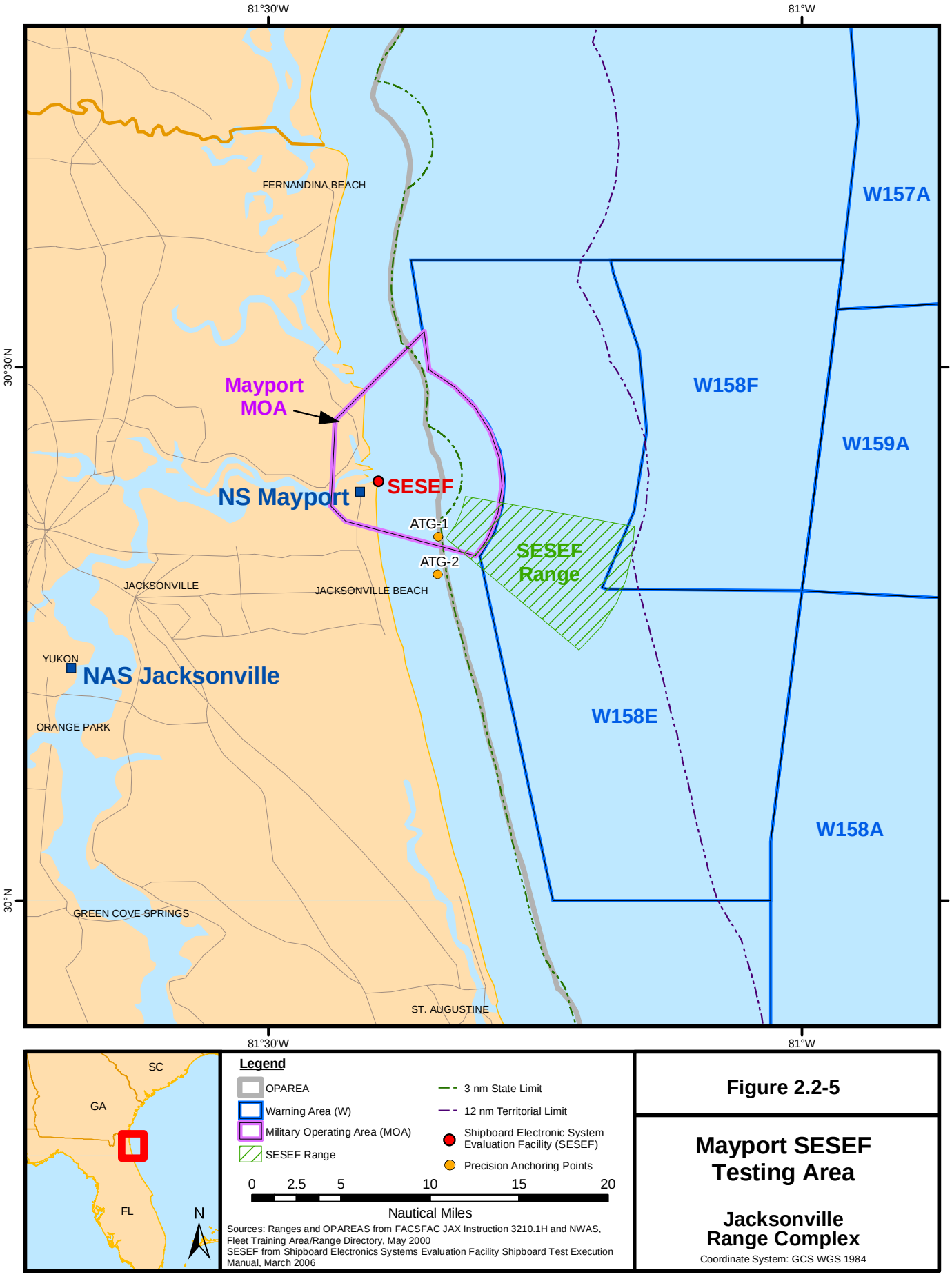


Figure 2.2-5

Mayport SESEF Testing Area

Jacksonville Range Complex

Coordinate System: GCS WGS 1984

TABLE 2.2-5
SUMMARY OF PROPOSED CHANGES IN ANNUAL OPERATIONS FOR ALL ALTERNATIVES IN THE JAX STUDY AREA

Potential Stressor	No Action	Alternative 1		Alternative 2	
	(#/yr)	(#/yr)	(Change From No Action)	(#/yr)	(Change From No Action)
Vessel Movements					
Approx. Steaming days/yr[42]	1,000	1,050	5%	1,050	5%
Aircraft Overflights					
Fixed-wing aircraft sorties/yr	1,687	1,820	8%	1,833	9%
Helicopters sorties/yr	896	1,096	22%	1,438	60%
Towed Mine Warfare Devices					
Sorties/yr (MK-103, MK-105, OASIS, AQS-20A, AQS-24A	78	150	92%	456	485%
Weapons Firing (NEPM only)					
Bombs/yr	500	500	0%	836	67%
Missiles (A-A)/yr	14	15	7%	15	7%
Cannon shells (20-30 mm)/yr	50,040	55,675	11 %	56,125	12%
Naval gun shells (5 in and 76 mm)/yr	2,174	2,372	9%	2,372	9%
Small caliber (.50 cal and 7.62 mm)/yr	485,180	503,240	4%	503,240	4%
M19 (40 mm rounds)/yr	11,520	12,700	10%	12,700	10%
Above Surface/HE Use					
Missiles, SM-2 (Surface-to-Air)	0	6	NA	6	NA
Missiles, Sea Sparrow (Surface-to-Air)	0	2	NA	2	NA
AIM -7, AIM-9, AIM-120	6	7	16%	7	16%
Underwater Explosions/detonations (High Explosive ordnance)					
Bombs					
MK-82/yr	60	60	0%	0	-100%
MK-83/yr	12	12	0%	0	-100%
MK-84/yr	1	1	0%	0	-100%
MK-20/yr	4	4	0%	0	-100%
Maverick A-S Missiles	3	3	0%	3	0%
Hellfire (A-S)	30	70	133%	70	133%
Naval gun shells (5in) (IMPASS events)/yr	390	390	0%	390	0%
20 lbs charges/yr	18	12	-33%	12	-33%
Anti-swimmer grenades (MK3A2)	80	80	0%	80	0%

[42] Vessel movement was computed as the number of steaming days per year by summing the number of steaming hours proposed in the range complex, dividing by 24 hours per day, and rounding to the nearest 10 days.

TABLE 2.2-5 (Continued)
SUMMARY OF PROPOSED CHANGES IN ANNUAL OPERATIONS FOR ALL ALTERNATIVES IN THE JAX STUDY AREA

Potential Stressor	No Action	Alternative 1		Alternative 2	
	(#/yr)	(#/yr)	(Change From No Action)	(#/yr)	(Change From No Action)
Expended Material					
Ordnance related material[43]	see footnote	see footnote	see footnote	see footnote	see footnote
Targets/yr	40	44	10%	44	10%
Chaff (RR-144 & R-129) canisters/yr	3,770	4,150	10%	4,150	10%
Chaff (RR-181) canisters/yr	8	9	13%	9	13%
Chaff (MK-214 & MK-216)canisters/yr	396	444	12%	444	12%
Defensive flares/yr	1,740	2,470	42%	2,470	42%
Marine markers (smoke floats)/yr	300	300	0%	300	0%

TABLE 2.2-6
SUMMARY OF ORDNANCE USE BY TRAINING AREA IN THE JAX STUDY AREA

Training Area and Ordnance Type	Number of Rounds Per Year		
	No Action	Alternative 1	Alternative 2
JAX and Charleston OPAREAs			
Missiles (Surface-to-Air; HE; SM-2 [NEW=76 lbs] and Sea Sparrow [NEW=32 lbs])	0	8	8
GUNEX (A-A) 20 mm NEPM	7500	8250	8250
Charleston OPAREA (11J)			
Small caliber (.50 cal and 7.62 mm; all NEPM)	84,800	93,300	93,300
M19 (40 mm rounds; NEPM)	11,520	12,700	12,700
Subtotal =	103,820	114,258	114,258
Charleston OPAREA (North and South Undet Boxes; 10L and 12I)			
MK3A2 Anti-swimmer grenades (8 oz HE)	80	80	80
20 lbs charges (HE)	18	12	12
RAMICS 30 mm projectiles (NEPM)	0	225	675
JAX OPAREA (AA, BB, CC)			
Naval gun shells (5 in and 76 mm; NEPM)	2,174	2,372	2,372
Naval gun shells (5 in; HE rounds)	390	390	390
Cannon shells (25 mm; NEPM)	24,000	26,400	26,400
Small caliber (.50 cal; NEPM)	96,240	105,800	105,800
Subtotal =	122,902	135,063	135,081

[43] Values are the same as those presented for weapons firing and ordnance use.

TABLE 2.2-6 (Continued)
SUMMARY OF ORDNANCE USE BY TRAINING AREA
IN THE JAX STUDY AREA

Training Area and Ordnance Type	Number of Rounds Per Year		
	No Action	Alternative 1	Alternative 2
W-132, W-133, W-134			
Missiles (Air-to-Air; NEPM)	7	8	8
Missiles (Air-to-Air; HE)	3	4	4
Small caliber (.50 cal and 7.62 mm; NEPM)	182,400	182,400	182,400
Subtotal =	182,410	182,412	182,412
W-157 and W-158			
Missiles (Air-to-Air; NEPM)	7	7	7
Missiles (Air-to-Air; HE)	3	3	3
Small caliber (.50 cal and 7.62 mm; NEPM)	121,740	121,740	121,740
Subtotal =	121,750	121,750	121,750
W-157A and W-159A (MLTR)			
Missiles, Air-to-Surface (Hellfire and Maverick; all HE rounds)	33	73	73
W-157A/B			
Bombs (NEPM)	180	180	348
W-158A/B			
Bombs (NEPM)	180	180	348
W-158A (31J)			
Bombs (HE)	77	77	0
Rodman Range			
Bombs (BDU-45, BDU-48, MK-76, or MK-106; NEPM)	100	100	100
Blank ammunition	297	50	50
Lake George Range			
Bombs (BDU-45, BDU-48, or MK-76; NEPM) used as mineshapes	40	40	40
Study Area Total =	531,789	554,183	554,460

TABLE 2.2-7
SUMMARY OF UNDERWATER EXPLOSIONS AND THEIR NET EXPLOSIVE WEIGHTS BY TRAINING AREA IN THE JAX STUDY AREA

Training Area, Ordnance Type, and Net Explosive Weight (NEW)	Number of Rounds Per Year		
	No Action	Alternative 1	Alternative 2
W-158 (31J)			
Bombs: MK-82 (192.2 lbs NEW)	60	60	0
Bombs: MK-83 (415.8 lbs NEW)	12	12	0
Bombs: MK-84 (944.7 lbs NEW)	1	1	0
Bombs: MK-20 (109.7 lbs NEW)	4	4	0
Subtotal =	77	77	0
W-157A and W-159A (MLTR)			
Missile: AGM-65 Maverick (80 lbs NEW)	3	3	3
Missile: Hellfire (8 lbs NEW)	30	70	70
JAX OPAREA (BB, CC)			
Naval Gun shells, 5 in (8 lbs NEW)	390	390	390
Charleston OPAREA (North and South UNDET boxes; 10L and 12I)			
20 lbs NEW charges	18	12	12
Charleston OPAREA (North and South UNDET boxes; 10L and 12I)			
MK3A2 Anti-swimmer grenades (0.5 lbs NEW)	80	80	80
Total Explosions in Study Area =	568	562	485

TABLE 2.2-8
COMPARISON OF ALTERNATIVES AND EFFECTS

Resource or Issue	Alternatives		
	No Action Alternative	Alternative 1	Preferred Alternative
Marine Communities	Long-term minor impacts to live hard bottom communities from accumulation of NEPM (Section 3.6.3.1)	Slight increase in potential impacts to live hard bottom communities from accumulation of NEPM (Section 3.6.3.2)	Slight increase from Alternative 1 in potential impacts to live hard bottom communities from accumulation of NEPM (Section 3.6.3.3)

TABLE 2.2-8 (Continued)
COMPARISON OF ALTERNATIVES AND EFFECTS

Resource or Issue	Alternatives		
	No Action Alternative	Alternative 1	Preferred Alternative
Marine Mammals	Under MMPA, no mortality potential exposures, 1,1416 non-injurious potential exposures, and 32 injurious exposures. Under ESA, proposed activities may affect listed species (Section 3.7.3.3).	Under MMPA, no mortality potential exposures, 1,159 non-injurious potential exposures, and 31 injurious potential exposures. Under ESA, proposed activities may affect listed species. (Section 3.7.3.4)	Under MMPA, no mortality potential exposures, 94 non-injurious potential exposures, and 2 injurious potential exposures. Under ESA, proposed activities may affect listed species. (Section 3.7.3.5)
Sea Turtles	No mortality potential exposures, 446 non-injurious exposures, and 9 injurious exposures. Under ESA, proposed activities may affect listed species (Section 3.8.3.2).	No mortality potential exposures, 453 non-injurious exposures, and 9 injurious exposures. Under ESA, proposed activities may affect listed species (Section 3.8.3.3).	No mortality potential exposures, 38 non-injurious exposures, and 0 injurious exposures. Under ESA, proposed activities may affect listed species (Section 3.8.3.4).
Fish and Essential Fish Habitat (EFH)	Under MSFCMA, no significant population-level impacts to managed species would occur; impacts would be temporary, minimal, and would not reduce the quality and/or quantity of EFH. Under ESA, underwater explosions may affect one listed species. (Section 3.9.3.1)	Under MSFCMA, no significant population-level impacts to managed species would occur; impacts would be temporary, minimal, and would not reduce the quality and/or quantity of EFH. Under ESA, underwater explosions may affect one listed species. (Section 3.9.3.2)	Under MSFCMA, no significant population-level impacts to managed species would occur; impacts would be temporary, minimal, and would not reduce the quality and/or quantity of EFH. Under ESA, underwater explosions may affect one listed species. (Section 3.9.3.3)
Seabirds and Migratory Birds	Under ESA and MBTA, no effect would occur to listed species and no long-term population-level effect would occur to migratory bird populations. (Section 3.10.3.1)	Under ESA and MBTA, no effect would occur to listed species and no long-term population-level effect would occur to migratory bird populations. (Section 3.10.3.2)	Under ESA and MBTA, no effect would occur to listed species and no long-term population-level effect would occur to migratory bird populations. (Section 3.10.3.3)

TABLE 2.2-8 (Continued)
COMPARISON OF ALTERNATIVES AND EFFECTS

Resource or Issue	Alternatives		
	No Action Alternative	Alternative 1	Preferred Alternative
Biological Resources at Rodman and Lake George Ranges	Under ESA, proposed activities may affect but would not adversely affect listed species. Under MBTA and Eagle Act, no long-term effect would occur to migratory bird populations and no impacts would occur to Bald Eagles. (Section 3.11.3.1)	Under ESA, proposed activities may affect but would not adversely affect listed species. Under MBTA and Eagle Act, no long-term effect would occur to migratory bird populations and no impacts would occur to Bald Eagles. (Section 3.11.3.2)	Under ESA, proposed activities may affect but would not adversely affect listed species. Under MBTA and Eagle Act, no long-term effect would occur to migratory bird populations and no impacts would occur to Bald Eagles. (Section 3.11.3.3)
Atlantic Fleet Active Sonar Training (AFAST)	Potential impacts to resources or issues from AFAST and the Proposed Action combined are less than significant. (Section 3.20)	Potential impacts to resources or issues from AFAST and the Proposed Action combined are less than significant. (Section 3.20)	Potential impacts to resources or issues from AFAST and the Proposed Action combined are less than significant. (Section 3.20)

CHAPTER 3 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter describes existing environmental conditions for resources potentially affected by the Alternatives described in Chapter 2. This chapter also identifies and assesses the environmental consequences of the Alternatives. The affected environment and environmental consequences are described and analyzed according to categories of resources. The categories of resources addressed in this FEIS/OEIS are:

Resource	Section	Resource	Section
Bathymetry, Sediments, and Soil	3.1	Hazardous Material and Hazardous Waste	3.2
Water Resources	3.3	Air Quality	3.4
Airborne Noise	3.5	Marine Communities	3.6
Marine Mammals	3.7	Sea Turtles	3.8
Fish and Essential Fish Habitat	3.9	Sea Birds and Migratory Birds	3.10
Biological Resources at Rodman and Lake George Ranges	3.11	Land Use	3.12
Cultural Resources	3.13	Transportation	3.14
Demographics	3.15	Regional Economy	3.16
Recreation	3.17	Environmental Justice	3.18
Public Health and Safety	3.19	Summary of AFAST SonarTtraining	3.20

3.1 BATHYMETRY, SEDIMENTS, AND SOIL

3.1.1 Introduction and Methods

Water depth and bottom topography (composition of the bottom), have features that define the physical environment. Soil and sediments include rock. For this analysis, sediments refer to the soil, sand, organic matter, and minerals that accumulate at the bottom of a body of water. Soil includes only the materials on the earth's surface, so the only area analyzed for impacts to soil is Rodman Range. The other analyses focus on sediments, as the affected environment is offshore or in Lake George.

The JAX Range Complex offshore is located entirely within the South Atlantic Bight. The South Atlantic Bight extends from Cape Hatteras, North Carolina to the Florida Straits (near Palm Beach). The sea ranges comprise the JAX and Charleston OPAREAs encompassing territorial sea, contiguous zone waters, and at sea/open-ocean waters between Wilmington, North Carolina and Daytona Beach, Florida. The majority of the western boundaries of the OPAREAs are located approximately 3 nm off the southeast U.S. coast, except for the area off southern Georgia and northeastern Florida where the boundary is 3 to 7 nm from shore. The JAX Range Complex also includes two inland ranges in north central Florida, including four impact targets on the surface of Lake George and Rodman Range. Lake George is approximately 65 miles south of Jacksonville, and Rodman Range is located approximately 57.5 miles south of Jacksonville (see Figure 1.1-1).

3.1.1.1 Assessment Methods and Data Used

This section was prepared primarily through consideration of the proposed activities under each Alternative and determining their effects on bottom sediments by reviewing the accumulation of MEM on the ocean bottom. The geographic dispersion of the proposed activities and the resulting density of the MEM, were the primary factors analyzed to determine potential impacts to bathymetry, sediments, and soil. A further consideration was the effect of decomposing MEM on the ocean bottom sediments.

Data used for assessing the existing conditions for bathymetry and sediments come from the Jacksonville Navy Marine Resource Assessment (MRA) (DoN, 2008). The goal of the MRA program is to describe and document the marine resources present in Navy OPAREAs. These MRAs represent a compilation and synthesis of available scientific literature (for example, journals, periodicals, theses, dissertations, project reports, and other technical reports published by government agencies, private businesses, or consulting firms) and National Marine Fisheries Service (NMFS) reports, including stock assessment reports, recovery plans, and survey reports. The MRAs provide a summary of the physical environment (*e.g.*, marine geology, circulation and currents, hydrography, and plankton and primary productivity) for each study area. The Navy also conducted Google and Yahoo keyword searches to obtain information on bathymetry and sediments baseline information for this FEIS/OEIS. The searches produced a number of websites that the author evaluated for credibility of the source, quality of the information, and relevance of the content, with only the best available information included in this document. Unless otherwise indicated, the existing conditions information provided in this chapter was taken from the Jacksonville OPAREA MRA.

3.1.1.2 Warfare Areas and Associated Environmental Stressors

Aspects of the proposed actions likely to act as stressors to bathymetry, sediments, and soil were identified by conducting a detailed analysis of the warfare areas, operations, and specific activities included in the alternatives, and are shown in Tables 1.1-1 and 1.1-2. After reviewing the Alternatives, the potential stressors were identified as the operations that introduced expended material and chemical contaminant items into the water. The stressors are those training activities associated with "Expended/Hazardous Training Items" or "Sediment Displacement" and are shown relative to the Alternatives in Table 3.1-1.

Table 2.2-6 in Chapter 2 was developed to detail the expended material that would result from each of the Alternatives. For each of the operations that expended material, the types of material and locations were detailed in Tables 2.2-6 and 2.2-7. Tables depicting expenditures of material in the OPAREAs (Tables 2.2-6 and 2.2-7) and the Hazardous Waste Section combined with information provided in Chapters 1 an 2 of this FEIS/OEIS provided the data used in the analysis of the potential stressors to Bathymetry, Sediments, and Soil.

3.1.2 Affected Environment

The general bottom features in the JAX Range Complex and bathymetry and sediments are shown in Figure 3.1-1 and Figure 3.1-2.

TABLE 3.1-1
SUMMARY OF POTENTIAL STRESSORS TO BATHYMETRY, SEDIMENTS, AND SOIL

Warfare Area and Operation	Training Areas	Mine Warfare Deployment/Recovery	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Material
Mine Warfare (MIW)					
Mine Laying	Lake George Range				✓
Mine Countermeasures Exercise	Carrier Operating Areas	✓			
Mine Neutralization	Charleston OPAREA (North and South UNDET Boxes)	✓	✓	✓	✓
Surface Warfare (SUW)					
MISSILEX (A-S)	W-157A (Area 4X) and W-159A (Area 5X)		✓	✓	✓
GUNEX (A-S)	W-132, W-133, W-134, W-157, W-158		✓		✓
GUNEX (S-S) Boat	Charleston OPAREA (Areas 11J)		✓		✓
GUNEX (S-S) Ship	JAX OPAREA (AA, BB, and CC)		✓		✓
BOMBEX (A-S) (at sea)	HE, W-158 (31J); NEPM W157A/B and W-158 A/B		✓	✓	✓
Laser Targeting	W-132, W-133, W-134, W-157, W-158				
GUNEX (S-S) (Fast Attack Craft/Fast Inshore Attack Craft [FAC/FIAC])	Amber Strait: Charleston OPAREA (Boxes Q-9&10, R-9&10)				
Visit, Board, Search & Seizure/ Maritime Intercept Operations (VBSS/MIO)-Ship	JAX and Charleston OPAREAs				
VBSS/MIO-Helicopter	W-157A (Area 4X) and W-159A (Area 5X)				
Air Warfare (AW)					
Air Combat Maneuver (ACM)	W-157A (Areas 3X & 4X)				✓

TABLE 3.1-1 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO BATHYMETRY, SEDIMENTS, AND SOIL

Warfare Area and Operation	Training Areas	Mine Warfare Deployment/Recovery	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Material
Air Intercept Control	JAX and Charleston OPAREAs				
ACM Chaff Exercise	W-157A (Areas 3X & 4X)				✓
ACM Flare Exercise	W-157A (Areas 3X & 4X)				✓
MISSILEX (A-A)	W-132, W-133, W-134, W-157, W-158		✓	✓[1]	✓
MISSILEX (S-A)	JAX and Charleston OPAREAs				✓
Detect-to-Engage	W-132, W-133, W-134, W-157, W-158				✓
GUNEX (S-A)	JAX OPAREA (AA, BB, and CC)		✓	✓	✓
GUNEX (A-A)	W-157A/W-133 (Area 2X)				✓
Amphibious Warfare (AMW)					
FIREX (S-S) with Integrated Maritime Portable Acoustic Scoring and Simulator System (IMPASS)	JAX OPAREA (BB and CC)		✓	✓	✓
Strike Warfare (STW)					
BOMBEX (A-G)	Rodman Range				✓
CSAR and Convoy Operations	Rodman Range				✓
Electronic Combat (EC)					
EC Operations- Aircraft	W-132, W-133, W-134, W-157, W-158				✓
EC Operations- Surface Ships	JAX and Charleston OPAREAs				✓
Chaff Exercise	JAX and Charleston OPAREAs				✓
Flare Exercise- Helicopter	Lake George Range				✓
Other Events					
SESEF Utilization	5-15 nm east of Mayport				

TABLE 3.1-1 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO BATHYMETRY, SEDIMENTS, AND SOIL

Warfare Area and Operation	Training Areas	Mine Warfare Deployment/Recovery	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Material
Precision Anchoring	NS Mayport				
Small Arms with anti-swimmer grenades (MK3A2)	Charleston OPAREA (Area 10L, 12I)			✓	✓

[1] Missile explodes in air, no explosive sound in the water.

3.1.3 Bathymetry

The coastline of the South Atlantic Bight forms a sweeping curve characterized by cuspate bays and shoals in the northern or Carolina Capes region, while the coast of the southern region consists of perforated barrier-island complexes. Due in large part to the scouring and eroding influence of the Gulf Stream, the sea floor of the South Atlantic Bight is relatively smooth compared to the bottom relief north of Cape Hatteras. The most dominant physiographic feature of the South Atlantic Bight sea bottom is the massive Blake Plateau (Figure 3.1-3), which ranges offshore from Florida northward to North Carolina. The Blake Plateau is a relatively smooth 228,000-square kilometer (km^2) platform lying at water depths of 2,297 to 3,609 feet (DoN, 2002a; Uchupi, 1967. Its surface from 30°N to 32°N is covered with small hills identified as coral mounds (DoN, 2002a; Uchupi, 1967). The Gulf Stream flows along the Florida Hatteras Slope over the Blake Plateau's western flank. The Blake Ridge is a 1,640-foot long formation of the sediments carried by ocean bottom currents parallel with the shoreline in water depths between 6,566 to 15,748 feet (NETL, 2008). The Blake Escarpment is the area where the Blake Plateau abruptly transitions from intermediate depths to oceanic depths (USGS, 2008). The majority of the OPAREAs lie over the continental shelf and the Blake Plateau.

At the shelf edge, the bottom drops abruptly to the continental slope. The continental slope, the most prominent physiographic feature along the mid-Atlantic continental margin, extends to water depths of between 6,560 and 13,120 feet. It has a seaward gradient of less than 1:1,000 (Hollister, 1973; Kennett, 1982). An abrupt increase in gradient (from 1:10 to 1:1,000) occurs at the "shelf break." The shelf break is the seaward limit of the continental shelf and the beginning of the continental slope.

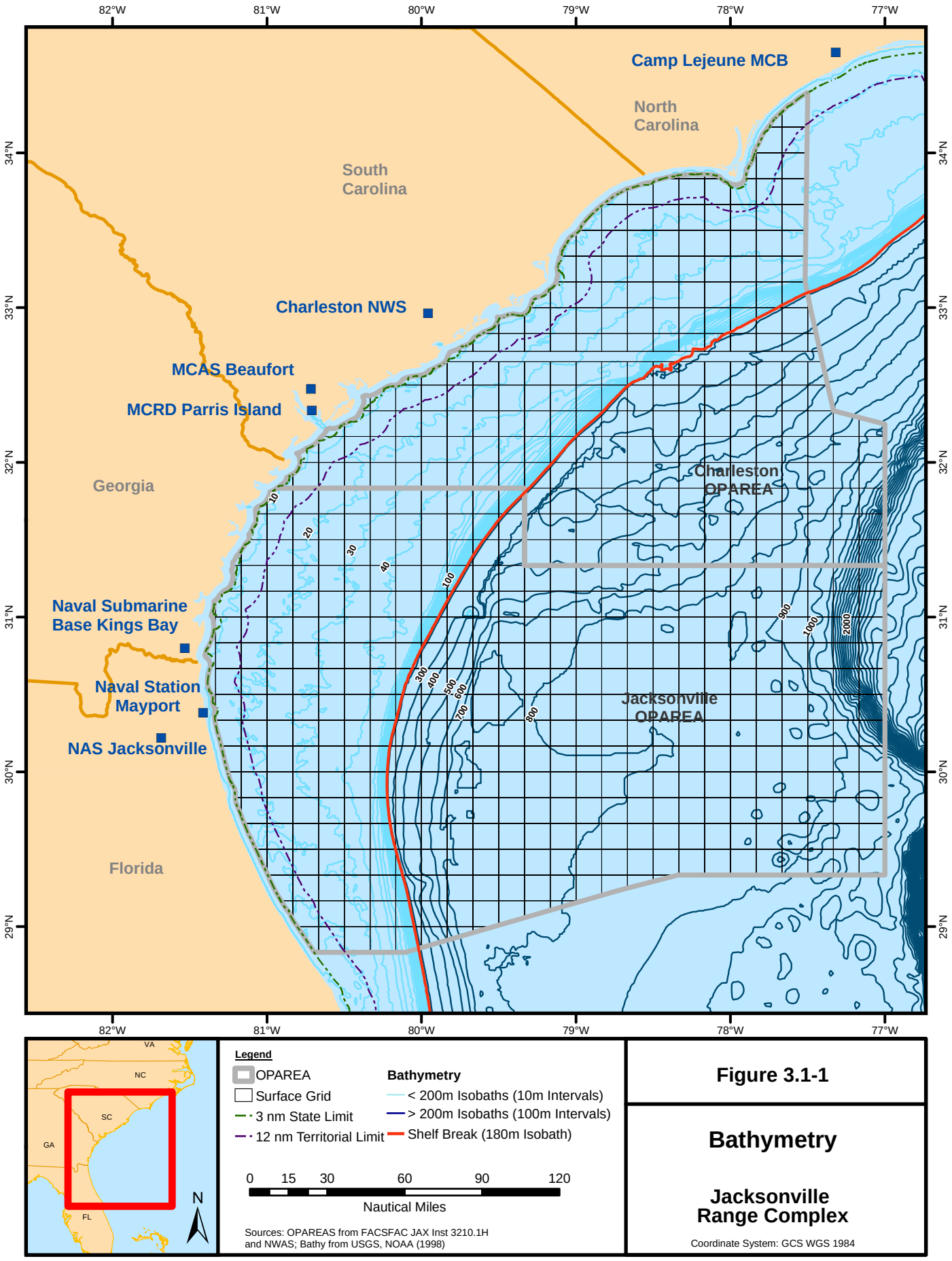


Figure 3.1-1

Bathymetry

Jacksonville Range Complex

Coordinate System: GCS WGS 1984

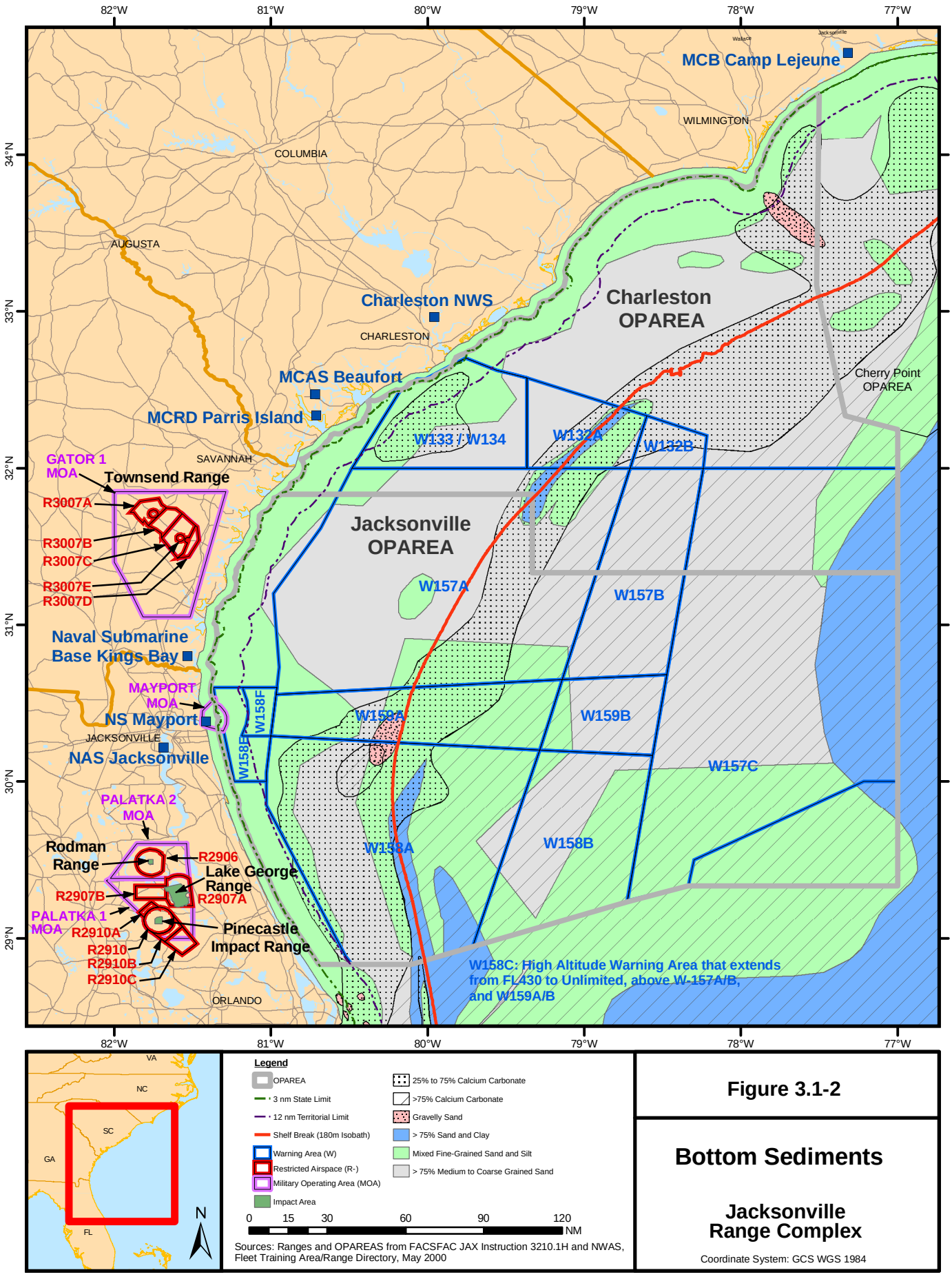


Figure 3.1-2

Bottom Sediments

Jacksonville Range Complex

Coordinate System: GCS WGS 1984

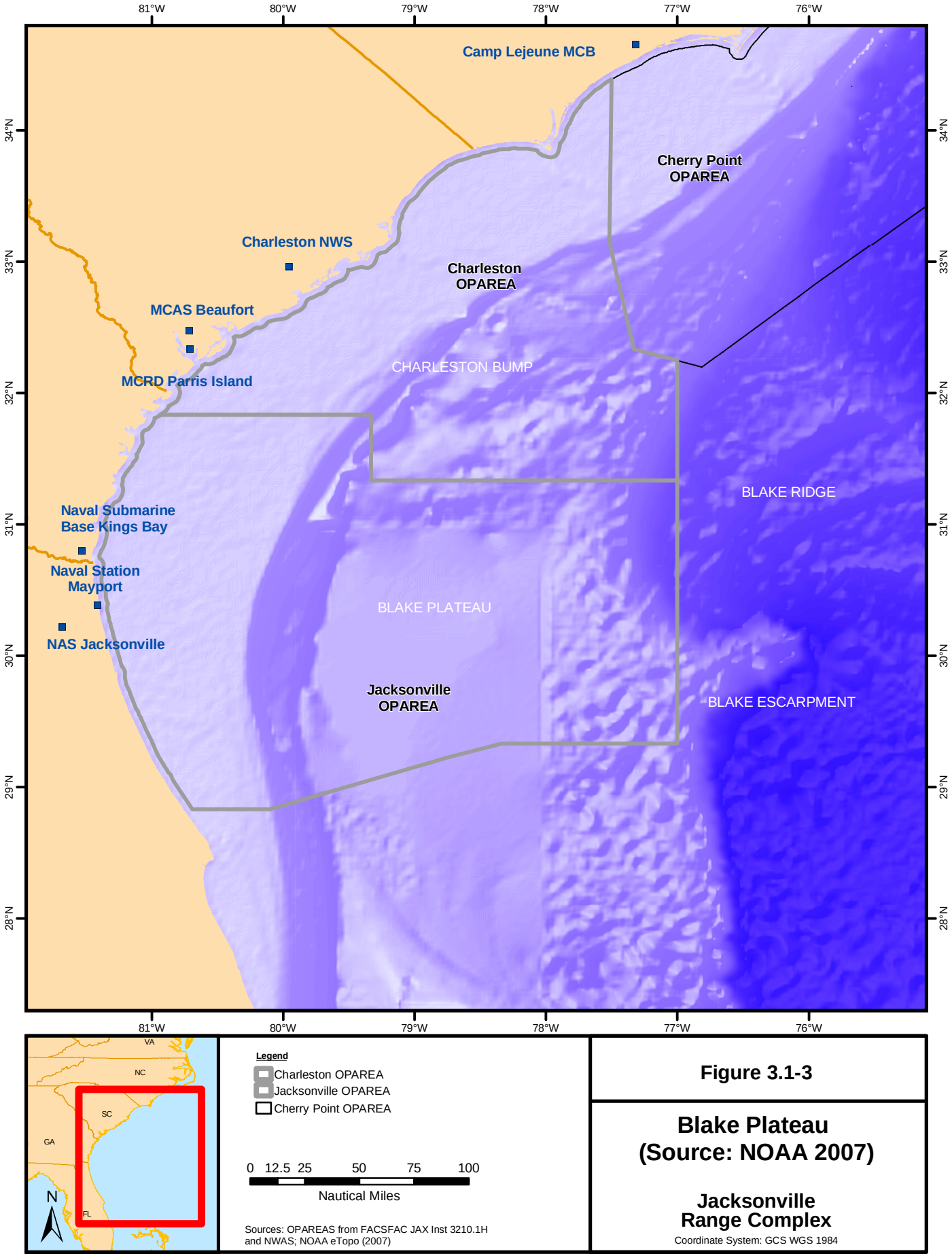


Figure 3.1-3

Blake Plateau (Source: NOAA 2007)

Jacksonville Range Complex

Coordinate System: GCS WGS 1984

The Charleston Bump is a deepwater bank that does not reach the sea surface. It ranges in depths of over 2,300 feet up to 1,230 feet with bottom depths of 410 feet in a series of steep cliff, overhangs, and caves. The Charleston Bump assists in the deflection of the flow of the Gulf Stream causing complex current features and a rocky bottom that mixes and moves sediments from the ocean floor (NOAA, 2008).

The sediments in the JAX Range Complex are typical of the offshore to shelf-edge area, consisting of fine quartz sand with a patchy veneer of shells (DoN, 2002a). Sediment texture varies from gravel patches and a fine sand mixture inshore, to medium sand offshore extending to the shelf edge (DoN, 2001). Fine sandy silt characterizes the edge of the shelf from 656 to 1,312 feet.

3.1.3.1 Rodman and Lake George Ranges

Lake George Range and Rodman Range are located in two major physiographic regions of Florida: Central Highlands and Coastal Lowlands. The Central Highlands includes a relatively new limestone plateau (50-60 million years) that is soft and is known as the Ocala Group (composed of the Inglis Formation, the Williston Formation, and the Crystal River Formation). The Hawthorn Formation sits on top of the Ocala Group and is composed of sand and clay that range from very thin (0-50 feet) along the Ocala uplift from West Central Florida, parallel and west of Interstate 75 to over 100 feet thick west and east of the uplift (The Florida Speleological Society, 2007).

The land type of the area is diverse with six recognized types within the Ocala National Forest, in which both locations reside, to include Eureka Flats, Ocala Wet Prairies, Lake Eaton Lowlands, Ponded Scrub, Ocala Eolian Sandy Hills, and St. Johns Riverine Lowlands (USDA, 1999). Vegetation is equally diverse with communities in aquatic environments, wet prairies, hydrophytic hardwoods, mesic hardwoods, flatwoods, and xerophytic sandhills. Soil is grouped into five associations, Astatula-Paola, Astatula, Immokalee-Sellers, Eureka, and Terra Ceia-Everglades. These soil associations are poorly drained with moderately high organic-matter content. They have low to moderate natural fertility and surface drainage is slow (USDA, 2007).

Rodman Range. Rodman Range is located approximately 57.5 miles south of NAS Jacksonville. The southwest quadrant of the Range is open and contains a single impact area. There are four landing zones located in open areas on the range and two that are confined areas for rotary-wing aircraft. Rodman Range has a single target with a 600-foot diameter ring encircling a single surplus military vehicle. Vehicle tires make up concentric circles at 50 feet and 100 feet radii surround the target (DoN, 2007b).

The southern portion of Rodman Range runs along the Ocklawaha River and contains soil associated with the Ocklawaha River floodplains. Except in extremely dry periods, the water table in these areas normally remains at or above the surface, which contributes to the frequently flooded, sandy soil identified on Rodman Range. Various sands such as Palmetto fine sand and Holopaw fine sand are found on the northern portion of the Rodman Range installation (DoN, 2002b).

Lake George Range. Lake George is located on the St. Johns River and is 8 miles wide and 12 miles long with an average depth of 10 feet (DoN, 2007c). It is the second largest lake in Florida. The west side of the lake is in the Ocala National Forest. The shorelines of the lake lead to consistent floor topography that results in an average water depth of 6 to 10 feet. The lake

waters are composed of numerous fresh and saltwater springs, creeks, and rivers including the St. Johns and Oklawaha Rivers, Juniper, Silver Glen Springs Run, and Salt Springs creeks. The Lake George Range is located in the east-central portion of the lake and is rectangular in shape with a boundary approximately 9 by 2 miles (Lake George Lake Information Guide, 2007).

Lake George lacks vegetation, except along the shallow shorelines. The area near the shoreline is very shallow and generally bordered by reeds and some standing grasses. On the outside of the reeds, significant amounts of eelgrass are found, mixed with some peppergrass. The eelgrass usually thins out and disappears when the depth gets to 4-5 feet. From that point, out to the gentle, rolling main drop-off, there is little to no vegetation. The shoreline and vegetation pattern holds constant around the main lake body (Lake George Lake Information Guide, 2007). The bottom sediments are composed of deposits of clay, sand, and carbonate sequence from the Hawthorn Group. This overlies the Ocala Limestone Group, based on seismic profiles taken from the northern end of Lake George. These materials are deposited in the Lake by the St. Johns River action that flows from south to north (USGS, 2007).

3.1.4 Environmental Consequences

The primary effect of the Navy's training activities in the JAX Range Complex would be the deposition of expended training material on the ocean bottom and their accumulation over time. Some of the proposed training activities in the marine waters of the JAX Range Complex would have no direct contact with the geological resources of the study area, which lie at some depth below the surface. Although explosive MK-82, MK-83, and MK-84 bombs are dropped at sea, they are dropped in deep waters and explode before reaching a depth that could cause disturbance or damage to the ocean floor. For the other activities, numbers of training items were calculated to determine the total number of training material deposited. Assessment on benthic organisms is addressed in Section 3.6, Marine Communities. For Rodman Range, training would affect geology and soil primarily in terms of the deposition of ordnance MEM on surface soil, with the potential for soil contamination, and in terms of its effects on erosion of surface soil. For the Lake George Range, the deposition of expended training material on the lake bottom, their accumulation over time, and impact on lake turbidity would be the greatest impact of Navy training activities.

3.1.4.1 No Action Alternative

Most at-sea training exercises do not affect ocean bottom topography. Some training activities could slightly increase local turbidity or create shallow depressions in bottom sediments; however, these are temporary effects that disappear over time under the influence of natural ocean circulation and sediment transport. Mine moorings, which are composed of 8-15 ft^3 of concrete weighing 1,200-2,400 lbs, would have some temporary bottom disturbance when dropped into water from a boat. If the moorings get covered up or move due to currents, then the Navy would retrieve them and redeploy. With the small numbers of moorings, their small bottom footprint, and their temporary nature, these effects on sediment displacement are not considered to be significant. Mine shapes utilized in these events (RAMICS and AMNS) are temporarily placed and removed at the end of the exercise. For these exercises one mine is used per sortie.

Section 3.2.2 discusses in detail the affected environment for hazardous material and hazardous constituents. Table 2.2-6 gives the detail of the sizes of the training material in each of the training areas. The aggregate effects of discarded material from training activities on ocean bottom sediments in the offshore OPAREAs can be assessed in terms of the number of deposited

items per unit area of bottom surface. A total of about 531,352 training items would be expended under the No Action Alternative (see Table 3.1-2). Assuming an ocean floor area of about 50,090 nm^2, this would be about 10.6 items per nm^2.

Of the 531,352 training items, approximately 516,380 or 97 percent are cannon shells (25 or 30 mm) or small arms munitions (.50 caliber or 7.62 bullets). These munitions (including the case) are small, ranging from 2.75 to 5.5 inches long. Due to the small size of the MEM and low density of expended material, sediment stability on the ocean bottom would not be affected by small arms. For the other MEM, even though they are larger, the proposed activities would not likely occur in the exact location each time; even if they were, due to ocean currents, the materials would not likely settle in the same vicinity.

Training MEM would accumulate in ocean bottom sediments over the entire period of military training, so a short-term analysis does not capture the magnitude of the environmental effects. In a worst-case scenario, assuming the same amounts of training material would be used annually for 20 years, the aggregate density of MEM on the ocean floor would be about 212 items per nm^2.

Some of the specific target area densities are considerable higher. In Charleston OPAREA 11J, JAX OPAREA AA, BB, and CC, and W-132, W-133, and W-134, the aggregate densities are higher than the average for the range complex. These densities are higher because of the small arms munitions used. Area 11J has the highest offshore average density, 1,268 items per nm^2 because of the small area where large numbers of non-explosive practice munitions (0.50 cal., 7.62 mm, and 40 mm) are used. Even at this density, there would only be approximately 1.5 items per acre.

Each of these materials would sink to the ocean floor. The small amount of material is spread over a relatively large area. This expended material settles to the ocean bottom and is covered with sediment over time. Due to the small size and low density of material, sediment stability on the ocean bottom would not be affected by implementation of the No Action Alternative.

Military expended material would settle to the ocean bottom and would be covered by sediment deposition over time. Most of the MEM would be inert, and thus harmless, but some of the MEM would consist of metals such as lead. Although there have not been studies of the specific MEM dropped in the JAX range, studies have been conducted for other underwater ranges. In 2005, the Canadian Forces Maritime Experimental and Test Ranges (CFMETR) near Nanoose, British Columbia, was analyzed for chemical effects associated with expendable components from activities involving sonobuoys, torpedoes, expendable mobile ASW training targets (EMATT), and auxiliary dry cargo Carriers (ESG, 2005). This expended material contains many of the same constituents as training material used in the OPAREAs. In the CFMETR study, the analysis focused on lead, copper, lithium and Otto fuel (torpedo fuel). The document stated that metal constituents were most likely to concentrate in fine-grained particulate matter, especially when smaller than 63 μm. The findings of the EA demonstrated that CFMETR operations did not cause a measurable effect on sediment quality (ESG, 2005). Based on the lower density of expended components in the OPAREAs, neither inert nor MEM would measurably affect sediment quality. This concentration of MEM in territorial waters would have no significant impact on bottom topography and sediment quality. This concentration of MEM in non-territorial waters would not cause significant harm on bottom topography and sediment quality.

TABLE 3.1-2
TRAINING MATERIAL IN JAX RANGE COMPLEX

Number of Training Items	No Action	Alternative 1	Alternative 2
Number of Items proposed in the entire Study Area	531,789	554,708	555,135
Number of Items proposed in the entire *Ocean* Study Area	531,352	534,218	554,945
Number of Items per nm^2	10.6	11.1	11.1
20-Year Aggregate Density per nm^2	212	222	222
Number of Items proposed in Charleston OPAREA (11J)	96,400	106,080	106,080
Number of Items per nm^2	1,268	1,396	1,396
20-Year Aggregate Density per nm^2	25,368	27,916	27,916
Number of Items proposed in JAX OPAREA (AA, BB, CC)	122,786	134,962	134,962
Number of Items per nm^2	196	216	216
20-Year Aggregate Density per nm^2	3,923	4,312	4,312
Number of Items proposed in W-132, W-133, W-134	182,410	182,637	183,087
Number of Items per nm^2	38	38	38
20-Year Aggregate Density per nm^2	751	751	751
Number of Items proposed in W-157 and W-158	121,750	121,750	121,750
Number of Items per nm^2	4	4	4
20-Year Aggregate Density per nm^2	81	81	81
Number of Items Proposed in W-157A and W-159A (MLTR)	33	73	73
Number of Items per nm^2	0.003	0.007	0.007
20-Year Aggregate Density per nm^2	0.066	0.145	0.145
Number of Items proposed in W-157A/B	180	180	180
Number of Items per nm^2	0.017	0.017	0.017
20-Year Aggregate Density per nm^2	0.346	0.346	0.346
Number of Items proposed in W-158A/B	180	180	103
Number of Items per nm^2	0.021	0.021	0.012
20-Year Aggregate Density per nm^2	0.419	0.419	0.240
Number of Items proposed in W-158A	77	77	77
Number of Items per nm^2	1	1	1
20-Year Aggregate Density per nm^2	18	18	18

Rodman Range

No live ordnance is currently authorized for Rodman Range. Training consists of dropping approximately 100 non-explosive bombs (10 or 25 lbs each) at or near the target per year. Additionally, 297 blank ammunitions are expended annually. A total of about 397 training items would be expended under the No Action Alternative (see Tables 2.2-6).

This training results in localized soil disturbance at the target. The Rodman Rangeis routinely cleared of range deris, which includes MEM as part of the Navy's Operational Range Clearance program and is performed annually for the 1,000-foot diameter around the center of the target and every 5 years for the 3,000-foot diameter. This range clearance is considered "low disturbance" as only the surface MEM is removed. As a result of this range maintenance, the concentration of MEM would have a less-than-significant effect on soil.

Lake George Range

No live ordnance is currently authorized for Lake George. Tables 2.2-4, 2.2-6 and 3.1-3 depict the current and proposed bombs at Lake George Range. The 1,680 flares expended over Lake George would burn up so that very little material, if any, would land in range area. There are four target areas at Lake George Range, including four MINEX targets, and three impact targets (north, center, and south). If the non-explosive bombs dropped fall within a 100-foot radius of the center of the targets, the total target areas would be approximately 5 acres. If the 40 bomb shapes are distributed evenly among the targets, there would be on average 1,074 bombs per nm^2. In a worst-case scenario, assuming the same amounts of training material would be used annually for 20 years (for a total of 800 bombs) and the periodic range maintenance did not occur, the aggregate density of MEM at the target area would be about 21,489 items per nm^2. The target areas are small so the density near the targets is high. The majority of ordnance will be sub-caliber practice bombs.

At the current usage rate, bombs would accumulate near the target areas, but would be covered by sediment over time. For some very small areas the bottom topography would be changed by the loading of training material. Because of the small area that could be affected, relative to the size of the lake, there would only be localized effects on the bottom topography. All the mineshapes are inert, and would therefore not affect sediment quality.

Water sampling conducted by the St. Johns Water Management District over the last 16 years, during the time the Navy has been training at the Lake George Range, indicates that total suspended solids are typical while turbidity is lower than typically found in other Class 3 surface waters. The lake has fair water quality based on the trophic state index; therefore, the concentration of MEM has a less than significant effect on bottom topography and sediment quality (St. Johns River Water Management District, 2007). Some 2.75 rocket mortars and large non-explosive bombs may be used for training at Lake George Range in the future.

The Patricia Target is an example of a underwater target, located off Key West. The Navy reviewed the impacts of using the underwater targets in the Preliminary Range Management Assessment of the Patricia Target (Lewis Environmental Services, Inc., 1996). The assessment took place in 1994 by professional marine biologists/divers. Inspections were made of the approach corridor, the actual target (the sunken hulk of a World War II Large Landing Ship Infantry) and the surrounding area of the target. A total of 497 objects were found within the immediate area, most of which were non-explosive MK-76 25-lbs practice bombs and bomb

dummy units (BDU-33). However, MK-15 fin assemblies, MK-83, MK-84, MK-82, MK-106, BDU-48, and 20 mm and 50-caliber machine gun bullets and casings were also observed. In addition, several unknown or unidentifiable munitions were found, as well as two rocket launchers and other miscellaneous MEM. The actual area of visible direct physical impacts was confined to approximately one acre directly surrounding the target and bounded by the target markers. Only minor amounts of MEM were found outside this area.

Soil surveys for heavy metals at Patricia Target revealed only trace levels comparable to control samples of some of the metals (barium, lead, chromium, and silver) while others were undetectable (arsenic, cadmium, mercury, and selenium). With activities at Lake George only involving non-explosive ordnance, less of an impact would be expected to the sediments at Lake George.

Navy training activities on U.S. territory would have no significant impact to bathymetry, sediment, or soil under the No Action Alternative. Navy training activities in non-territorial waters would not cause harm to bathymetry, sediment, or soil under the No Action Alternative.

TABLE 3.1-3
TRAINING MATERIAL AT LAND RANGES IN JAX EIS/OEIS

Number of Training Items	No Action	Alternative 1	Alternative 2
Number of Items proposed in Lake George Range	40	40	40
Number of Items per nm^2	1074	1074	1074
20 Year Aggregate Density per nm^2 (Note: A total of 800 bombs would be expended over 20 years in proximity to the small target areas)	21,490	21,490	21,490

3.1.4.2 Alternative 1

Most at-sea training exercises would have no potential to affect ocean bottom topography. Some training activities could slightly increase local turbidity or create shallow depressions in bottom sediments; these are temporary effects that would disappear over time under the influence of natural ocean circulation and sediment transport. Mine moorings, composed of 8-15 ft^3 of concrete weighing 1,200-2,400 lbs, would have some temporary bottom disturbance when dropped into water from a boat. If the moorings get covered up or moved due to currents, then the Navy would retrieve them and redeploy. With the small numbers of moorings, their small bottom footprint, and their temporary nature, these effects on sediment displacement are not considered to be significant.

The aggregate effects of discarded material from training activities on ocean bottom sediments in the OPAREAs can be assessed in terms of the number of deposited items per unit area of bottom surface. A total of about 534,218 training items would be expended under Alternative 1 (see Table 3.1-2). Assuming an ocean floor area of about 50,090 nm^2, this would be about 11.1 items per nm^2.

Of the 534,218 training items, approximately 97 percent are cannon shells (25 or 30 mm) or small arms munitions (.50 caliber or 7.62 bullets). These munitions (including the case) are small, ranging from 2.75 to 5.5 inches long. Due to the small size of the MEM and low density of expended material, sediment stability on the ocean bottom would not be affected by small arms. For the other MEM, even though they are larger, the proposed activities would not likely occur in

the exact location each time; even if they were, due to ocean currents, the materials would not likely settle in the same vicinity.

Military expended material would accumulate in ocean bottom sediments over the entire period of military training, so a short-term analysis does not capture the magnitude of the environmental effects. In a worst-case scenario, assuming the same amounts of training material would be used annually for 20 years, the aggregate density of MEM on the ocean floor would be about 222 items per nm^2. At this density, MEM would have no discernable effect on bottom sediments.

Military expended material would settle to the ocean bottom and would be covered by sediment deposition over time. Most of the MEM would be inert, and thus harmless, but some of the MEM would consist of metals such as lead. Neither inert nor MEM at this density would measurably affect sediment quality. As described in the No Action Alternative, these types of training material did not have a measurable effect on sediment quality in offshore ranges where impacts to sediment have been analyzed. This concentration of MEM would have a less than significant effect on bottom topography and sediment quality. This concentration of MEM in non-territorial waters would not cause significant harm on bottom topography and sediment quality.

Rodman Range

No live ordnance is currently authorized for Rodman Ranges. Training consists of dropping approximately 100 non-explosive bombs (10 or 25 lbs each) at or near the target per year. Blank ammunition is anticipated to decrease from the No Action Alternative level of 296 to 50 per year. This would result in localized soil disturbance at the target. At Rodman Range, MEM is cleared annually from the 1,000-foot diameter around the center of the target. Range maintenance on Rodman Range is performed in accordance with the Operational Range Clearance program. As a result, this concentration of MEM would have a less-than-significant effect on soil.

Lake George Range

The Alternative 1 proposed action for Lake George Range is the same as the proposed action for the No Action Alternative; therefore, the analysis of Alternative 1 is the same as that for the No Action Alternative. The 2,400 flares proposed to be expended over Lake George Range under Alternative 1 would burn up so that very little material if any, would land in range area.

Navy training activities in U.S. territory would have no significant impact to bathymetry, sediment, or soil under Alternative 1. Navy training activities in non-territorial waters would not cause harm to bathymetry, sediment, or soil under Alternative 1.

3.1.4.3 Alternative 2 (Preferred Alternative)

Most at-sea training exercises would have no potential to affect ocean bottom topography. Some training activities could slightly increase local turbidity or create shallow depressions in bottom sediments; these are temporary effects that would disappear over time under the influence of natural ocean circulation and sediment transport. Under Alternative 2, the Navy proposes to eliminate all BOMBEX training events that involve dropping explosive (live) ordnance on targets at-sea

The aggregate effects of discarded material from training activities on ocean bottom sediments in the OPAREAs can be assessed in terms of the number of deposited items per unit area of bottom surface. A total of about 554,945 training items would be expended under Alternative 2 (see

Table 3.1-2). Assuming an ocean floor area of about 50,090 nm^2, this would be about 11.1 items per nm^2.

Of the 554,945 training items, approximately 97 percent are cannon shells (25 or 30 mm) or small arms munitions (.50 caliber or 7.62 bullets). These munitions (including the case) are small, ranging from 2.75 to 5.5 inches long. Due to the small size of the MEM and low density of expended material, sediment stability on the ocean bottom would not be affected by the small arms. For the other MEM, even though they are larger, the proposed activities would not likely occur in the exact location each time; even if they were, due to ocean currents, the materials would not likely settle in the same vicinity.

Military expended material would accumulate in ocean bottom sediments over the entire period of military training, so a short-term analysis does not capture the magnitude of the environmental effects. In a worst-case scenario, assuming the same amounts of training material would be used annually for 20 years, the aggregate density of MEM on the ocean floor would be about 222 items per nm^2. At this density, MEM would have no discernable effect on bottom sediments.

Military expended material would settle to the ocean bottom and would be covered by sediment deposition over time. Most of the MEM would be inert, and thus harmless, but some of the MEM would consist of metals such as lead. Neither inert nor MEM at this density would measurably affect sediment quality. This concentration of training MEM in U.S. territory would have no significant impact on bottom topography and sediment quality. This concentration of MEM in non-territorial waters would not cause harm on bottom topography and sediment quality.

Rodman Ranges

The proposed action at Rodman Range for Alternative 2 is the same as that for Alternative 1. Approximately 100 bombs and blank ammunition would be expended under Alternative 2; therefore, the analysis is the same for Alternative 2 as it was for Alternative 1. This concentration of MEM would have a less-than-significant effect on soil.

Lake George

The proposed action for Alternative 2 at Lake George Range is the same as that proposed under Alternative 1. The number of bombs proposed remains at 40 and the number of flares remains 2,400. As a result, the analysis for Lake George Range under Alternative 1 would apply to Alternative 2. Navy training activities in U.S. territory would have no significant impact to bathymetry, sediment, or soil under Alternative 2. Navy training activities in non-territorial waters would not cause harm to bathymetry, sediment, or soil under Alternative 2.

3.1.5 Unavoidable Significant Environmental Effects

There are no unavoidable significant environmental effects as a result of implementation of the No Action Alternative, Alternative 1, or Alternative 2.

3.1.6 Summary of Environmental Effects (NEPA and EO 12114)

As summarized in Table 3.1-4, the environmental effects of the No Action Alternative, Alternative 1, and Alternative 2 on Bathymetry and Sediments would be less than significant. Navy training activities on U.S. territory would have no significant impact to bathymetry, sediment, or soil under the No Action Alternative, Alternative 1, or Alternative 2. Navy training

activities in non-territorial waters would not cause harm to bathymetry, sediment, or soil under the No Action Alternative, Alternative 1, or Alternative 2.

TABLE 3.1-4
SUMMARY OF BATHYMETRY, SEDIMENTS, AND SOIL ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES IN THE JAX RANGE COMPLEX

Alternative and Stressor	NEPA (U.S. Territory)	EO 12114 (Non-Territorial Waters, >12 nm)
No Action		
MIW Deployment/Recovery	At-sea training exercises would have no potential to affect ocean bottom topography. Some training activities could slightly increase local turbidity or create shallow depressions in bottom sediments; these are temporary effects that would disappear over time under the influence of natural ocean circulation and sediment transport.	At-sea training exercises would have no potential to affect ocean bottom topography. Some training activities could slightly increase local turbidity or create shallow depressions in bottom sediments; these are temporary effects that would disappear over time under the influence of natural ocean circulation and sediment transport.
NEPM		
UNDET and HE Ordnance		
MEM		
Conclusion	The environmental effects of the No Action Alternative on bathymetry, sediments, and soil resources would have no impact on U.S. Territory.	The environmental effects of the No Action Alternative on bathymetry, sediments, and soil resources would cause no harm in non-territorial waters.
Alternative 1		
MIW Deployment/Recovery	At-sea training exercises would have no potential to affect ocean bottom topography. Some training activities could slightly increase local turbidity or create shallow depressions in bottom sediments; these are temporary effects that would disappear over time under the influence of natural ocean circulation and sediment transport.	At-sea training exercises would have no potential to affect ocean bottom topography. Some training activities could slightly increase local turbidity or create shallow depressions in bottom sediments; these are temporary effects that would disappear over time under the influence of natural ocean circulation and sediment transport.
NEPM		
UNDET and HE Ordnance		
MEM		
Conclusion	The environmental effects of Alternative 1 on bathymetry, sediments, and soil resources would have no impact on U.S. territory.	The environmental effects of Alternative 1 on bathymetry, sediments, and soil resources would cause no harm in non-territorial waters.

TABLE 3.1-4 (Continued)
SUMMARY OF BATHYMETRY, SEDIMENTS, AND SOIL ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES IN THE JAX RANGE COMPLEX

Alternative and Stressor	NEPA (U.S. Territory)	EO 12114 (Non-Territorial Waters, >12 nm)
Alternative 2		
MIW Deployment/Recovery	At-sea training exercises would have no potential to affect ocean bottom topography. Some training activities could slightly increase local turbidity or create shallow depressions in bottom sediments; these are temporary effects that would disappear over time under the influence of natural ocean circulation and sediment transport.	At-sea training exercises would have no potential to affect ocean bottom topography. Some training activities could slightly increase local turbidity or create shallow depressions in bottom sediments; these are temporary effects that would disappear over time under the influence of natural ocean circulation and sediment transport.
NEPM		
UNDET and HE Ordnance		
MEM		
Conclusion	The environmental effects of Alternative 2 on bathymetry, sediments, and soil resources would have no impact on U.S. territory.	The environmental effects of Alternative 2 on bathymetry, sediments, and soil resources would cause no harm in non-territorial waters.

3.2 HAZARDOUS MATERIAL AND HAZARDOUS WASTE

3.2.1 Introduction and Methods

This section addresses non-hazardous as well as hazardous components of the training operations described in this FEIS/OEIS. Some items such as fuels, adhesives, and solvents required for maintenance and operation of vessels, machinery, and equipment are used by the Navy as well as by other organizations and individuals. Other items such as missiles and chaff are only used in military activities. Terms used to describe various items are:

- **Military Expended Material –** Military expended material (MEM) refers to those munitions, items, devices, equipment and materials which are uniquely military in nature, and are used and expended in the conduct of the military training and testing mission, such as: sonobuoys, flares, chaff, drones, targets, bathymetry measuring devices and other instrumentation, communications devices, and items used as training substitutes. This definition may also include materials expended (such as propellants, weights, guidance wires) from items typically recovered, such as aerial target drones and practice torpedoes.

  According to an annual report from the Ocean Conservancy further details the main sources of marine debris resulting from the 2007 International Coastal Cleanup effort, with shoreline/recreational activities and smoking-related activities accounting for more than 90% of marine pollution worldwide (Ocean Conservancy, 2007). More specifically, the report states that on average, land based activities in South Carolina, Georgia, and Florida, including picnics, festivals, sporting events, beach outings, and litter runoff from parking lots, streets, and storm drains account for more than 62% of marine pollution. On average, smoking–related products accounted for an additional 29% of all marine debris collected in these states. In summary, this study does not point to the Navy as a primary contributor to the marine debris problem.

  In addition to recovering spent training and testing materials whenever possible, proactive Best Management Practices (BMPs) instituted by the Navy play a crucial role in reducing or eliminating the amount of expended materials introduced into the environment. The Navy P2 Afloat Program details many pollution prevention practices, including shipboard recycling programs, use of non-polluting technologies and materials, reducing excess packaging materials, and eliminating discarded plastics through the use of shipboard Plastic Waste Processors (http://205.153.241.230/p2_documents/navy.html).

- **Military Expended Material Constituent –** Any constituent released into the environment from the use of MEM is considered a military expended material constituent (MEMC). MEMC includes constituents from explosive and non-explosive material and the emission, degradation, or breakdown products from such MEM.
- **Non-hazardous Components –** Parts of a device made of nonreactive material, including parts made of steel or aluminum, polymers (*e.g.,* nylon, rubber, vinyl, and various other plastics), glass fiber, and concrete. While these items represent persistent seabed litter, their strong resistance to degradation and their chemical composition mean they do not chemically contaminate the surrounding environment by leaching heavy metals or organic compounds.
- **Hazardous Material –** Hazardous material consists of chemical substances that pose a risk to human health or the environment. In general, this material poses hazards because of its quantity, concentration, physical, chemical, or infectious characteristics. Hazardous material

includes, but is not limited to, petroleum products, coolants, paints, adhesives, solvents, corrosion inhibitors, cleaning compounds, photographic materials, and chemicals. Hazardous material is also used in missiles, munitions, and targets because they are strong, lightweight, reliable, long-lasting, or low-cost.

- **Munitions Constituents –** Material originating from unexploded ordnance, discarded military munitions, or other military munitions, including explosive and non-explosive material and emission, degradation, or breakdown products of such ordnance and munitions, are called munitions constituents. Components that contain hazardous constituents include propellants, batteries, flares, telemetry, igniters, jet fuel, diesel fuel, hydraulic fluid, and explosive warheads. Each constituent has the potential to affect human health and the environment through direct contact with individuals, water, soil, or air.
- **Hazardous Constituents –** Hazardous constituents can generally be defined as hazardous material present at low concentrations in a generally non-hazardous matrix, such that the hazardous properties do not produce acute effects. The USEPA and the DoD have identified numerous waste streams from Navy vessels that do or may contain hazardous constituents. Waste streams from Navy vessels that may contain hazardous constituents include hull coating leachate, bilgewater/oil water separator discharges, gray water, cooling water, weather deck runoff, chain locker effluent, elevator pit effluent, and photographic laboratory drains. Small boat engines discharge petroleum products in their wet exhaust.
- **Hazardous Waste –** A hazardous waste may cause, or significantly contribute to, an increase in mortality or an increase in serious irreversible or incapacitating reversible illness; or pose a present or potential risk to human health or the environment when improperly treated, stored, transported, disposed, or otherwise managed. Resource Conservation and Recovery Act (RCRA) 42 U.S.C. §6901, *et seq*. regulates management of solid and hazardous waste.
- **Military Munitions Rule –** Clarifies when conventional and chemical military munitions become a solid waste, which then may be regulated as solid waste under RCRA. Military munitions are not considered hazardous waste under two conditions stated in the USEPA Military Munitions Rule and the DoD Interim Policy on Military Munitions (1997). These conditions cover virtually all the uses of missiles, munitions, and targets at the JAX Study Area. Specifically, munitions are not considered solid waste when:

    1. Used for their intended purpose, including training of military personnel and explosive emergency response specialists, research and development activities, and when recovered, collected, and destroyed during range clearance events.
    2. Unused and being repaired, reused, recycled, reclaimed, disassembled, reconfigured, or subjected to other material recovery activities.

Used hazardous material and chemical byproducts generated at-sea are not considered hazardous waste until offloaded at port. Environmental compliance policies and procedures applicable to shipboard operations afloat are defined in applicable naval operations instruction manuals. These instructions reinforce the Clean Water Act's prohibition against discharge of harmful quantities of hazardous substances into or on U.S. waters out to 200 nm. Navy ships are required to conduct operations at-sea in such a manner as to minimize or eliminate any adverse impacts on marine environment. This includes stringent hazardous waste discharge, storage, dumping, and pollution prevention requirements.

Hazardous material and waste generated afloat are stored in approved containers and offloaded for proper disposal within five working days of arrival at a Navy port. All commands (ship or shore) can return excess and unused hazardous material to the Hazardous Material Minimization Center located at their assigned Naval Station (DoN, 2005a). The Consolidated Hazardous Materials Reutilization and Inventory Management Program provides assistance in the development and implementation of local hazardous material management and is available online at: http://www.naspensacola.navy.mil/logistics/chrimp.pdf. The 2005 Hazardous Materials Minimization, Hazardous Waste Reutilization and Disposal Guide, available online at http://www.cnrma.navy.mil/environmental/ hazardous_waste.htm, provides points of contact and detailed information regarding shipboard hazardous waste and hazardous material turn-in. These documents provide a comprehensive compilation of procedures and requirements mandated by law, directive, or regulation. They have a compliance orientation to ensure safe and efficient control, use, transport, and disposal of hazardous waste.

3.2.1.1 Assessment Methods and Data Used

General Approach to Analysis

Each alternative analyzed in this FEIS/OEIS includes several warfare areas (*e.g.,* Mine Warfare, Air Warfare, Surface Warfare, *etc*.) and most warfare areas include multiple types of training operations (*e.g.,* GUNEX (S-A), MISSILEX (S-A), *etc*.). Likewise, several activities (*e.g.,* weapons firing, target deployment, *etc*.) are accomplished under each operation. Furthermore, MEM (*e.g.,* bombs, missiles, small caliber ammunition, marine markers, *etc*.) are common to multiple activities.

To address potential impacts, the approach to analysis includes characterizing the yearly test and training operations that may contribute MEM and MEMC to the environment with the JAX Study Area. This section of the FEIS/OEIS reviews the MEM and MEMC associated with training. Specific MEM categories analyzed include: bombs, missiles, targets and countermeasures, marine markers (smoke floats), naval gun ammunition, smalls arms and close-in weapons system ammunition, chaff, flares, lightsticks, and UNDETs. For each category, a general description and quantity used is presented and followed by the anticipated "fate and transport" of the item. The "fate and transport" section describes what is expected to happen to the MEM and MEMC once introduced into the environment. Potential impacts on environmental resources are addressed in other sections of this chapter as appropriate.

Study Area

In this FEIS/OEIS, the MEM and MEMC study area is the same as defined in Section 1.5.

Data Sources

Prior EAs, EISs, Marine Resource Assessments, studies, databases, and websites were reviewed. Numerous federal, state, and local regulations governing the handling, storage, and disposal of waste and hazardous material (Appendix K) were also researched.

3.2.1.2 Warfare Areas and Associated Environmental Stressors

Aspects of the proposed actions that are likely to act as stressors were identified by conducting an analysis of the warfare areas, operations, and specific activities included in the alternatives. Appendix D provides detailed descriptions of the JAX Study Area operations. Table 3.2-1 provided below presents identified stressors and their association with specific operations that would occur

within the JAX Study Area. Checkmarked cells in Table 3.2-1 are associated with the operation and that the activities and associated training item(s) are carried forward for detailed analysis in this FEIS/OEIS.

3.2.2 Affected Environment

Open ocean areas are typically considered relatively pristine with regard to hazardous material and hazardous waste. Hazardous material is present on the ocean, however, as cargo and as fuel, lubricants, and cleaning and maintenance materials for marine vessels and aircraft. Infrequently, large hazardous material leaks and spills - especially of petroleum products - affect the marine environment and adversely affect marine life. No quantitative information is available on the overall types and quantities of hazardous material present on the sea ranges at a given time, nor on its distribution among the various categories of vessels.

Navy vessels present within the JAX Study Area represent a small fraction of the overall commercial and recreational boat traffic and, correspondingly, account for only a small fraction of the hazardous material present within the JAX Study Area. Navy training activities in open ocean areas involve the use of fuel, lubricants, explosives, propellants, batteries, oxidizers, and other hazardous substances. The Navy makes every effort to minimize its use of hazardous material during training, and recovers and reuses unexpended training material to the extent practicable.

TABLE 3.2-1
POTENTIAL STRESSORS ASSOCIATED WITH HAZARDOUS MATERIALS AND HAZARDOUS WASTE

Warfare Area and Operation	Training Areas	Mine Warfare Deployment/Recovery	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Material
Mine Warfare (MIW)					
Mine Laying	Lake George Range	✓	✓		✓
Mine Countermeasures Exercise (MCM)	Carrier Operating Areas	✓			
Mine Neutralization	Charleston OPAREA (North and South UNDET Boxes)	✓	✓	✓	✓
Surface Warfare (SUW)					
MISSILEX (A-S)	W-157A (Area 4X) and W-159A (Area 5X)		✓	✓	✓
GUNEX (A-S)	W-132, W-133, W-134, W-157, W-158		✓		✓

TABLE 3.2-1 (Continued)
POTENTIAL STRESSORS ASSOCIATED WITH HAZARDOUS MATERIAL AND HAZARDOUS WASTE

Warfare Area and Operation	Training Areas	Mine Warfare Deployment/Recovery	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Material
GUNEX (S-S) Boat	Charleston OPAREA (Areas 11J)		✓		✓
GUNEX (S-S) Ship	JAX OPAREA (AA, BB, and CC)		✓		✓
BOMBEX (A-S) (at-sea)	HE, W-158 (31J); NEPM, W157A/B and W-158 A/B		✓	✓	✓
Laser Targeting	W-132, W-133, W-134, W-157, W-158				
GUNEX (S-S) (FAC/FIAC)	Amber Strait: Charleston OPAREA (Boxes Q-9&10, R-9&10)				
VBSS/MIO-Ship	JAX and Charleston OPAREAs				
VBSS/MIO-Helicopter	W-157A (Area 4X) and W-159A (Area 5X)				
Air Warfare (AW)					
Air Combat Maneuver (ACM)	W-157A (Areas 3X and 4X)		✓		✓
Air Intercept Control	JAX and Charleston OPAREAs		✓		
ACM Chaff Exercise	W-157A (Areas 3X and 4X)		✓		✓
ACM Flare Exercise	W-157A (Areas 3X and 4X)		✓		
MISSILEX (A-A)	W-132, W-133, W-134, W-157, W-158		✓	✓[1]	✓
MISSILEX (S-A)	JA and Charleston OPAREAs				✓
Detect-to-Engage	W-132, W-133, W-134, W-157, W-158				
GUNEX (S-A)	JAX OPAREA (AA, BB, and CC)		✓		✓
GUNEX (A_A)	W-157A/W-133 (Area 2X)				✓
Amphibious Warfare (AMW)					
FIREX with Integrated Maritime Portable Acoustic Scoring and Simulator System (IMPASS)	JAX OPAREA (BB and CC)		✓	✓	✓

TABLE 3.2-1 (Continued)
POTENTIAL STRESSORS ASSOCIATED WITH HAZARDOUS MATERIAL AND HAZARDOUS WASTE

Warfare Area and Operation	Training Areas	Mine Warfare Deployment/Recovery	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Material
Strike Warfare (STW)					
BOMBEX (A-G)	Rodman Range		✓		✓
Combat Search and Rescue (CSAR) and Convoy Operations	Rodman Range		✓		✓
Electronic Combat (EC)					
EC Operations- Aircraft	W-132, W-133, W-134, W-157, W-158				
EC Operations- Surface Ships	JAX and Charleston OPAREAs				
Chaff Exercise	JAX and Charleston OPAREAs				✓
Flare Exercise- Helicopter	Lake George Range				✓
Other Events					
SESEF Utilization	5-15 nm east of Mayport				
Precision Anchoring	NS Mayport				
Small Arms with anti-swimmer grenades (MK3A2)	Charleston OPAREA (Area 10L, 12I)			✓	✓

[1] Missile explodes in air, no explosive sound in the water.

Commercial, scientific, and military vessels generate small quantities of hazardous waste during their operations. This material is typically accumulated while at-sea, and then offloaded and transported to land disposal facilities when in port. No quantitative information is available on the overall types and quantities of hazardous waste present on the sea ranges at a given time, nor on its distribution among the various categories of vessels.

Lake George and Rodman Ranges

A 600-foot diameter target is used for air-to-ground training with non-explosive practice munitions at Rodman Range. Seven targets within a 2 x 7 nm range within Lake George are used for air-to surface trainng with non-explosive practice munitions at Lake George Range.

3.2.3 Environmental Consequences

Navy ships may not discharge overboard untreated used or excess hazardous material generated onboard the ship within 200 nm of shore. Ships retain used and excess hazardous material on board for shore disposal. Ships offload used hazardous material within five working days of arrival at a Navy port. The 2005 Hazardous Materials Minimization, Hazardous Waste Reutilization and Disposal Guide, available online at http://www.cnrma.navy.mil/environmental/hazardous_waste.htm, provides points of contact and detailed information regarding shipboard hazardous waste and material turn-in.

The International Convention for the Prevention of Pollution from Ships (MARPOL 73/78) prohibits certain discharges of oil, garbage, and other substances from vessels. The MARPOL Convention and its Annexes are implemented by national legislation, including the Act to Prevent Pollution from Ships (33 U.S.C. 1901 to 1915) and the Federal Water Pollution Control Act (33 U.S.C. 1321 to 1322). These statutes are further implemented and amplified by DoN and the Office of the Chief of Naval Operations Environmental and Natural Resources Program Manual, which establishes Navy policy, guidance, and requirements for the operation of Navy vessels. The vessels operating in the JAX Range would comply with the discharge requirements, minimizing or eliminating potential impacts from discharges from ships.

If a fuel spill occurs, the effects would be mitigated through compliance with standard spill-control responses and wildlife rescue procedures. Fuel dumping by aircraft rarely occurs. DoN aircrews are prohibited from dumping fuel below 6,000 feet, except in an emergency situation. Above 6,000 feet, the fuel has enough time to completely vaporize and dissipate and would therefore have a negligible effect on the surface below. A study performed by Air Force (USAF, 2002) indicates that 735 gallons of fuel ejected from an aircraft at 5,000 feet altitude would result in approximately 99 percent evaporation before fuel hits the surface. Additionally, jet fuel generally evaporates from the surface of water within 24 hours, and consequently does not persist in the marine environment.

The Navy has recently implemented the Water Range Sustainability Environmental Program Assessment (WRSEPA) Policy (29 August 2008) to ensure the long-term viability of our operational ranges while protecting human health and the environment (Chief of Naval Operations, 2008). The impact of training materials expended in the marine environment will be a focus of the WRSEPA Policy. Protective measures will be considered and implemented if practicable to sustain range operations, maintain environmental compliance, and address unacceptable risks associated with munitions constituents and MEMCs. Protective measures are actions or best management practices designed and implemented to abate, prevent, minimize, stabilize, or eliminate the release or the threat of release of munitions constituents and MEMCs and risks to human health or the environment.

Tables 2.2-4 and 2.2-5 list quantities of MEM by Navy range operation and training activity used during exercises at the JAX Study Area. Appendix D contains detailed weapons system descriptions. MEM and associated MEMC can leak or leach small amounts of toxic substances into the water as they degrade and decompose (Table 3.2-2). These items decompose very slowly, so the volume of MEM that decomposes within the training areas, and the amounts of toxic substances being released to the environment, gradually increase over the period of military use. Concentrations of some substances in sediments surrounding the expended material increase over

time. Sediment transport via currents can eventually disperse these contaminants where they will be present at very low concentrations and, thus, are anticipated to have minimal effect on the environment (Environmental Sciences Group, 2005). MEM and MEMC are described in subsequent paragraphs.

TABLE 3.2-2
MUNITIONS CONSTITUENTS OF POTENTIAL CONCERN

Training Application/ Munitions Element	Munitions Constituent
Pyrotechnics Tracers Spotting Charges	Barium chromate Potassium perchlorate Chlorides Phosphorus Titanium compounds
Oxidizers	Lead oxide
Delay Elements	Barium chromate Potassium perchlorate Lead chromate
Propellants	Ammonium perchlorate
Fuses	Potassium perchlorate
Detonators	Fulminate of mercury Potassium perchlorate
Primers	Lead azide
Other Explosives*	2-Amino-4,6-dinitrotoluene (2-A-4,6-DNT 4-Amino-2,6-dinitrotoluene (4-A-2,6-DNT) 1,3-Dinitrobenzene (1,3-DNB) 2,4-Dinitrotoluene (DNT) 2,6-DNT Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) Methyl-2,4,6-trinitrophenylnitramine (Tetryl) Nitrobenzene Nitroglycerin 2-Nitrotoluene 3-Nitrotoluene 4-Nitrotoluene Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX) Perchlorate 1,3,5-Trinitrobenzene (1,3,5-TNB) 2,4,6-Trinitrotoluene (TNT) Metals (*e.g.,* aluminum, arsenic, lead, mercury)

**Source: U.S. Navy Range Sustainability Environmental Program Assessment Policy Implementation Manual, November 2006*

This FEIS/OEIS does not contain MEM associated with sonar training. The Navy prepared the AFAST FEIS/OEIS for the use of multiple sonar types in the east coast and Gulf OPAREAs of the United States. A summary of the AFAST FEIS/OEIS is provided in Section 3.20.

3.2.3.1 No Action Alternative

Navy training operations conducted under the No Action Alternative use a variety of material. Material required on the JAX Study Area is broadly classified as shipboard material necessary for normal operations and maintenance, such as fuel and paint and MEM. MEM includes both HE and NEPM.

Some MEM, including gun ammunition, bombs, missiles, targets, chaff, and flares are expended on the range and not recovered. A small percentage of training items containing military explosives may fail to function properly and, if not recovered, may remain on the range as unexploded ordnance.

MEM that falls into the water may release small amounts of toxic substances as it degrades and decomposes. The items degrade very slowly, so the volume of expended decomposing training material within the training areas—and the amounts of toxic substances being released to the environment—gradually increase over the period of military use. Concentrations of some substances in sediments surrounding the expended material would increase over time. Sediment movements in response to tidal surge and longshore currents, and sediment disturbance from ship traffic and other sources, would eventually disperse contaminants. The following paragraphs discuss the characteristics and the fate and transport of training items used within the JAX Training Complex.

Bombs

Typically, BOMBEX at-sea involve one or more aircraft bombing a target simulating a hostile surface vessel. Bomb bodies are steel and the bomb fins are either steel or aluminum. Based on the American Society for Testing and Materials standards specified for bomb construction, each of the iron bomb bodies or steel fins may also contain small percentages (typically less than 1%) of any of the following: carbon, manganese, phosphorus, sulfur, copper, nickel, chromium, molybdenum, vanadium, columbium, or titanium. The aluminum fins, in addition to the aluminum, may also contain: zinc, magnesium, copper, chromium, manganese, silicon, or titanium (DoN, 2005e). Refer to Section 3.3, Water Resources, for additional detail regarding water quality.

Practice bombs, also called bomb dummy units, are bomb bodies filled with an inert material (*e.g.,* concrete). A BDU mimics the weight, size, center of gravity, and ballistics of a high explosive bomb. Non-explosive practice mineshapes are similar in composition to BDUs—pieces of concrete or steel cases formed in the shape of a mine filled with concrete. Both could be used within the JAX Study Area. These non-explosive practice munitions may contain spotting charges/signal cartridges that produce a visual indication of impact.

Bombs used at the JAX Study Area during the No Action Alternative and their approximate weight, length, and diameter are provided in Table 3.2-3.

Eighty seven percent of the 577 bombs and mineshapes used in JAX Study Area exercises at-sea and on land during the No Action Alternative would be practice bombs and mineshapes without explosive warheads (DoN, 2006a).

Seventy seven high explosive bombs would be dropped in the No Action Alternative exercise at the JAX Study Area sea range. Bombs with high explosive ordnance would be fused to detonate

TABLE 3.2-3
BOMBS DEPLOYED UNDER THE NO ACTION ALTERNATIVE ON THE JAX STUDY AREA

Area	Bomb Type	Type	~Weight (pounds)	~Length (inches)	~Diameter (inches)
RODMAN RANGE					
BOMBEX (Inland)	BDU-45	Non-explosive Practice (also used as mine shape)	500	66	11
BOMBEX (Inland)	BDU-48 (simulates 500 and 1,000 lbs high-drag bombs)	Non-explosive Practice	10	12	1
BOMBEX (Inland)	MK-76	Non-explosive Practice (also used as mine shape)	25	25	4
BOMBEX (Inland)	MK-106 (simulates MK-82)	Non-explosive Practice	5	12	4
JAX OPAREA					
BOMBEX (Sea)	MK-20 Rockeye Cluster (each dispenses 247 bomblets)	Non-explosive Practice	1.32 per bomblet	6.5	2
BOMBEX (Sea)	MK-76	Non-explosive Practice (also used as mine shape)	25	25	4
BOMBEX (Sea)	BDU-45	Non-explosive Practice (also used as mine shape)	500	66	11
BOMBEX (Sea)	MK-20 Cluster Each dispenses 247 bomblets	High Explosive	1.32 per bomblet	6.5	2
BOMBEX (Sea)	MK-82	High Explosive	500	90	11
BOMBEX (Sea)	MK-83	High Explosive	1,000	119	14
BOMBEX (Sea)	MK-84	High Explosive	2,000	154	18
LAKE GEORGE RANGE					
Mine Laying	BDU-45	Non-explosive Practice (also used as mine shape)	500	66	11
Mine Laying	BDU-48 simulates 500 and 1,000 lbs high-drag bombs	Non-explosive Practice	10	12	1
Mine Laying	MK-76	Non-explosive Practice (also used as mine shape)	25	25	4

Source: DoN, 2006a

on contact with the water, and it is estimated that 99 percent of them would explode within 5 feet of the ocean surface (DoN, 2005b). Propelled fragments would be produced by an exploding bomb.

Fate and Transport

Small fragments of detonated bombs would settle to the sea floor. Unrecovered ordnance would also sink to the bottom where solid metal components would be corroded by seawater at slow rates. Over time, natural encrustation of exposed surfaces would occur, reducing the rate at which subsequent corrosion occurs. Rates of deterioration would vary, depending on the material and conditions in the immediate marine and benthic environment. Due to the large ocean area of the JAX Study Area, expended ordnance scattered on the ocean floor would be widespread and have a minimal impact on the benthic environment. Initial chemical by-product concentrations released during bomb detonation disperse rapidly in water and are considered negligible (DoN, 2005b).Practice bombs entering the water would be devoid of combustion chemicals found in the warheads of explosive bombs. They are typically made of concrete, steel, and iron. These components are consistent with the primary component building blocks of today's artificially built reef structures. The steel and iron, though durable, would corrode over time, with no noticeable environmental impacts. The concrete is also durable and would offer a beneficial substrate for benthic organisms. After sinking to the bottom, the physical structure of bombs would be incorporated into the marine environment by natural encrustation and/or sedimentation. (DoN, 2006b). Refer to Section 3.3, Water Resources for additional detail regarding water quality.

Missiles

Missiles would be fired by aircraft, ships, and Naval Special Warfare (NSW) operatives at a variety of airborne and surface targets on the JAX Study Area. In general, the single largest hazardous constituent of missiles is solid propellant primarily composed of rubber (polybutadiene) mixed with ammonium perchlorate (*i.e.,* solid double-base propellant; aluminum and ammonia propellant grain; and arcite propellant grain). Hazardous constituents are also used in igniters, explosive bolts, batteries (potassium hydroxide and lithium chloride), and warheads (*i.e.,* PBX-N high explosive components; PBXN-106 explosive; and PBX (AF)-108 explosive). Chromium or cadmium may also be found in anti-corrosion compounds coating exterior missile surfaces.

In the event of an ignition failure or other launch mishap, the rocket motor or portions of the unburned propellant may impact the environment. Experience with Hellfire missiles shows that if the rocket motor generates sufficient thrust to overcome the launcher hold-back, all the rocket propellant is consumed. In the rare cases where the rocket does not generate sufficient thrust to overcome the hold-back (hang fire or miss fire), some propellant may remain unburned but the missile remains on the launcher. Jettisoning the launcher is a possibility for hang fire or miss fire situations, but in most cases the aircraft returns to base where the malfunctioning missile is handled by explosives ordnance disposal personnel.

Table 3.2-4 below provides the approximate dimensions, weight, number, and type of missiles that would be fired during operations of the No Action Alternative, missile exercises at the JAX Study Area sea range.

Approximately 26 percent of the 53 missiles fired on the JAX Study Area carry non-explosive practice warheads with no hazardous constituents under the No Action Alternative.

TABLE 3.2-4
MISSILES FIRED UNDER THE NO ACTION ALTERNATIVE AT THE JAX STUDY AREA

Missile Name	Designation	Type		~Launch Weight (pounds)	~Length (feet)	~Diameter (inches)
Sidewinder	AIM-9	Air-to-Air	HE & NEPM	190	9.4	5
Sparrow	AIM-7	Air-to-Air	HE & NEPM	500	12	8
AMRAAM Slammer	AIM-120	Air-to-Air	HE & NEPM	350	12	7
Hellfire	AGM-114	Air-to-Surface	HE	100	5.6	7
Maverick	AGM-65	Air-to-Surface	HE	460-670	8.5	12

HE = High Explosive

NEPM = Non-explosive Practice Munitions

Fate and Transport

Non-explosive practice missiles do not explode upon contact with the target or sea surface. The main environmental effect would be the physical structure of the missile itself entering the water. Practice missiles do not use rocket motors and therefore do not have potentially hazardous rocket fuel.

Exploding warheads may be used in air-to-air missile exercises, but to avoid damaging the aerial target, the missile explodes at an offset to the target in the air, disintegrates, then, falls into the ocean. High explosive missiles used in air-to-surface exercises explode near the water surface (DoN, 2006a).

The principal source of potential impacts to water and sediment quality would be unburned solid propellant residue. Solid propellant fragments would sink to the ocean floor and undergo changes in the presence of seawater. The concentration decreases over time as the leaching rate decreases and further dilution occurs. The aluminum remains in the propellant binder and is eventually oxidized by seawater to aluminum oxide. The remaining binder material and aluminum oxide pose no threat to the marine environment (DoN, 1996). Section 3.3, Water Resources, discusses missile propellant in the marine environment in further detail.

Targets

At-sea targets are usually remotely operated airborne, surface, or subsurface traveling units, most of which are designed to be recovered for reuse. An estimated 40 expended targets would be used annually on the JAX Study Area under operations in the No Action Alternative. Small concentrations of fuel and ionic metals are released during battery operation.

A typical aerial target drone is powered by a jet fuel engine, generates radio frequency (RF) signals for tracking purposes, and is equipped with a parachute to allow recovery. Drones contain oils, hydraulic fluid, batteries, and explosive cartridges as part of their operating systems. There are also recoverable, remotely controlled target boats and underwater targets designed to simulate

submarines. If severely damaged or displaced, targets may sink before they can be retrieved. Aerial targets on the JAX Study Area would include AST/ALQ/ESM pods. Banner drones, BQM 74E drones, Lear Jets, and Tactical Air-Launched Decoys (TALD). The only expended target is the TALD. The TALD is a non-powered, air-launched, aerodynamic vehicle. It provides false imagery to defense acquisition systems by using chaff/electromagnetic and radar signature augmentation. It is approximately 7.6 feet long, 10 inches high and 10 inches wide. It weighs about 400 lbs and is constructed of extruded aluminum.

Surface targets would include Integrated Maritime Portable Acoustic Scoring and Simulator Systems (IMPASS); Improved Surface Tow Targets (ISTT); QST-35 Seaborne Powered Targets (SEPTAR); and 1,620 expended marine markers (smoke floats). Expended surface targets commonly used in addition to marine markers include cardboard boxes, 55-gallon steel drums, and a 10-foot diameter red balloon tethered by a sea anchor (also known as "killer tomatoes"). Floating debris, such as styrofoam, may be lost from target boats.

Lake George Range targets are located in the lake waters. The targets are pilings used as aim points. One target contains a 24-foot-square reflective center surrounded by a 900-foot ring of pilings; another is three rings of pilings with an outermost diameter of 1,000 feet; and a third target is a 30-foot by 60-foot rectangle surrounded by three rings of pilings with an outermost diameter of 1,000 feet. One MINEX target area is also present at Lake George and consists of four pre-planned splash points.

A ground (inland) target is used at Rodman Range. The range is a 600-foot-diameter cleared area with a single surplus military tank in the center. The tank is surrounded by 50- and 100-foot rings of tires. The tank is not completely destroyed or expended because only non-explosive practice ordnance is used at Rodman Range. Expended material is recovered in accordance with the operational range clearance plan for Rodman Range. Operational Range Clearance (ORC) efforts are conducted in accordance with the Navy's ORC policy and the Rodman ORC Plan, dated 2 Apr 2004. Specifically for Rodman, ORC activities will predominantly involve the (manual) collection of recoverable sub scale (less than/equal to 25 lb) NEPM (DoN, 2007)..

Fate and Transport

Most target fragments would sink quickly in the sea. An estimated 300 expended marine markers (smoke floats) would be used within the JAX Study Area for the No Action Alternative. Expended material that sinks to the sea floor would gradually degrade, be overgrown by marine life, and/or be incorporated into the sediments. Floating non-hazardous expended material may be lost from target boats and would either degrade over time or wash ashore as flotsam. Non-hazardous expended material is defined as the parts of a device made of non-reactive material. Typical non-reactive material includes steel or aluminum, polymers (*e.g.,* nylon, rubber, vinyl, and various other plastics), glass fiber, and concrete. While these items represent persistent seabed litter, their strong resistance to degradation and their chemical composition mean they do not chemically contaminate the surrounding environment by leaching heavy metals or organic compounds.

An extensive study conducted in Canada (Environmental Sciences Group, 2005) at Canadian Forces Maritime Experimental and Test Ranges near Nanoose, British Columbia, concluded that in general, the direct impact of debris accumulation on the sea floor appeared to be minimal and had no detectable effects on wildlife or sediment quality.

Marine Markers (Smoke Floats)

Marine markers are pyrotechnic devices dropped on the water's surface. They are used in training exercises to mark a surface position on the ocean. The chemical flame of a marine marker burns like a flare but also produces smoke.

The MK-25 marker consists of a cylindrical outer tube about 18.5 inches long and 3 inches diameter. It weighs 3.7 lbs and produces a yellow flame and white smoke for 10 to 20 minutes. It contains red phosphorus and a seawater-activated battery (The Ordnance Shop, 2007a). Sea water batteries use magnesium anodes, sea water as the electrolyte, and oxygen dissolved in the sea water as oxidant.

The MK-58 is composed of tin and contains two red phosphorus pyrotechnic candles and a seawater-activated battery. The MK-58 marine marker is 21.78 inches long and 5.03 inches in diameter, weighs 12.8 lbs, and produces a yellow flame and white smoke for a minimum of 40 minutes and a maximum of 60 minutes (The Ordnance Shop, 2007b).

Fate and Transport

Smoke from marine markers would be rapidly diffused by air movement. The marker itself is not designed to be recovered and would eventually sink to the bottom and become encrusted and/or incorporated into the sediments.

Unburned phosphorus contained in the marker settles to the sea floor where it reacts with the water to produce phosphoric acid, until all phosphorus is consumed by the reaction. Combustion of red phosphorus produces phosphorus oxides, which have a low toxicity to aquatic organisms. The red phosphorus is not anticipated to have a significant effect on the marine environment (DoN, 2006b). Refer to Section 3.3, Water Resources for additional detail regarding water quality.

Seawater-activated batteries would be expended during their normal service life and would not present a significant impact to the environment (Environmental Sciences Group, 2005).

Naval Gun Ammunition

Naval gun fire exercises with the JAX Study Area would use non-explosive and explosive 5-inch and 76-mm rounds. Over 75 percent of training rounds are non-explosive and contain an iron shell and sand, iron grit, or cement filler. Rapid-detonating explosive (RDX) is used in explosive rounds. An estimated 2,174 non-explosive practice rounds and 390 high explosive rounds are fired under the No Action Alternative annually during the JAX Study Area exercises that use 5-inch guns.

Unexploded shells and non-explosive ordnance practice shells would not be recovered and would sink to the ocean floor. Solid metal components (mainly iron) of unexploded ordnance and non-explosive ordnance would also sink.

Fate and Transport

High explosive 5-inch shells are typically fuzed to detonate within 3 feet of the water surface. Shell fragments rapidly decelerate through contact with the surrounding water and settle to the sea floor. Un-recovered ordnance also sinks to the bottom. Iron shells and fragments would be corroded by seawater at slow rates, with comparable slow release rates. Over time, natural

encrustation of exposed surfaces would occur, reducing the rate at which subsequent corrosion occurs. Rates of deterioration would vary, depending on the material and conditions in the immediate marine and benthic environment. However, the release of contaminants from unexploded ordnance, non-explosive ordnance, and fragments is not expected to result in measurable degradation of marine water quality. Refer to Section 3.3, Water Resources, for additional detail regarding water quality.

Unexploded shells and non-explosive ordnance practice shells would not be recovered and would sink to the ocean floor. The RDX material of unexploded ordnance would not typically be exposed to the marine environment. Should the RDX be exposed on the ocean floor, it would break down within a few hours (DoN, 2001). Over time, the RDX residue would be covered by ocean sediments or diluted by ocean water.

Small Arms, Crew Served, and Close-In Weapons System Fire

Ammunition used in .50 caliber and 7.62-mm small arms cartridges often contains lead cores. The 20-mm and 25-mm cannon shells used in Small Arms and Close-In Weapons Systems (CIWS) training are primarily steel; 20 mm projectiles used in CIWS training are typically inert tungsten. Depleted Uranium, is being phased out of the inventory, and is not used in training events. The environmental effects of tungsten are inconclusive.

A total of 485,180 small arms rounds and 42,900 cannon shells would be fired in the No Action Alternative. Under Alternative 1 and the Preferred Alternative (Alternative 2), the use of small arms would increase by four percent and CIWS ammunition would increase from the No Action Alternative by 10 percent.

An estimated 11,520 non-explosive practice M19 40-mm grenades and 80 high explosive MK3A2 anti-swimmer grenades would also be used. M-19 40mm grenades are about the same size and shape as a chicken egg, and contains an inert dye in a metal shell, and uses a variety of fuzes. MK3A2 anti-swimmer grenades are about the same size as a 12 ounce soda can and contain 8 ounces of high explosive (TNT).

Fate and Transport

Expended .50-caliber and 7.62 mm bullets may release small amounts of iron, aluminum, copper, and tungsten into the sediments and the overlying water column as bullets corrode. Aluminum, copper, and tungsten are elements that exist naturally in the environment. Their presence in water is mainly due to erosion of soil and rocks. Increased concentrations of metals in sediments would be restricted to a small zone around the bullet, and releases to the overlying water column would be quickly diluted (DoN, 2005c). Refer to Section 3.3, Water Resources, for additional detail regarding water quality.

Chaff

Radiofrequency chaff (chaff) is an electronic countermeasure designed to reflect radar waves and obscure aircraft, ships, and other equipment from radar tracking sources. Chaff is non-hazardous and consists of aluminum-coated glass fibers (about 60% silica and 40% aluminum by weight) ranging in lengths of 0.3 to 3 inches with a diameter of about 40 micrometers. Chaff is released or dispensed from military vehicles in cartridges or projectiles that contain millions of chaff fibers.

For each chaff cartridge used, a plastic end-cap and Plexiglas piston is released into the environment in addition to the chaff fibers. The end-cap and piston are both round and are 1.3 inches in diameter and 0.13 inches thick (Spargo, 2007).

Chaff is used during ACM training and EC Operations throughout the JAX Study Area. Under the No Action Alternative, it is estimated that 451 exercises would be held per year, releasing about 4,174 rounds (cartridges) of chaff in the JAX Study Area.

Fate and Transport

When deployed, a diffuse cloud of fibers undetectable to the human eye is formed. Chaff is a very light material that can remain suspended in air anywhere from 10 minutes to 10 hours and can travel considerable distances from its release point, depending on prevailing atmospheric conditions (Arfsten *et al.,* 2002).

Based on the dispersion characteristics of chaff, large areas of open water within the JAX Study Area would be exposed to chaff, but the chaff concentrations would be low. For example, Hullar *et al.* (1999) calculated that a 4.97 mile by 7.46 mile (37.1 mi^2 or 28 nm^2) area would be affected by deployment of a single cartridge containing 150 grams of chaff. The resulting chaff concentration would be about 5.4 g/nm^2. This corresponds to less than 179,000 $fibers/nm^2$ or less than 0.005 $fibers/ft^2$, assuming that each canister contains five million fibers.

The fine, neutrally buoyant chaff streamers act like particulates in the water, temporarily increasing the turbidity of the ocean's surface, but are quickly dispersed.

The end-caps and pistons would sink; however, some may remain at or near the surface if it were to fall directly on a dense *Sargassum* mat. The expended material could also be transported long distances before becoming incorporated into the bottom sediments.

Flares

Infrared decoy flares are used at the JAX Study Area to attract heat-seeking missiles. Infrared decoy flares are also called "self protection flares." They consist of an aluminum case approximately 7 inches long with a 1-1.5-inch diameter.

The type of metal burned in the flare determines the color of the flame; most flares burn magnesium to produce a white flame. Traces of orange indicate the burning of the aluminum casing. Solid flare and pyrotechnic residues may contain, depending on their purpose and color, aluminum, magnesium, zinc, strontium, barium, cadmium, and nickel, as well as perchlorates. Hazardous constituents in pyrotechnic residues are typically present in small amounts or low concentrations, and are bound in relatively insoluble compounds. As inert, incombustible solids with low concentrations of leachable metals, these materials typically do not meet the RCRA criteria for characteristic hazardous waste. The perchlorate compounds present in the residues are relatively soluble, although persistent (*i.e.,* do not break down readily into other compounds under natural conditions) in the environment, and should disperse quickly (DoN, 2008). Refer to Section 3.3, Water Resources, for additional detail regarding water quality.

Under normal operations, the only decoy flare waste material that would enter the water would be ash and a small, round plastic end-cap (approximately 1.4-inch diameter). In rare instances an unburned, dud flare could enter the water. While no data specifying absolute flare reliability rates

are available, the dud rate is estimated at less than one percent based on studies conducted by the Air Force (USAF, 1997).

Decoy flares are used during ACM, EC OPS, and IMPASS training. Under the No Action Alterative, 1,740 flares would be used.

Fate and Transport

Flares are designed to burn completely, thus reducing the amount of waste material that falls to the sea surface. Similar to chaff cartridge end-caps and pistons discussed above, plastic flare end-caps would be released into the marine environment where they would persist for long periods. The end-caps would typically sink; however, some could remain at or near the surface if it were to fall directly on a dense *Sargassum* mat. The expended material could also be transported long distances before becoming incorporated into the bottom sediments.

Laboratory leaching tests of flare pellets and residual ash using synthetic seawater found barium in the pellet tests, while boron and chromium were found in the ash tests. The pH of the test water was raised in both tests. Ash from flares is dispersed over the water surface and then settles out. Chemical leaching occurs throughout the settling period through the water column, and any leaching after the particles reach the bottom are dispersed by currents. The compounds present in the residues are relatively soluble, although persistent (*i.e.,* do not break down readily into other compounds under natural conditions) in the environment, and should disperse quickly (DoN, 2007b). Refer to Section 3.3, Water Resources for additional detail regarding water quality.

Dud flares would sink to the bottom and slowly degrade. Based on studies conducted by the Air Force, flare dud degradation products in saltwater would include magnesium and barium (USAF, 1997). Incidental flare duds falling into marine environments would not be expected to generate adverse affects due to the small amount of chemicals released (USAF, 1997), the small number of dud flares, and the large dilution capacity of the receiving waters of the JAX Study Area.

Underwater Detonations

Most UNDETs during JAX Range operations would be associated with small mine neutralization and anti swimmer grenade training. Under the No Action Alternative, 96 anti-swimmer grenade training events would be performed. 80 explosive grenades would be used per year (not all events would use explosive grenades during exercises). Mine Neutralization event involve Explosive ordnance disposal (EOD) detachments placing explosive charges next to or on non-explosive practice mines. Charges used by EOD divers consist of 20-lbs explosives, which reflects the size of charges EOD divers use to detonate mines in combat or real-world conditions. Under the No Action Alternative, 18 20-lbs charges would be used per year.

The combustion products from the detonation of high explosives are commonly found in sea water— carbon monoxide, carbon dioxide, hydrogen, water, nitrogen, and ammonia. The primary contaminant released from explosives used in MIW training are nitroaromatic compounds such as trinitrotoluene, RDX, and octogen (High Melting Explosive or HMX) (URS *et al.,* 2000). Refer to Section 3.3, Water Resources, for additional detail regarding water quality.

Fate and Transport

Initial concentrations of explosion by-products are not expected to be hazardous to marine life (DoN, 2001) and would not accumulate in the training area because exercises are spread out over time and chemicals rapidly disperse in the ocean. Therefore, no adverse effects from chemical by-products would be expected. Refer to Section 3.3, Water Resources, for additional detail regarding water quality.

Lake George Range

No live ordnance is currently authorized for Lake George Range. No hazardous materials or hazardous waste would be generated in training activities. Therefore, no significant impact would be expected.

Rodman Range

No live ordnance is currently authorized for Rodman Range. No hazardous materials or hazardous waste would be generated in training activities. Therefore, no significant impact would be expected.

3.2.3.2 Alternative 1

JAX Study Area training operations involving hazardous material would increase by varying degrees from current levels in support of the FRTP. Only the number of training operations would increase; no new training activities (*i.e.,* weapons firing, target deployment, *etc*.) would be introduced. MEM use under Alternative 1, as compared to the No Action Alternative would be as follows:

- use of high explosive bombs would remain the same;
- use of non-explosive practice bombs would remain the same;
- use of high explosive missiles would increase by 136 percent;
- use of non-explosive practice missiles would increase by 7 percent;
- use of expended targets would increase by 10 percent;
- use of marine markers (smoke floats) would remain the same;
- use of high-explosive naval gun ammunition rounds would remain the same;
- use of non-explosive practice naval gun ammunition would increase by 9 percent;
- the use of grenades would remain the same;
- use of chaff would increase by 12 percent;
- use of defensive/decoy flares would increase by 42 percent; and
- use of 20-lbs charges would decrease from the No Action Alternative by 33 percent.

As indicated in Tables 2.2-4 and 2.2-5, amounts of MEM would increase and decrease in rough proportion to the overall increases and decreases in training operations. A summary of ordnance use by training area is provided in Table 2.2-6.

Vessels, aircraft, and other military assets employed in these operations would carry and use hazardous material for routine operation and maintenance. Increases in hazardous material transport, storage, and use to support increased training operations under Alternative 1 would be managed in compliance with applicable laws and regulations. No new types of hazardous material would be required, and existing hazardous material storage and handling facilities, equipment,

supplies, and procedures would continue to provide for adequate management of these materials. No significant harm or effect on the environment is anticipated.

The amounts of hazardous waste generated by normal vessel and aircraft operations and maintenance during training under Alternative 1 would be about the same as that generated under the No Action Alternative. The amounts of hazardous waste generated by training operations under Alternative 1 would be incrementally greater than those under the No Action Alternative. All hazardous waste would continue to be managed in compliance with applicable laws and regulations. No changes in hazardous waste management are anticipated for operating Navy assets under Alternative 1.

Proposed Increases in Training Operations

Amounts of MEM would increase in rough proportion to the overall increases and decreases in these training operations. Navy vessels, aircraft, and other military assets engaged in these operations would use minor quantities of hazardous material and generate minor quantities of used hazardous material during routine ship operations. This material would be managed in accordance with applicable laws and regulations. Hazardous material inventories would be replenished, and used hazardous material would be offloaded while the vessels are in port.

Expand Warfare Missions to Conduct Maritime Security Surface Strike Group Training

Maritime Security (MS) Surface Strike Group (SSG) training is not measurably different than training that already occurs within the JAX Study Area. Essentially, it is a repackaging of cruiser/destroyer training operations such that a three-ship SSG practices operating as an autonomous entity. Maritime Security SSG training does not involve the expenditure of ordnance. None of the MS SSG training would have a substantial effect on MEM, hazardous material use, or solid waste generation under Alternative 1.

Accommodate Mission Requirements Associated with Force Structure Changes

Conduct MH-60R/S Training. The Navy proposes to conduct the MH-60R training missions in the JAX Study Area in accordance with the recent restructuring of Navy helicopter forces around the two linchpin airframes, the MH-60S and MH-60R. The MH-60R squadrons will be consolidated at Naval Station Mayport and Naval Air Station Jacksonville. An additional 52 Hellfire missile capable airframes are expected in the JAX Study Area in the coming years (DoN, 2002).

Organic Mine Countermeasures. Navy vessels, aircraft, and other military assets engaged in these operations would use minor quantities of hazardous material and generate minor quantities of used hazardous material during routine operations. This material would be managed in accordance with applicable laws and regulations. No mineshapes would be involved. Training would be conducted to establish and maintain proficiency in the airborne mine countermeasures mission. Potential effects to hazardous materials and waste associated with the active sonar components are analyzed separately in the AFAST FEIS/OEIS and summarized in Section 3.20 of this document.

Lake George Range

No live ordnance is currently authorized for Lake George Range. No hazardous materials or hazardous waste would be generated in training activities. Therefore, no significant impact would be expected.

Rodman Range

No live ordnance is currently authorized for Rodman Range. No hazardous materials or hazardous waste would be generated in training activities. Therefore, no significant impact would be expected.

3.2.3.3 Alternative 2 (Preferred Alternative)

JAX Study Area training operations involving hazardous material would increase by varying degrees from current levels in support of the FRTP. Only the number of training operations would increase; no new training activities (*i.e.,* weapons firing, target deployment, *etc*.) would be introduced. MEM use under the Preferred Alternative (Alternative 2) would be the same as Alternative 1 except for the following:

- use of high explosive bombs would decrease from the No Action Alternative by 100 percent;
- use of non-explosive practice bombs would increase above the No Action Alternative by 67 percent; and
- use of 20-lbs charges would decrease from the No Action Alternative by 33 percent.

As indicated in Tables 2.2-4 and 2.2-5, amounts of MEM would increase and decrease in rough proportion to the overall increases and decreases in training operations. A summary of ordnance use by training area is provided in Table 2.2-6.

Vessels, aircraft, and other military assets employed in these operations would carry and use hazardous material for routine operation and maintenance. Increases in hazardous materials transport, storage, and use to support increased training operations under Alternative 2 would be managed in compliance with applicable laws and regulations. No new types of hazardous material would be required. Existing hazardous material storage and handling facilities, equipment, supplies, and procedures would continue to provide for adequate management of these materials. No releases of hazardous material to the environment and no unplanned exposures of personnel to hazardous material are anticipated under this alternative.

The overall amount of hazardous waste generated by normal vessel and aircraft operation and maintenance during training under Alternative 2 would be more than that generated under the No Action Alternative. This increase would be due primarily to the increased number of training operations anticipated under Alternative 2. All hazardous waste would continue to be managed in compliance with applicable laws and regulations. No changes in hazardous material management practices are anticipated under Alternative 2.

Lake George Range

No live ordnance is currently authorized for Lake George Range. No hazardous materials or hazardous waste would be generated in training activities. Therefore, no significant impact would be expected.

Rodman Range

No live ordnance is currently authorized for Rodman Range. No hazardous materials or hazardous waste would be generated in training activities. Therefore, no significant impact would be expected.

3.2.4 Unavoidable Significant Environmental Effects

The analysis presented above indicates that No Action Alternative, Alternatives 1 and 2 would not result in unavoidable significant adverse effects to the environment.

3.2.5 Summary of Environmental Effects (NEPA and EO 12114)

Hazardous material, waste, and MEM used and generated during the JAX Study Area operations would be managed in accordance with applicable federal and state regulations, and DoD service guidelines. Any spills or mishaps would be handled pursuant to all applicable federal and state laws, and DoD regulations.

Military munitions are not considered solid waste when used for their intended purpose, which includes training of military personnel and research and development activities. This includes virtually all missiles, munitions, and targets used at the JAX Study Area. A review of the use of munitions and targets was conducted and their hazardous constituents' disposition was analyzed. The components that contain hazardous constituents include propellants, batteries, flares, telemetry, igniters, jet fuel, diesel fuel, hydraulic fluid, and explosive warheads

Non-hazardous expended material is defined as all parts of a device made of nonreactive material, including parts made of steel or aluminum, polymers (*e.g.*, nylon, rubber, vinyl, and various other plastics), glass fiber, and concrete. While these items represent persistent seabed litter, their strong resistance to degradation and their chemical composition mean they do not chemically contaminate the surrounding environment by leaching heavy metals or organic compounds. Expended material that sinks to the sea floor would gradually degrade, be overgrown by marine life, and/or be incorporated into the sediments. Floating non-hazardous expended material may be lost from target boats and would either degrade over time or wash ashore as flotsam.

MEM would introduce small amounts of potentially hazardous chemicals into the marine environment. The water quality analysis of all current and proposed operations indicates that concentrations of constituents of concern associated with material expended in the JAX Range are well below water quality criteria established to protect aquatic life (see Section 3.3, Water Resources).

The combustion products from the detonation of high explosives are commonly found in sea water. Initial concentrations of explosion by-products are not expected to be hazardous to marine life (DoN, 2001) and would not accumulate in the area training because exercises are spread out over time and the chemicals would rapidly disperse in the ocean. Therefore, no adverse effects from chemical by-products would be expected.

Table 3.2-5 provides a summary of environmental effects for the alternatives. Implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in significant impacts to the environment in territorial waters. Implementation of the No Action Alternative, Alternative 1 or Alternative 2 would not result in significant harm to the environment in the global commons

TABLE 3.2-5
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES IN THE JAX STUDY AREA

Alternative and Stressor	Summary of Effects and Impact Conclusion	
	NEPA (U.S. Territory)	Executive Order 12114 (Non-Territorial Waters, >12 nm)
No Action		
Military Expended Material (MEM)	Long-term, minor, and localized accumulation of MEM on the ocean floor, *Sargassum* mats, and beaches.	Long-term, minor, and localized accumulation of MEM on the ocean floor and *Sargassum* mats.
UNDETs and HE Ordnance	Negligible effects.	Negligible effects.
Non-Explosive Practice Munitions	Long-term, minor, and localized accumulation of MEM on the ocean floor, *Sargassum* mats, and beaches.	Long-term, minor, and localized accumulation of MEM on the ocean floor and *Sargassum* mats.
Mine Warfare Deployment/Recovery	Negligible effects.	Negligible effects.
Conclusion	Less than significant impact.	Less than significant harm.
Alternative 1		
MEM	Long-term, minor, and localized accumulation of MEM on the ocean floor, *Sargassum* mats, and beaches. Slight increase compared to No Action.	Long-term, minor, and localized accumulation of MEM on the ocean floor and *Sargassum* mats. Slight increase compared to No Action.
UNDETs and HE Ordnance	Negligible effects.	Negligible effects.
Non-Explosive Practice Munitions	Long-term, minor, and localized accumulation of MEM on the ocean floor, *Sargassum* mats, and beaches. Slight increase compared to No Action.	Long-term, minor, and localized accumulation of MEM on the ocean floor and *Sargassum* mats. Slight increase compared to No Action.
Mine Warfare Deployment/Recovery	Negligible effects.	Negligible effects.
Conclusion	Less than significant impact	Less than significant harm.
Alternative 2 (Preferred Alternative)		
MEM	Long-term, minor, and localized accumulation of MEM on the ocean floor, *Sargassum* mats, and beaches. Slight increase compared to No Action.	Long-term, minor, and localized accumulation of MEM on the ocean floor and *Sargassum* mats. Slight increase compared to No Action.
UNDETs and HE Ordnance	Negligible effects.	Negligible effects.
Non-Explosive Practice Munitions	Long-term, minor, and localized accumulation of MEM on the ocean floor, *Sargassum* mats, and beaches. Slight increase compared to No Action.	Long-term, minor, and localized accumulation of MEM on the ocean floor and *Sargassum* mats. Slight increase compared to No Action.
Mine Warfare Deployment/Recovery	Negligible effects.	Negligible effects.
Conclusion	Less than significant impact	Less than significant harm.

3.3 WATER RESOURCES

3.3.1 Introduction and Methods

Water resources on land include surface and subsurface water bodies. The only land range areas in the JAX Range Complex being evaluated as part of this FEIS/OEIS are the Lake George Range and the Rodman Range; both land range areas are in Florida. Water resources such as lakes, ponds, rivers, streams, groundwater, and aquifers are discussed as they specifically pertain to an activity in the proposed action or are linked to the marine environment. The marine environment refers to offshore, high-salinity waters, and is further defined by prevailing currents, harbor flushing hydraulics, and tidal variations.

Water quality describes the chemical and physical composition of water as affected by natural conditions and human activities. For the purposes of this analysis, water quality is evaluated with respect to the possible release of hazardous constituents from those aircraft, vessels, and munitions used in the JAX Range Complex.

After the existing water quality conditions are described, the potential future water quality impacts of the project alternatives are compared to the existing water quality conditions to identify the differences in environmental impacts that might be expected if one of the project alternatives were selected. In other words, environmental impacts are currently taking place from current natural and human activities, including those of the Navy.

3.3.1.1 Assessment Methods and Data Used

Each of the alternatives analyzed in this FEIS/OEIS includes several warfare areas (*e.g.*, Mine Warfare, Anti-air Warfare, *etc.*) and most warfare areas include multiple types of training operations (*e.g.*, Mine Neutralization, MISSILEX (S-A), *etc.*). Likewise, several activities (*e.g.*, vessel maneuver, target deployment, weapons firing, *etc.*) are accomplished under each operation. Most of the specific activities accomplished under a given operation are not unique to that operation. For example, many of the operations included in the alternatives involve Navy vessel maneuvers and aircraft overflights. Accordingly, the analysis for water resources is organized by specific activity rather than warfare area or operations.

This section of the FEIS/OEIS reviews the water resources and impacts to water quality associated with training in the JAX Range Complex. For the purposes of this analysis, water quality is evaluated with respect to possible release of expended material from aircraft, munitions, and other vessels. To address potential impacts, the approach to analysis includes characterizing the yearly test and training operations that may contribute expended material to the JAX Range Complex ocean environment. These include missile flights, targets expenditure, ship, boat, and aircraft operations, weapons firing, and items of expended material in inert ordnance. A full discussion of hazardous material and hazardous waste is presented in Section 3.2.

It was determined that no water quality modeling or monitoring was specifically required for a complete and thorough analysis.

3.3.1.2 EIS Study Area

In this FEIS/OEIS, the water resources/water quality study area for the JAX Range Complex includes the Navy's sea ranges – the JAX and Charleston OPAREAs, adjacent waters, land associated with Rodman Range, and waters and adjacent shoreline associated with Lake George.

The JAX OPAREA includes offshore surface and subsurface operating area extending southward generally from the Georgia-South Carolina border along the coast of Georgia and Florida for a distance of approximately 200 miles and seaward (east) from approximately 12 nm off the coast for a distance of approximately 250 nm. The Charleston OPAREA includes offshore surface and subsurface operating area extending north-northeast generally from Georgia-South Carolina border along the coast of South Carolina and North Carolina for a distance of approximately 200 miles and seaward (east) from approximately 3 to 12 nm off the coast for varying distances.

3.3.1.3 Data Sources

State and federal regulations, as well as each state's water resource/water quality programs were reviewed. Available reference materials, including prior EAs and EISs, were reviewed, and are cited, as appropriate.

3.3.1.4 Significance Criteria and Impact Thresholds

Numerous federal, state, and local regulations govern the protection of water resources; these regulations are summarized in Appendix K. The primary objective of these regulations is to protect public health and the environment, as well as biological resources. A significant impact would result if the use of hazardous material or the generation of hazardous waste resulted in a violation of any of the laws cited above.

3.3.1.5 Warfare Areas and Associated Environmental Stressors

Aspects of the proposed actions that are likely to act as stressors were identified by conducting an analysis of the warfare areas, operations, and specific activities included in the alternatives. Appendix D provides detailed descriptions of operations, and Table 3.3-1 summarizes this analysis and shows the primary stressors associated with each operation (see Appendix D for detailed descriptions of operations). After the primary stressors were identified, training items associated with warfare areas and operations were identified.

TABLE 3.3-1
POTENTIAL STRESSORS ASSOCIATED WITH WATER QUALITY

Warfare Area and Operation	Training Areas	Mine Warfare Deployment/Recovery	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Material
Mine Warfare (MIW)					
Mine Laying	Lake George Range	✓	✓		✓
Mine Countermeasures Exercise (MCM)	Carrier Operating Areas	✓			
Mine Neutralization	Charleston OPAREA (North and South UNDET Boxes)	✓	✓	✓	✓

TABLE 3.3-1 (Continued)
POTENTIAL STRESSORS ASSOCIATED WITH WATER QUALITY

Warfare Area and Operation	Training Areas	Mine Warfare Deployment/Recovery	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Material
Surface Warfare (SUW)					
MISSILEX (A-S)	W-157A (Area 4X) and W-159A (Area 5X)		✓	✓	✓
GUNEX (A-S)	W-132, W-133, W-134, W-157, W-158		✓		✓
GUNEX (S-S) Boat	Charleston OPAREA (Area 11J)		✓		✓
GUNEX (S-S) Ship	JAX OPAREA (AA, BB, and CC)		✓		✓
Bombing Exercise (A-S) (at sea)	HE, W-158A (31J); NEPM, W-157A/B and W-158 A/B		✓	✓	✓
Laser Targeting	W-132, W-133, W-134, W-157, W-158				
GUNEX (S-S) (FAC/FIAC)	Amber Strait: Charleston OPAREA (Boxes Q-9&10, R-9&10)				
VBSS/MIO-Ship	JAX and Charleston OPAREAs				
VBSS/MIO-Helicopter	W-157A (Area 4X) and W-159A (Area 5X)				
Air Warfare (AW)					
ACM	W-157A (Areas 3X and 4X)		✓		✓
Air Intercept Control	W-132, W-133, W-134, W-157, W-158		✓		
ACM Chaff Exercise	W-157A (Areas 3X and 4X)		✓		✓
ACM Flare Exercise	W-157A (Areas 3X and 4X)		✓		
MISSILEX (A-A)	W-132, W-133, W-134, W-157, W-158		✓	✓[1]	✓
MISSILEX (S-A)	JAX and Charleston OPAERAs				✓
Detect-to-Engage	W-132, W-133, W-134, W-157, W-158				
GUNEX (S-A)	JAX OPAREA (AA, BB, and CC)		✓		✓
GUNEX (A_A)	W-157A/W-133 (Area 2X)				✓

TABLE 3.3-1 (Continued)
POTENTIAL STRESSORS ASSOCIATED WITH WATER QUALITY

Warfare Area and Operation	Training Areas	Mine Warfare Deployment/Recovery	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Material
Amphibious Warfare (AMW)					
FIREX with IMPASS	JAX OPAREA (BB and CC)		✓	✓	✓
Strike Warfare (STW)					
BOMBEX (A-G)	Rodman Range				✓
CSAR and Convoy Recovery	Rodman Range				✓
Electronic Combat (EC)					
EC Operations- Aircraft	W-132, W-133, W-134, W-157, W-158				
EC Operations- Surface Ships	JAX and Charleston OPAREAs				
Chaff Exercise	JAX and Charleston OPAREAs				✓
FIREX - Helicopter	Lake George Range				✓
Other Events					
SESEF Utilization	5-15 nm east of Mayport				
Precision Anchoring	NS Mayport				
Small Arms with anti-swimmer grenades (MK3A2)	Charleston OPAREA (Area 10L, 12I)			✓	✓

[1] Missile explodes in air, no explosive sound in the water.

Table 3.3-2 identifies the training item source associated with the expended material for each operation and the location relative to the shoreline where the operation would occur.

TABLE 3.3-2
EXPENDED TRAINING ITEMS ASSOCIATED WITH THE JAX RANGE COMPLEX OPERATIONS

Operation	Training Area Proximity	Expended Training Item
Mine Laying	Inside 12 nm (Lake George Range)	• BDU-45 bomb • BDU-48 bomb • MK-76 bomb (all NEPM)
MCM Exercise	Outside 12 nm	• none
Mine Neutralization	Outside 12 nm	• 20-lbs explosive charges
MISSILEX (A-S)	Outside 12 nm	• AGM-114 (Hellfire) HE missile • AGM-65 (Maverick) HE missile • MK-25 Marine Marker (Smoke Float)
Missilex (S-A)	Outside 12 nm	• SM-2 • Sea Sparrow
GUNEX (A-S)	Outside 12 nm	• .50-caliber projectile • 7.62 mm projectile • Marine Marker (Smoke float)
GUNEX (A_A)	Outside 12 nm	• 20 mm projectile
GUNEX (S-S) Boat	Outside 12 nm	• .50-caliber projectile • 7.62 mm projectile • 40 mm projectile
GUNEX (S-S) Ship	Outside 12 nm	• 5 inch projectile • 76 mm projectile • .50-caliber projectile • 25 mm projectile
BOMBEX (A-S)	Outside 12 nm	• BDU-45 (500 lbs NEPM) bomb • MK-82 (I) bomb • MK-82 (500 lbs HE) bomb • MK-20 cluster bomb, HE • MK-20 cluster bomb, NEPM • MK-76 (25 lbs NEPM with small smoke charge) bomb • MK-83 (1,000 HE) bomb • MK-83 (I) (1,000 lbs NEPM) • MK-84 (2,000 lbs HE bomb) • Marine Marker (Smoke Float)
Air Combat Maneuver	Outside 12 nm	• Chaff • Flares
MISSILEX (A-A)	Outside 12 nm	• AIM-7 • AIM-9 • AIM-120 (30% HE, 70% NEPM)
GUNEX (S-A)	Outside 12 nm	• 5 inch projectile (inert) • 20 mm projectile • 76 mm projectile
FIREX with IMPASS	Outside 12 nm	• 5 inch projectile (56% HE, 44% NEPM)
Chaff Exercise	Outside 12 nm	• Chaff

TABLE 3.3-2 (Continued)
EXPENDED TRAINING ITEMS ASSOCIATED WITH THE JAX RANGE COMPLEX OPERATIONS

Operation	Training Area Proximity	Expended Training Item
Flare Exercise	Inside 12 nm (Lake George Range)	• Flares
Small Arms	Inside 12 nm (Area 10L, 12I)	• MK3A2 Concussion anti-swimmer grenades (8 oz HE)

3.3.2 Affected Environment

The affected environment for purposes of water quality includes the JAX and Charleston OPAREAs, adjacent waters, land associated with the Rodman Range, and waters and adjacent shoreline associated with Lake George. As mentioned in Chapters 1 and 2, the JAX Range Complex includes other land areas, but these are not analyzed in this FEIS/OEIS. The area of the JAX Range Complex assessed in this FEIS/OEIS is almost entirely offshore training sea space, undersea space, and special use airspace. For water quality purposes, the vast majority of area assessed is the 50,090 nm^2 of sea space (20,794 nm^2 shallow water (<~591 feet) and 29,296 nm^2 deep water (>~591 feet). This area begin 3 nm from shore, where state waters end; however, the nearshore environment is also included in this analysis.

The marine environment of the study area can be characterized in terms of its bathymetry, circulation, sediment transport, deposition, and bottom composition. Bathymetry and bottom composition are addressed in Section 3.1. Water characteristics, sediment transport, deposition, and circulation, along with marine water quality, are discussed below. Fate and transport of hazardous material and hazardous waste in the marine environment is discussed in Section 3.2.

3.3.2.1 Marine Water Quality

The OPAREAs are located within the South Atlantic Bight (SAB), the marine geographic province that extends from roughly 27 degrees north latitude (West Palm Beach, Florida) to 35 degrees north latitude (Cape Hatteras, North Carolina) (Atkinson and Menzel, 1985). The SAB is unique among U.S. oceanic provinces because of its direct link with the Gulf Stream Current. The Gulf Stream is in nearest proximity to the coast in the SAB, and the influence of this current dominates the physical, biological, and climatological processes of the region. The climate is highly variable, ranging from temperate to subtropical, due to the large latitudinal range this area encompasses as well as the tempering effect of the warm water Gulf Stream Current. The coastline of the SAB forms a sweeping curve characterized by cuspate bays and shoals in the northern or Carolina Capes region, while the coast of the southern region has been likened to a perforated barrier-island complex (DoN, 2008).

Water quality in the marine environment is determined by a complex set of interactions between chemical and physical processes operating continuously in the ocean system. This dynamic equilibrium is expressed by a variety of indicators, including temperature, salinity, dissolved oxygen, and nutrient levels. Water pollutants alter the basic chemistry of sea water in various ways.

The following discussion characterizes in general terms the major determinants of marine water quality in the OPAREAs.

Currents

Prevailing winds and centripetal force cause surface waters to move in a circular fashion in ocean basins. In the North Atlantic Ocean, the circular system is composed of the Gulf Stream and the North Atlantic, Canary, and Equatorial Currents. The Gulf Stream is the dominant surface water mass in the SAB and the OPAREAs (Figure 3.3-1). Southerly flowing currents, typical north of Cape Hatteras, are transient events in the SAB and, when present, are limited to the area along the coast. Circulation over the continental shelf in the SAB is typified by a broad, slow, northerly flow of water, with frequent intrusions of the Gulf Stream onto the shelf.

As the Gulf Stream enters the OPAREAs at a depth of less than 328 feet, it is fairly narrow and clearly defined. As the current travels north and east through the OPAREAs, it expands to approximately 27 nm wide and more than 1,641 feet deep. Surface velocities range from 32.3 to 5.8 nm/hr), and the water temperature is 77° to 82°F (Mann and Lazier, 1996).

In the SAB, wavelike meanders and cyclonic eddies are consistent features of the Gulf Stream front (Verity, *et al*., 1993). These frontal eddies are formed from the large warm and cold core rings that pinch off from the Gulf Stream after it is deflected from the U.S. Atlantic coast. Frontal eddies commonly occur in areas where the Gulf Stream is far from the coast (*e.g*., off the coast of northern Florida and Georgia).

In deep waters within the SAB, currents flow opposite to those of the Gulf Stream. The Deep Water Boundary Current consists of several cold, deep-water masses, each with a characteristic temperature and salinity. The Deep Water Boundary Current flows southward toward the equator at depths of 2,625 to 13,124 feet along the eastern flank of the Blake Plateau (Adams, *et al*., 1993).

Temperature and Salinity

The waters of the OPAREAs follow an annual temperature cycle. Throughout the year, there is an eastern gradient of increasing temperature on the sea surface, with the highest temperature centered in the Gulf Stream. Water temperature and salinity are vertically stratified within the Gulf Stream, with density increasing and temperature decreasing with increasing depth. Near the shore, there is a temperature flux greater than 18°F throughout the year. Temperatures in the JAX and Charleston OPAREAs vary from 70° to 90ºF. The OPAREAs have the greatest deviation in temperature in winter, with temperatures varying from 70° to 80ºF. The cooler water temperatures occur along the coast from Charleston, South Carolina, northward. The most stable temperatures occur during summer, with water temperature throughout the OPAREAs at 81° to 82ºF, with some intrusion of warmer water about 84ºF around the Gulf Stream (DoN, 2008). The marine environment has a high buffering capacity (*i.e*., the pH of seawater is relatively stable) due to the presence of dissolved elements, particularly carbon and hydrogen. Most of the carbon in the sea is present as dissolved inorganic carbon that originates from the complex equilibrium reaction of dissolved carbon dioxide and water. This carbon dioxide-carbonate equilibrium system is the major buffering system in seawater, maintaining a pH between 7.5 and 8.5. The major ions present in seawater are sodium, chloride, potassium, calcium, magnesium, and sulfate (DoN, 2008).

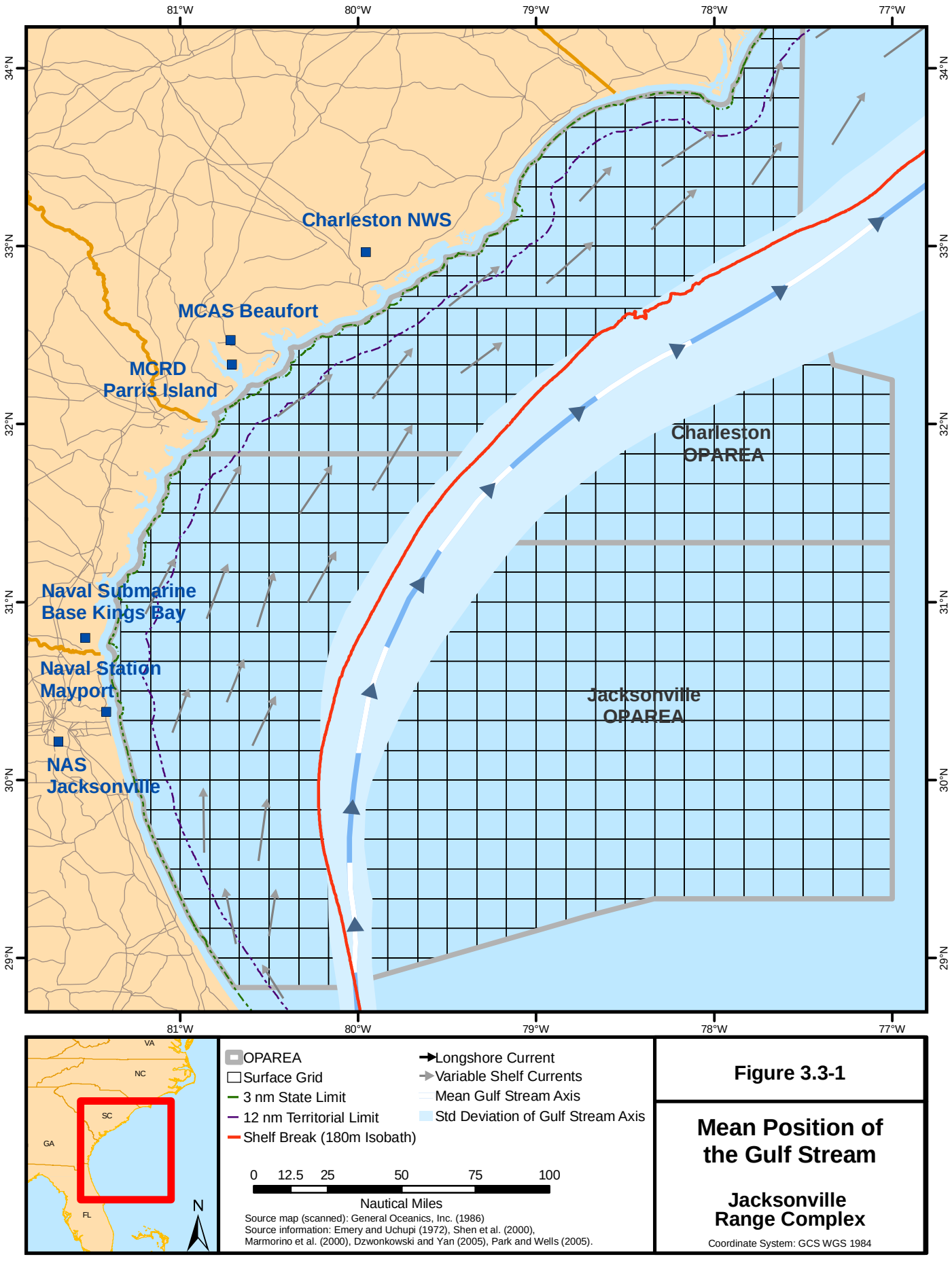


Figure 3.3-1

Mean Position of the Gulf Stream

Jacksonville Range Complex

Coordinate System: GCS WGS 1984

The salinity over the continental shelf ranges from 28 to 36 parts per thousand or (ppt), with the lowest salinities found near the coast and the highest near the continental shelf break (DoN, 2008). Salinities are highest in continental shelf waters during winter and lowest in the spring. Variability in this area results from the intrusion of saltier water (salinities greater than 35 ppt) from the continental slope waters and freshwater input from precipitation and coastal sources. Below 984 feet, the vertical distribution of salinity does not appear to vary, remaining fairly consistent at 34 ppt to approximately 3,281 feet (DoN, 2008).

Sediment Transport and Deposition

The distribution of bottom sediments found on the continental shelf and slope of the SAB are much more complex than those found in other areas (Amato, 1994). The layers of sand and gravel are much thinner than found north of Cape Hatteras and rock outcrops are common. Most of the sediments found covering the continental shelf of the SAB are quartzose sand with a thin band of fine-grained sand and silt. The bottom sediments found south of Cape Hatteras contain from 5 to 50 percent calcium carbonate, while on the Florida-Hatteras Slope and the Blake Plateau, this amounts to an increase of 50 to 100 percent (Amato, 1994).

Most of the sands on the continental shelf are remnants of delta and riverine sediments. The inner part of the Blake Plateau is nearly scoured clean of sediments by the Gulf Stream. A thick layer of phosphorite sediments and only a thin layer of carbonate sand cover much of the Blake Plateau (Amato, 1994). Continental slope sediments in the south-Atlantic area are primarily composed of silt and clay (Tucholke, 1987).

Water Pollutants

The heavy concentration of activity in coastal areas, combined with pollutants flowing from streams far inland and others carried through the air great distances from their source, are the primary causes of nutrient enrichment, hypoxia, harmful algal blooms, toxic contamination, sedimentation, and other problems that plague coastal waters (U.S. Commission on Ocean Policy [USCOP], 2004).

The USEPA 2002 National Water Quality Inventory found that just over half of the estuarine areas assessed were polluted to the extent that their use was compromised, either for aquatic life, drinking water, swimming, boating, or fish consumption. Estuarine waters can directly or indirectly affect marine water quality of coastal waters. The interagency 2004 Draft National Coastal Condition Report II rated coastal waters along the southeast United States as being in fair condition (USCOP, 2004).

Point source pollution comes from identifiable sources. The major point sources of pollution to the nation's waterways include wastewater treatment plants, sewer system overflows, septic systems, industrial facilities, and concentrated animal feeding operations. Nutrient pollution has had a major impact on coastal waters, contributing to toxic algal blooms, loss of seagrass habitat and coral reefs, and oxygen depletion (USCOP, 2004).

Nonpoint source pollution arises when rainfall and snowmelt carry contaminants over land, into streams and groundwater, and down to coastal waters. Nonpoint source pollutants include fertilizers and pesticides from rural farms and urban lawns; bacteria and viruses from livestock and pet waste; sediments from improperly managed construction sites and timber harvesting; oil and chemicals flowing over streets, parking lots, and industrial facilities; and a variety of pollutants being blown along airborne pathways. Ninety percent of impaired water bodies do not

meet water quality standards, at least in part because of nonpoint source pollution. The majority of nonpoint source pollution entering rivers, estuaries, coastal waters, and ultimately the oceans, is from agricultural and storm water runoff (USCOP, 2004).

Shipboard waste-handling procedures governing the discharge of non-hazardous waste streams have been established for commercial and Navy vessels. These categories of waste include: (a) Liquids: "black water" (sewage); "grey water" (water from deck drains, showers, dishwashers, laundries, *etc.*); and oily waste (oil/water mixtures); and (b) Solids (garbage). Table 3.3-3 summarizes the waste stream discharge restrictions for Navy vessels at sea.

TABLE 3.3-3
WASTE DISCHARGE RESTRICTIONS FOR NAVY SHIPS.

Zone (nm from shore)	Type of Waste	
	Black Water (Sewage)	Gray Water
U.S. Waters (0-3 nm)	No discharge.	If vessel is equipped to collect gray water, pump out when in port. If no collection capability exists, direct discharge permitted.
U.S. Contiguous Zone (3-12 nm)	Direct discharge permitted.	Direct discharge permitted.
>12 nm from shore	Direct discharge permitted.	Direct discharge permitted.
Zone	Oily Waste	Garbage (Non-plastic)
U.S. Waters (0-3 nm)	Discharge allowed if waste has no visible sheen. If equipped with Oil Content Monitor (OCM), discharge <15 ppm oil.	No discharge.
U.S. Contiguous Zone (3-12 nm)	Same as 0-3 nm.	Pulped garbage may be discharged.
>12 nm from shore	If equipped with OCM, discharge <15 ppm oil. Ships with Oil/Water Separator but no OCM must process all bilge water through the oil-water separator.	Direct discharge permitted.
Zone	Garbage (Plastic) (Non-food-contaminated)	Garbage (Plastic) (food-contaminated)
U.S. Waters (0-3 nm)	No discharge.	No discharge.
U.S. Contiguous Zone (3-12 nm)	No discharge.	No discharge.
12-50 nm from shore	No discharge.	No discharge.
>50 nm from shore	Retain last 20 days before return to port. Discharge if necessary.	Retain last three days before return to port. Discharge if necessary.

Source: Northern Division 1996; Office of the Chief of Naval Operations, 1994

3.3.2.2 South Carolina Water Quality

Current and proposed training and testing operations in South Carolina only occur outside the 12 nm limit; therefore, the discussion of water quality focuses on coastal areas and estuarine systems and the major rivers that drain into the Atlantic Ocean.

The South Carolina Estuarine and Coastal Assessment Program (SCECAP) was initiated in 1999 as a collaborative program between the South Carolina Department of Natural Resources (SCDNR) and the SCDHEC. The goal of SCECAP is to monitor the condition of the state's estuarine habitats to determine the proportion of the coastal zone that meets desired criteria with respect to water quality, sediment quality, and biotic condition (SCECAP, 2004).

Temperature, salinity, pH, dissolved oxygen, and sediment quality were evaluated as part of the SCECAP. Sixty of the sites were tidal creeks and 64 sites were in larger open water bodies. Specific site locations and sampling dates are provided in Figure 3.3-2. The average depth of the open water sites sampled during the 2-year period was 5.1 m and ranged from approximately 1 – 17.6 m; average depth of the tidal creek sites, was 2.9 m and ranged from approximately 1 to 6.7 m (SCECAP, 2004).

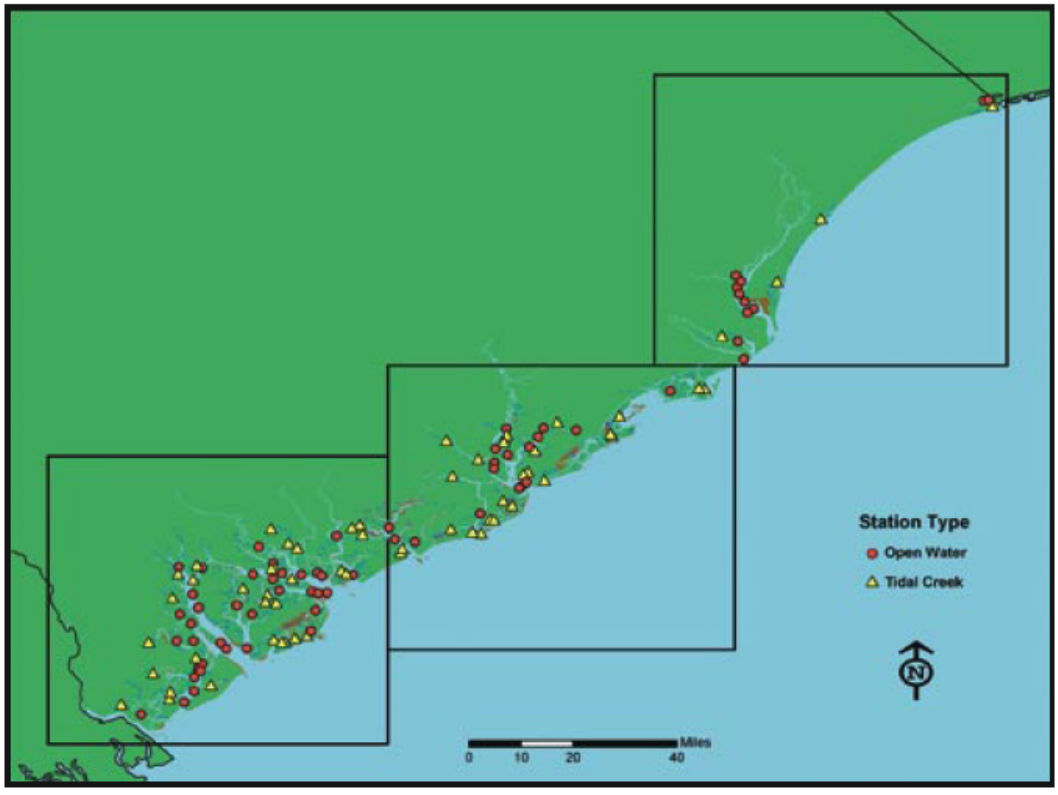


Figure 3.3-2 Distribution of Open Water and Tidal Creek Stations Sampled Throughout South Carolina's Coastal Zone During 2001-2002

Temperature data are primarily collected to relate with other water quality variables affected by this parameter. The average bottom water temperature based on the continuous 25-hour data collected at each site was 29.3°C for both the tidal creek and open water sites (SCECAP, 2004).

This average was comparable to the average temperatures observed in each habitat during the 1999-2000 survey. The range of mean bottom temperatures during 2001-2002 was 26.0 to 31.8°C among the tidal creek sites and 26.4 to 31.1°C among the open water sites. The slightly greater variation in average bottom water temperature observed in the tidal creek habitats compared to the open water sites reflects the effects of solar heating on these shallow water sites. Fauna inhabiting South Carolina estuaries are generally well-adapted to the temperature ranges observed in this program (SCECAP, 2004).

Salinity influences the distribution and diversity of many invertebrate and fish species. Changes in salinity at a site can also provide a measure of stressful conditions if there is a large variation in concentrations over short time periods. The average bottom salinity of all tidal creek sites sampled during the 2001 – 2002 survey was 30.6 ppt and ranged from 9.5 to 37.4 ppt. The average bottom salinity among the open water sites was 29.5 ppt and ranged from 10.0 to 38.1 ppt. This represents near full-strength seawater and reflects the effects of severe drought conditions that persisted throughout this sampling period. There was no significant difference between bottom salinities observed at the creek versus open water sites (SCECAP, 2004).

Dissolved oxygen was one of the most critical water quality parameters measured in SCECAP. Low dissolved oxygen conditions can limit the distribution or survival of most estuarine biota, especially if these conditions persist for extended time periods (Diaz and Rosenberg, 1995; USEPA, 2001). Dissolved Oxygen criteria established by the SCDHEC for Shellfish Harvesting (SFH) waters and Class SA saltwaters are a daily average not less than 5.0 mg/L and a low of 4.0 mg/L. Class SB waters should have dissolved oxygen levels not less than 4.0 mg/L. Based on the state water quality standards, mean or instantaneous dissolved oxygen concentrations >4 mg/L are considered to be good for summer time periods, values <4 mg/L, and >3 mg/L are considered to be fair (*i.e.*, contravenes one portion of the state standards), and average or instantaneous measures <3 mg/L are considered to be poor and potentially stressful to many invertebrate and fish species (SCDHEC, 2004).

The average bottom dissolved oxygen concentration at the open water stations during the 2001-2002 survey was 5.0 mg/L, with approximately 89 percent of the state's open water habitat having a mean dissolved oxygen >4.0 mg/L based on the 25-hour instrument deployments. The average bottom dissolved oxygen concentration observed at tidal creek sites was 4.5 mg/L, with 78 percent of this habitat having a mean dissolved oxygen value >4 mg/L (SCECAP, 2004).

The difference in mean dissolved oxygen values observed among the creek versus open water sites was highly significant ($p < 0.001$). Approximately 9 percent of the state's tidal creek habitat had mean dissolved oxygen levels <3.0 mg/L and 13 percent of this habitat had dissolved oxygen levels between 3 and 4 mg/L. In both survey periods, tidal creek sites generally had a much greater range in dissolved oxygen concentrations than the open water as well as a higher percentage of sites with marginal or poor dissolved oxygen (SCECAP, 2004).

Although numeric state dissolved oxygen standards apply to all waters, the SCECAP data suggest that lower dissolved oxygen concentrations in tidal creeks may be normal during the summer months compared to larger water bodies. Creek sites with the mean dissolved oxygen levels <3 mg/L may not fully support biological assemblages inhabiting those sites, especially during periods when dissolved oxygen levels are less than 2 mg/L (hypoxic conditions). Hypoxic conditions are known to be limiting to many estuarine and marine biota (Gibson, *et al.*, 2000).

Measures of pH provide an indicator of water quality in estuarine habitats. Measures of pH are based on a logarithmic scale, so even small changes in the value can result in significant stress to estuarine organisms (Bamber, 1990; Ringwood and Keppler, 2002). Unusually low or high pH values may indicate the presence of pollutants (*e.g.*, release of acids or caustic material) or high concentrations of carbon dioxide. Because salinity and alkalinity affect the pH of estuarine waters, SCDHEC-established water quality standards that account for these effects. The pH in Class SA and SB tidal saltwater areas should not vary more than one-half of a pH unit above or below effluent-free waters in the same geologic area having a similar salinity, alkalinity, and temperature, and values should never be lower than 6.5 or higher than 8.5. SFH waters should not deviate more than 0.3 units from effluent-free waters (Gibson *et al*., 2000).

The overall average pH observed in 2001-2002 based on the 25-hour measures was 7.5 in tidal creek habitats and 7.7 in open water habitats. The difference in mean pH values was statistically significant between habitats ($p < 0.001$) with a higher percentage of the state's creek habitat having pH values considered to be only fair or poor compared to the state's open water habitat. A similar trend was noted in 1999-2000 (SCDHEC, 2007). None of the stations sampled in 2001-2002 had mean or maximum values that exceeded the maximum (8.5 pH units) or minimum (6.5 pH units) criteria established by SCDHEC, at any time during the 25-hour instrument deployment period at each site. Therefore, although the SCECAP criteria cannot be applied to the 10 sites with average salinities less than 18 ppt, those sites at least had pH values within the maximum range accepted by SCDHEC.

Sediments collected for SCECAP were examined for a wide range of contaminants including 15 metals, 25 polycyclic aromatic hydrocarbons (PAH), 30 polychlorinated biphenyls (PCB), and 23 pesticides. For many of these contaminants, Long, *et al*. (1995) published bioeffects guidelines that reflect the concentration of a contaminant that resulted in adverse bioeffects in 10 percent of the studies examined (defined as Effects Range-Low or ER-L) and concentrations that resulted in adverse effects in 50 percent of the studies (defined as Effects Range-Median or ER-M). Eight of the randomly selected open water sites in 2001 and six in 2002 had one or more contaminant concentrations above ER-L values. Nine tidal creek sites in 2001 and 11 in 2002 had contaminant concentrations above ER-L values.

Many of the ER-L exceedances in the tidal creeks were due to high levels of arsenic. Arsenic concentrations are naturally elevated in South Carolina estuarine sediments (Scott, *et al*., 1994; 2000) and therefore, the values observed were probably not related to anthropogenic stress. Other metal contaminants that exceeded ER-L values include nickel, chromium, mercury, lead, copper, cadmium, and zinc. A few PCBs, PAHs, and pesticides also exceeded their respective ER-L values. In most cases, the stations with ER-L exceedances were located in urbanized estuaries such as Charleston Harbor and Winyah Bay, reflecting the increased loadings of contaminants in these areas (SCECAP, 2004).

South Carolina is in the Atlantic Ocean Watershed and streams flow eastward and drain into the Atlantic Ocean. Most of the state's drainage is carried by the Waccamaw, Black, Santee, Edisto, Salkehatchie and Savannah Rivers (Geology.com, 2007). The Salkehatchie River and Savannah River drain directly into the Atlantic Ocean and, thus, are relevant to the study area.

3.3.2.3 Georgia Water Quality

Georgia's coast is composed of approximately 100 miles of ocean beach, including nine major and five minor barrier islands. In addition to the coastline, approximately half a million acres of

rich green saltmarsh can be found on the inland sides of these islands. It is primarily in these estuarine ecosystems where the majority of Georgia's unique and diverse living resources thrive. The Coastal Resources Division of the Georgia Department of Natural Resources initiated an environmental monitoring and assessment program in 2000 to provide information and reports to both coastal resource managers and the public.

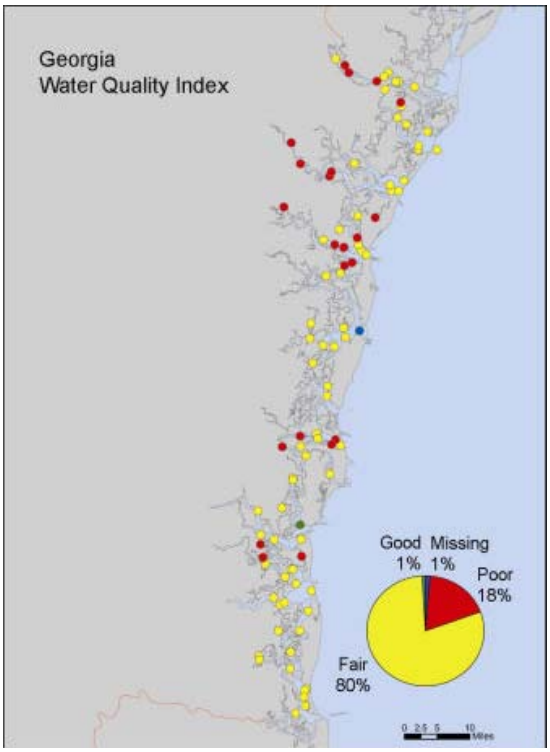


Figure 3.3-3 Georgia Water Quality Index

A report summarizing the ecological condition of Georgia's estuaries based on 50 sites each year for 2000 and 2001 during a summer index period was published in 2005 (Guadagnoli, *et al*., 2005). Approximately 50 stations were probabilistically selected according to USEPA EMAP National Coastal Assessment methods for sampling each year. All sites were located within the coastal zone extending from the saltwater-freshwater interface to near the mouth of each estuarine drainage basin and extending from the Savannah River in the north to St. Mary's River in the south. All samples were collected during the summer months of 2000 and 2001 because ecological stressors are usually greatest during this season and many fish and crustacean species of concern are utilizing estuaries as a nursery habitat. Water samples were taken and analyzed for chlorophyll, turbidity, and nutrients.

Although no state or federal criteria exist in Georgia estuarine waters for nutrients and phytoplankton (chlorophyll *a*), concentrations were estimated and compared to guidelines developed by the NOAA. The water quality index for Georgia estuaries is rated "fair" based on the combined values for the following five indicators: dissolved oxygen concentration, dissolved inorganic nitrogen, dissolved inorganic phosphorus, chlorophyll a, and water clarity. The sampling conducted under this study estimated the percentage of an area in good, fair, or poor condition, and is displayed in Figure 3.3-3. The colored dots on the map represent the value of the indicator specifically at the time of sampling. The values for good, fair, and poor are based on individual measurements of indicators; if no indicators are poor, and a maximum of one indicator is fair, the rating is "good." If one of the indicators is poor and two or more indicators are rated fair, the rating is "fair." If two or more of the five indicators are poor, then the index rating for that area is "poor." Based on the water quality index, 80 percent of Georgia's estuarine resources were rated fair, while 18 percent were rated poor; only 1 percent of Georgia's estuarine area was rated as good (Guadagnoli, *et al*., 2005).

Dissolved oxygen concentrations in Georgia estuaries were rated in fair condition, with 63 percent of the sites having fair bottom dissolved oxygen levels between 2-5 ppm and 37 percent having bottom dissolved oxygen levels greater than 5 ppm (Guadagnoli, *et al*., 2005). Although some nutrient inputs to coastal waters are necessary for a healthy, functioning estuarine

ecosystem, when the concentrations of nutrients become too great, eutrophication may occur, resulting in a host of undesirable conditions, such as excessive growth of algae.

Nutrient loading into estuarine waters has become an issue of concern due to runoff from agricultural fields, atmospheric deposition, and rapid development along U.S. coastal zones. Development adjacent to coastal areas can contribute nutrients above natural background levels from wastewater treatment facilities, urban and suburban runoff of fertilizers, vehicle exhaust and some industries. Nitrogen and phosphorus are the primary nutrients of concern in coastal areas, with nitrogen usually being more important in marine and estuarine systems and phosphorus being more important in freshwater systems. Since there are no federal or state criteria for nutrients in marine waters, we present our data in the framework of NOAA's National Estuarine Eutrophication Assessment (NOAA, 1999).

Dissolved Inorganic Nitrogen concentrations were rated as good, because 54 percent of Georgia coastal areas had values below 0.1 mg/L dissolved inorganic nitrogen, and only 4 percent was rated poor (>0.5 mg/L) (Guadagnoli, *et al*., 2005).

3.3.2.4 Florida Water Quality

With over 8,000 coastal miles, Florida is second only to Alaska in amount of coastline (FDEP, 2004). Florida, like other coastal states, suffers from coastal pollution. Its warm waters, dense coastal population and inland agricultural activities combine to create challenges to maintain water quality standards along some areas of Florida's coasts (Kildow, 2006).

St. Johns River

The St. Johns River is the longest river in Florida (273 miles) (FDEP, 2004). The river and its tributaries are the main sources of surface water in the Jacksonville area. Several characteristics of the St. Johns River limit its assimilation capabilities, thereby contributing to its high pollution rates. These characteristics include the relatively flat drainage basin, the high number of associated draining water bodies, and the excessively slow flow rate of the river. The St. Johns River, its tributaries, and lakes within the basin are designated as Class III. Class III is intended for recreational use and the propagation of fish and wildlife.

3.3.2.5 Lake George

Lake George is approximately 46,000 acres (72 mi^2) and is located in northwestern Volusia County (SJRWMD, 2007). The Ocala National Forest lies to the west of Lake George with the Lake George State Forest to the southeast. Lake George is the second largest lake in Florida; the St. Johns River flows through the center from south to north; it receives water from Salt Springs in the northwest corner; there is a salt marsh located near the eastern shore with a salty pond; and two additional freshwater springs runs empty into the lake. The Navy also conducts training over the lake using ranges constructed on the eastern side of the lake.

A water quality monitoring site is located at Channel Marker 9 on Lake George in Volusia County about 8 miles southeast of Georgetown, Florida. There are no wastewater treatment facilities (point sources) within a 5-mile radius or within the drainage basin of the water quality monitoring site. Water is sampled every other month as part of the ambient monitoring program. The lake is about 11 feet deep at the sample site and has a typical temperature range (52.7°F to 88.2°F; median of 75.0°F) (SJRWMD, 2007).

When compared to other lakes, conductivity and major ion concentrations are elevated in Lake George, resulting in hard water. The median dissolved oxygen concentration is well above the FDEP standard for Class III surface waters (SJRWMD, 2007). The lake is moderately buffered and slightly alkaline. Although total organic carbon concentrations are lower than typically found, color is elevated, as is the Secchi (water transparency) depth. Total phosphorus and chlorophyll *a* concentrations are typical and indicate eutrophic (rich in nutrient and mineral concentration) conditions, according to the Forsberg-Ryding criteria. Total nitrogen concentrations are less than typically found, but indicate hypereutrophic conditions (excessively rich in nutrient concentration). Total suspended solids are typical, while turbidity concentrations are lower. The lake has fair water quality, according to the trophic (nutrient contribution to the food chain) state index (SJRWMD, 2007).

The Lake George Range is located on Lake George in north-central Florida (Figure 3.3-4). The range operates under easement with the State of Florida, which has jurisdiction over the lake waters. The current agreement expires in 2014. There are four impact targets on the range, all of which are located on the lake surface. These consist of the North Target, Center Target, and South Target, and a set of four Mine Laying Exercise (MINEX) Splashdown Points. There are two spotting towers on Lake George Range. Pine Island Tower and Nine Mile Tower are located on the east shore of Lake George, east of the Center Target and the MINEX Splashdown Points.

Navy training that takes place at Lake George includes mine laying activities using all non-explosive practice munitions, including MK-76, BDU-45, and BDU-48. Other operations include noncombatant evacuation operations.

3.3.2.6 Rodman Range

The Rodman Range is located in north central Florida, approximately 57.5 miles south of Jacksonville, Florida (DoN, 2001) (Figure 3.3-4). A majority of the range is located in Putnam County, but the southwestern corner of the property is located in Marion County. The range and surrounding areas are primarily forested.

Rodman Bomb Target has a main target area of about 100 acres maintained by clearing and plowing. The Rodman Bomb Target is immediately adjacent to the Ocklawaha River, and a canal runs through the center of the site, draining toward the Ocklawaha River. The Ocklawaha River is the principal tributary to the St. Johns River (DoN, 2002).

The Ocklawaha River is classified as Class III, intended for recreational use and the propagation of fish and wildlife. The Ocklawaha River begins in Lake County from waters of the Harris Chain of Lakes and starts at Lake Griffin and flows north until it reaches the St. Johns River in Putnam County. The river flows through the Ocala National Forest; the shorelines are sparsely populated with much of the river being in a floodplain (SJRWMD, 2007).

There are no wastewater treatment facilities upstream within a 5-mile radius and within the drainage basin of the water quality station. The Ocklawaha River is sampled monthly under contract with FDEP. The river is about 11.5 feet deep at the sample site and has a narrow temperature range. Major ion concentrations result in hard water at the site floodplain (SJRWMD, 2007). The median dissolved oxygen value is above the FDEP standard for Class III surface waters. The water is well-buffered and slightly alkaline. Low concentrations of total organic carbon result in low color and a high median Secchi depth. The river has lower concentrations of total suspended solids, turbidity, total nitrogen, total phosphorus, and fecal

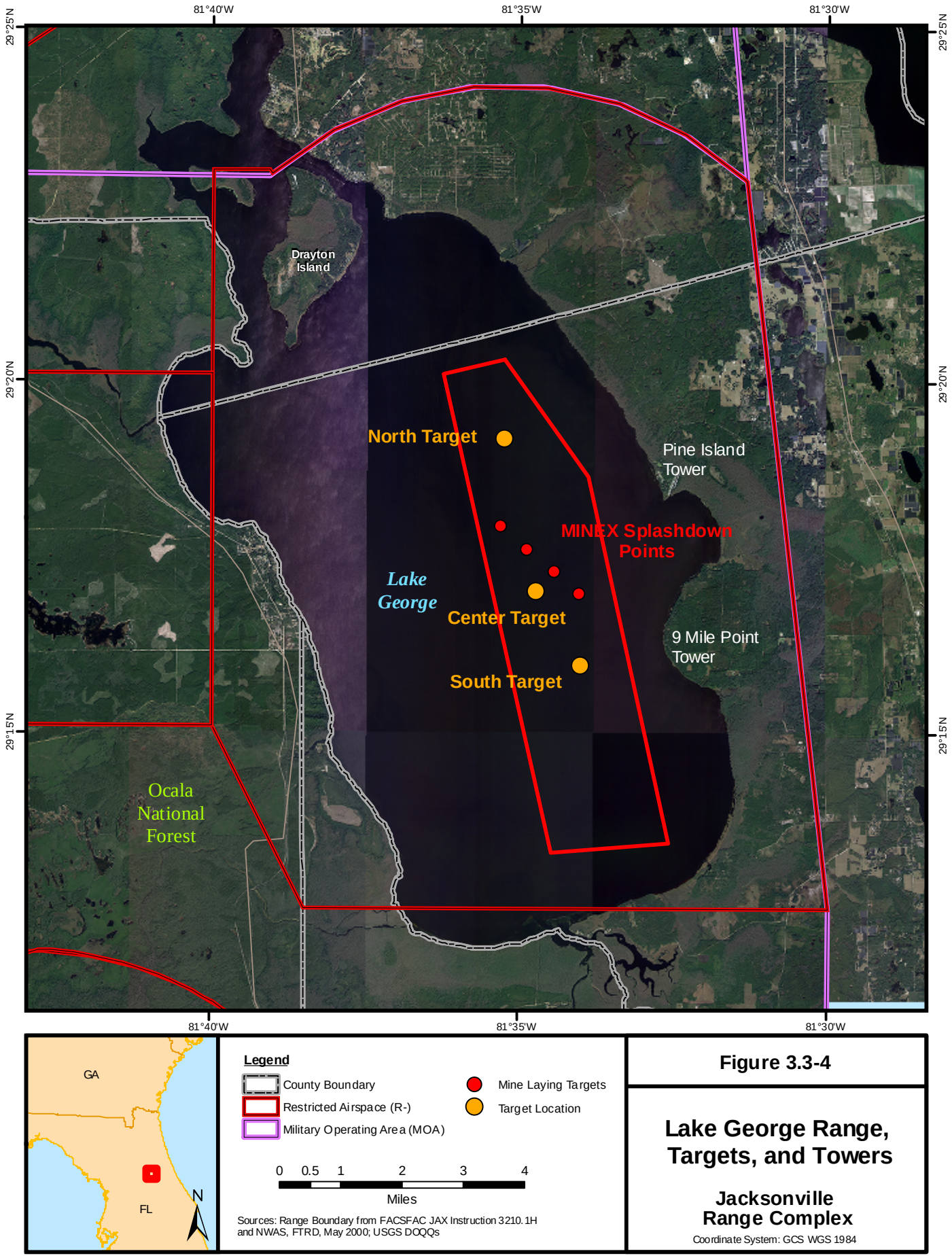


Figure 3.3-4

Lake George Range, Targets, and Towers

Jacksonville Range Complex

Coordinate System: GCS WGS 1984

coliforms when compared to other rivers, although chlorophyll a concentrations are typical. The river has good water quality at the sample site, according to the water quality criteria for Class III surface waters (SJRWMD, 2007).

In 1997, wetland delineation surveys were conducted on the Rodman Bomb Target property by CZR, Incorporated (DoN, 2002). Wetlands are considered transitional zones between the terrestrial and aquatic environments. These areas are characterized by physical, chemical, and biological features indicative of hydrological conditions. Wetlands serve as a valuable resource for groundwater recharge within the region and are currently regulated by the U.S. Army Corps of Engineers (USACE) under Section 404 of the Clean Water Act of 1972. Wetlands are defined by USACE as "…those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal circumstances do support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas."

The wetland delineations for Rodman Bomb Target have been informally accepted by USACE and the SJRWMD. The 1997 surveys did not address the quality of the wetlands surveyed. Rodman Bomb Target wetland surveys resulted in the mapping of approximately 1,886 acres of jurisdictional wetlands within the approximately 2,696 acres surveyed, or approximately 70 percent (Figure 3.3-5). Rodman Bomb Target wetlands remain in relatively natural condition (DoN, 2002).

The Rodman Range offers air-to-ground training utilizing non-explosive practice bombs only. No live ordnance or gunnery is authorized. The southwest quadrant of the range area is open and contains a single impact area. There are six landing zones for rotary-wing aircraft operations on the Rodman Range. These are situated in various open areas of the range. Navy training that takes place at Rodman Range includes bombing activities (land) using all non-explosive practice munitions.

3.3.3 Environmental Consequences

3.3.3.1 No Action Alternative

Jacksonville and Charleston OPAREAs

Bombs

Typically, BOMBEXs involve one or more aircraft bombing a target simulating a hostile surface vessel at sea and a variety of targets to include buildings, convoys, and missile sites on land. As discussed in Section 3.2, each of the iron bomb bodies or steel fins may contain small percentages (typically less than 1%) of any of the following: carbon, manganese, phosphorus, sulfur, copper, nickel, chromium, molybdenum, vanadium, columbium, or titanium. The aluminum fins, in addition to the aluminum, may also contain: zinc, magnesium, copper, chromium, manganese, silicon, or titanium.

Practice bombs are also called bomb dummy units. They are bomb bodies filled with an inert material (*e.g.*, concrete) and configured with either low-drag conical tail fins or high-drag tail fins for retarded weapon delivery. A BDU mimics the weight, size, center of gravity, and ballistics of a high explosive bomb. Non-explosive practice munitions are similar in composition to BDUs—pieces of concrete or steel cases formed in the shape of a mine filled with concrete. These

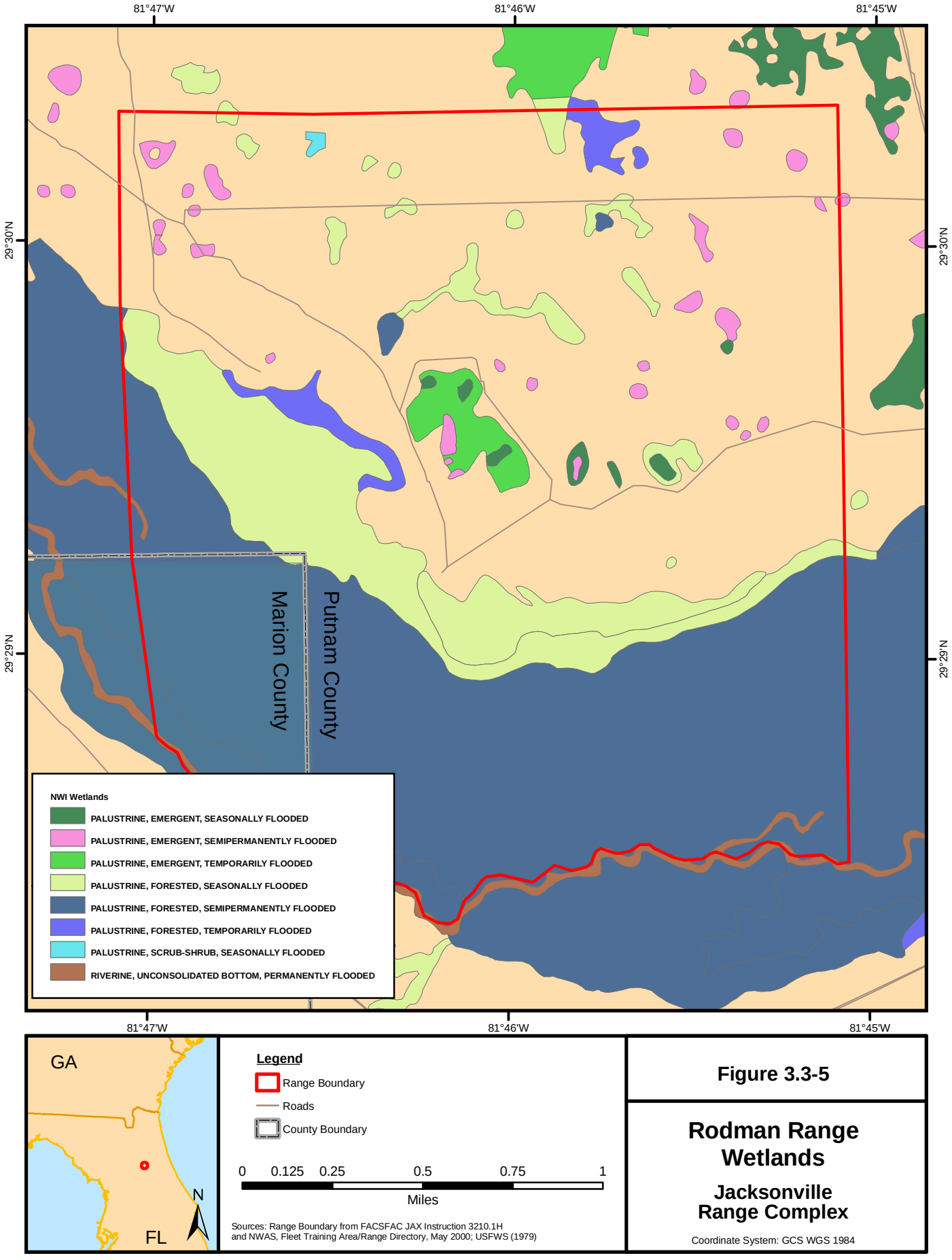


Figure 3.3-5

Rodman Range Wetlands

Jacksonville Range Complex

Coordinate System: GCS WGS 1984

Non-explosive practice munitions may contain spotting charges/signal cartridges that produce a visual indication of impact.

Practice bombs entering the water would be devoid of combustion chemicals found in the warheads of explosive bombs. They are typically made of concrete, steel, and iron. These components are consistent with the primary component building blocks of today's artificially built reef structures. The steel and iron, though durable, would corrode over time, with no noticeable environmental impacts. The concrete is also durable and would offer a beneficial substrate for benthic organisms. Due to the large ocean area of the JAX Study Area, expended ordnance would be dispersed over a widespread area. The minimal debris over a wide area would not affect sediment stability on the ocean bottom or cause disturbance to natural ocean processes.

Chemical products of underwater explosions are initially confined to a thin, circular area called the surface pool. It is estimated that 100% of the solid explosion products and 10% of the gases remain in the pool (DoN, 2001). After the turbulence of the explosion has dispersed, the pool stabilizes and the chemical products are diluted and become undetectable. Because of continued dispersion and mixing, no buildup of explosion products in the water column would occur. Chemical effects to the marine environment and water quality are considered to be negligible from a BOMBEX (DoN, 2005a). Initial concentrations of the chemical by-products of ordnance detonations are not hazardous to marine life and are rapidly dispersed in the ocean. Small and mostly metallic pieces of the bomb eventually come to rest on the seafloor with each detonation. Numerous steel non-explosive practice bombs, likewise, find their way to the seafloor. All these materials slowly deteriorate with time and, given that they will be spread out over a relatively large area, their potential impact on the environment is considered negligible.

Bombs used at the JAX Range Complex during the No Action Alternative are listed in Chapter 2, and their approximate weight, length, and diameter are provided in Section 3.2.

Missiles

Missiles would be fired by aircraft and ships at a variety of airborne and surface targets on the JAX Range Complex. The principal source of potential impacts to water and sediment quality is unburned solid propellant residue as well as other hazardous material used in igniters, explosive bolts, batteries, and warheads. However, the rocket motor is typically fully expended prior to the missile reaching the target. Further, if it is a high explosive missile, the warhead is detonated prior to hitting the ground/water. Testing demonstrates that water penetrates only 0.06 inches into the propellant during the first 24 hours of immersion, and that fragments very slowly release ammonium and perchlorate ions (Aerospace Corporation, 1998). These ions are expected to be rapidly diluted and disperse in the surrounding water such that local concentrations will be extremely low. However, assuming that all propellant on the ocean floor would be in the form of 4-inch cubes, only 0.42 percent would be wetted during the first 24 hours. If all the ammonium perchlorate leached out of the wetted propellant, then approximately 0.01 lbs would enter the surrounding seawater. The concentration would decrease over time as the leaching rate decreases and further dilution occurs. The aluminum would remain in the propellant binder and eventually be oxidized by seawater to aluminum oxide. The remaining binder material and aluminum oxide would not pose a threat to the marine environment. Therefore, effects from missile propellant may have temporary, minimal impacts on water quality.

The effects of hydrocarbon releases on water quality were analyzed using the federal criteria in the National Ambient Water Quality Criteria (NAWQC), which includes maximum concentration

levels for the protection of aquatic life from contaminants in water. Saltwater criteria exist for benzene and toluene, and three PAH compounds: naphthalene, acenaphthene, and fluoranthene. However, both benzene and toluene are very volatile and are unlikely to be present after a short period, and fluoranthene is generally not present or is found in such low amounts (<0.1%) in refined petroleum that these constituents were not considered in this analysis (National Research Council, 1985).

Currently, ingestion of drinking water is the only viable exposure route for humans to perchlorate. Although the USEPA has published a reference dose in the Integrated Risk Information System specifically for the drinking water exposure route for humans, the environmental effects of perchlorate in the marine environment remain largely unknown and un-regulated. Navy training at sea with munitions containing perchlorate would not present a significant source of perchlorate to the marine environment and, therefore, would not have a significant effect on the environment as: 1) most, if not all, of the propellant would be consumed during use; 2) all perchlorate salts are readily soluble so any residual perchlorate remaining in the spent missile or on fragments would rapidly disperse through dilution; and 3) the most currently accepted, peer-reviewed screening value for aquatic, ecological receptors is significantly higher than the human health drinking water exposure level (Dean *et. al*, 2004).

Short-Term Effects. Once concentrations are determined for each activity, comparisons with the NAWQC are possible. The NAWQC provides both acute and chronic concentrations. Acute values are levels producing short-term effects (*i.e.*, lethality), while chronic values produce long-term or sub-lethal effects.

Long-Term Effects. The combined concentrations from multiple exercises throughout a year cannot be compared with the NAWQC because of assumptions underlying the criteria. The criteria apply to instantaneous or short-term concentrations, not to loading or long-term effects. Even if two events were to occur simultaneously, it would be extremely unlikely for the two events to affect the same volume of water. Hence, the calculations for water quality analysis reflect each current and proposed activity independently.

Targets and Countermeasures

At sea targets are usually remotely operated airborne, surface, or subsurface traveling units, most of which are designed to be recovered for reuse. Aerial and surface targets would be deployed annually on the JAX Range Complex at baseline operations in the No Action Alternative. Small concentrations of fuel and ionic metals released during battery operation could enter the water and contaminate limited areas; however, they do not represent a source of substantial environmental degradation.

A typical aerial target drone is powered by a jet fuel engine, generates RF signals for tracking purposes, and is equipped with a parachute to allow recovery. They also contain oils, hydraulic fluid, batteries, and explosive cartridges as part of their operating systems. There are also recoverable, remotely controlled target boats and underwater targets designed to simulate submarines. If severely damaged or displaced, targets may sink before they can be retrieved. Aerial targets on the JAX Range Complex would include AST/ALQ/ESM pods; Banner drones; BQM 74E drones; Lear Jets; and TALDs. The only expendable target is the TALD; all other aerial targets are non-expendable.

Target Assumptions. Potentially hazardous material in targets (*e.g.*, BQM-74) include fuel and batteries. A BQM-74 starts operation with 107 lbs of liquid fuel, and it was assumed that 20 percent of the fuel (21.5 lbs) remains at the completion of each mission. It was also conservatively assumed that 20 percent of the fuel was composed of PAHs (PAHs such as acenaphthene generally make up less than 4% of fuel oil, and naphthalene is generally less than 1% [National Research Council, 1985]). This analysis also assumed a worst-case scenario in which the target would be destroyed on impact with the water rather than recovered intact. The majority of targets are recovered by use of an engine cut-off switch and a parachute. The target is retrieved from the water by helicopter.

In the case of a severe malfunction and a crash, water surface impacts would occur at a speed of at least 500 knots (600 miles per hour) and could realistically affect an area up to 10 times the size of the target (taking into consideration water displacement). A typical target (BQM-74) is approximately 12.9 feet long, 2.3 feet high, with a wingspan of approximately 5.8 feet. Therefore, the analysis assumed a circle with a diameter of 58 feet would encompass the affected area. Given the low density of the hazardous constituents (*e.g.*, fuel, oil) relative to seawater, the analysis also assumed that only the top 3 feet of the water column would be affected. Based on these assumptions, the affected surface area would be about 10,600 ft_2 and the affected volume of seawater would be 2.5 by 105 gallons. The resulting concentration of PAHs would be 503 µg/L for each operation. This concentration is below the threshold established in the NAWQC for naphthalene (acute = 2,350 µg/L) and acenaphthene (acute = 970 µg/L; chronic = 710 µg/L). Note: 1 µg/L = 1 ppb

Surface targets would include IMPASS; ISTT; QST-35 SEPTAR; and 1,620 expendable marine markers (smoke floats). Expendable surface targets commonly used in addition to marine markers include cardboard boxes, 55-gallon steel drums, and a 10-foot diameter red balloon tethered by a sea anchor. Floating debris, such as styrofoam, may be lost from target boats.

Lake George Range targets are all located in lake waters. There are four impact areas. Three are impact targets consisting of a 24-foot-square reflective center surrounded by a 900-foot-diameter ring of pilings; three concentric rings of pilings with diameters of 250, 500, and 1,000 feet; and six pilings in a 30-foot by 60-foot rectangle, surrounded by three concentric rings of pilings 250, 500, and 1,000 feet in diameter. One MINEX target area is also present at Lake George and consists of four pre-planned splash points.

Ground (inland) targets are used at the Rodman Range. The range is configured as a 600-foot-diameter cleared area with a single surplus military vehicle at its center. The vehicle is surrounded by concentric rings of tires at 50- and 100-foot radii. The target is equipped with integral illumination and a lighted run-in line system for night ordnance delivery training. The target is not destroyed during the exercise as non-explosive ordnance is used. Expended material is recovered to the greatest extent practicable.

Naval Gun Fire

Naval gun fire exercises at the JAX Range Complex would use non-explosive and explosive 5-inch and 76-mm rounds. The surface area of the ocean affected by the impact of a non-explosive 5-inch and 76-mm round is 20-in^2 and 12-in^2, respectively. An estimated 2,174 non-explosive practice rounds and 390 high explosive rounds would be fired under the No Action Alterative annually. When added together, this creates an estimated impact area accumulating to

0.00001-nm^2, which when compared to the total JAX Range Complex sea range area (50,090 nm^2), becomes negligible.

Unexploded 5-inch shells and non-explosive ordnance practice shells would not be recovered and would sink to the ocean floor. Solid metal components of unexploded ordnance and non-explosive ordnance would also sink.

Any changes in water quality would be negligible based on the dispersed nature of the expended rounds, slow breakdown rates, and enormous dilution capacity of the surrounding sea water. Therefore, indirect effects resulting from changes in water quality would not occur.

Small Arms, Crew Served, and Close-In Weapons System Fire

5.56-mm and 7.62-mm gun ammunition have lead cores. The 20-mm and 25-mm cannon shells used in Small Arms and CIWS training are primarily steel; 20 mm projectiles used in CIWS training are typically inert tungsten. Depleted Uranium, is being phased out of the inventory, and is not used in training events.

A total of 485,180 small arms rounds and 42,900 cannon shells would be fired in the No Action Alternative. Expended bullets may release small amounts of iron, aluminum, and copper into the sediments and the overlying water column as bullets corrode. Although, elevated levels of these elements can cause toxic reactions in exposed animals, high concentrations in sediments would be restricted to a small zone around the bullet, and releases to the overlying water column would be quickly diluted (DoN, 2005b).

Any changes in water quality would be negligible based on the dispersed nature of the expended rounds, slow breakdown rates, and enormous dilution capacity of the surrounding sea water. Therefore, indirect effects resulting from changes in water quality would not occur.

Expended Material

Various types of small, expendable training items are shot, thrown, dropped, or placed within the training areas. They are used for selected training activities and are scattered over a large area. Items expended on the water, and fragments not recognizable as training debris (*e.g.*, flare residue or candle mix) are not collected.

Expended material that falls into the water may release small amounts of toxic substances as they degrade and decompose. The items degrade very slowly, so the volume of decomposing training debris within the training areas—and the amounts of toxic substances being released to the environment—gradually increases over the period of military use. Concentrations of some substances in sediments surrounding the disposed items would increase over time. Sediment movements in response to tidal surge and longshore currents, and sediment disturbance from ship traffic and other sources, would eventually disperse contaminants outside the training areas.

Chaff

Chaff is an aluminum coated glass fiber used as a defensive mechanism to reflect radar. All components of the aluminum coating are present in seawater in trace amounts, except magnesium, which is present at 0.1 percent. The stearic acid coating is biodegradable and nontoxic. The potential for chaff to have a long-term adverse impact on water quality is very unlikely, and chemicals leached from the chaff would also be diluted by the surrounding

seawater, thus reducing the potential for concentrations to build up to levels that can have effects on sediment quality and benthic habitats.

Radiofrequency chaff (chaff) is an electronic countermeasure designed to reflect radar waves and obscure aircraft, ships, and other equipment from radar tracking sources. Chaff is non-hazardous and consists of aluminum-coated glass fibers (about 60% silica and 40% aluminum by weight) ranging in lengths of 0.3 to 3 inches with a diameter of about 40 micrometers. Chaff is released or dispensed from military vehicles in cartridges or projectiles that contain millions of chaff fibers.

A typical bundle of training chaff contains approximately five million fibers, each composed of glass silicate with an aluminum coating. Aluminum and silicon comprise the most common minerals in the earth's crust, aluminum oxide and silicon dioxide. Since ocean waters are in constant exposure to crustal material, there is little reason to believe that the addition of small amounts of chaff would have any effect on either water or sediment composition (Hullar, *et al*., 1999). Chaff is generally resistant to chemical weathering and likely remains in the environment for long periods of time. As it is much like aluminosilicate minerals, the influence on the physical environment would be small, and likely limited to settling with bottom geology.

The physical environment may be affected by the leaching of metals from the chaff particles. However, the concentration of chaff needed to cause any kind of significant environmental impact far exceeds the amount that actually enters the water during air combat maneuvers. Sediment in the bottom of the ocean is composed of silicate minerals arising from various geomorphic processes. Minerals such as aluminum also enter the water through hydrothermal vents and the geologic processes themselves. The ions that can be leached from the chaff particles render such a small concentration in the at-sea environment (because of the large volume of water in comparison the actual number of chaff particles is so great) that the influence of aluminum ions entering the water is of smaller quantity than the processes that introduce metallic ions in the water naturally.

Under the No Action Alternative, it is estimated that 451 exercises would be held annually, releasing about 4,174 canisters of chaff in the JAX Range Complex. The amount of chaff necessary to impact the environment is not realistically deposited during normal naval training activities.

Flares

Infrared decoy flares, or "self protection flares", are used in the JAX Range Complex to illuminate targets at night and to attract heat-seeking missiles. The type of metal burned in the flare determines the color of the flame; most flares burn magnesium to produce a white flame. Traces of orange indicate the burning of the aluminum casing. Solid flare and pyrotechnic residues may contain, depending on their purpose and color, aluminum, magnesium, zinc, strontium, barium, cadmium, and nickel, as well as perchlorates. The perchlorate compounds present in the residues are relatively soluble, although persistent (*i.e*., do not break down readily into other compounds under natural conditions) in the environment, and should disperse quickly.

Flares are composed of a magnesium pellet that burns quickly at a very high temperature leaving ash and end caps and pistons. Laboratory leaching tests of flare pellets and residual ash using synthetic seawater found barium in the pellet tests, while boron and chromium were found in the ash tests. The pH of the test water was raised in both tests. Ash from flares would be dispersed

over the water surface and then settle out. Chemical leaching would occur throughout the settling period through the water column, and any leaching after the particles reached the bottom would be dispersed by currents. Therefore, localized and temporary impacts to water quality may occur, but no long-term impact is anticipated.

Combustion products from flares are non-hazardous, consisting of magnesium oxide, sodium carbonate, carbon dioxide, and water. The amounts of debris are negligible, and the chemical constituents do not substantially affect water quality resources. Under the No Action Alterative, 1,740 flares would be used.

Marine Markers (Smoke Floats)

Marine markers are pyrotechnic devices dropped on the water's surface. They are used in training exercises to mark a surface position on the ocean. The chemical flame of a marine marker burns like a flare but also produces smoke. The MK-25 marker contains red phosphorus and a seawater-activated battery (The Ordnance Shop, 2007).

The Navy prepared the AFAST FEIS/OEIS for the use of multiple sonar types in the east coast and gulf coast OPAREAs of the United States. Additional assessment regarding the use of marine markers (smoke floats) in the JAX Range Complex is included the AFAST FEIS/OEIS. A summary of the AFAST FEIS/OEIS is provided in Section 3.20, Summary of Sonar Effects.

Marine markers would be used during gunnery exercises, missile exercises, and BOMBEXs within the JAX Range Complex. An estimated 300 marine markers (smoke floats) would be used within the JAX Range Complex under the No Action Alternative.

Underwater Detonations

Most underwater detonations (UNDET) during JAX Range operations would be associated with mine neutralization exercises. Underwater detonations would take place in the Charleston UNDET area and the Charleston OPAREA (north and south UNDET boxes). Explosive ordnance disposal detachments place explosive charges next to or on inert practice mines. Charges used by EOD divers consist of 5-, 10-, or 20-lbs explosives. These charge sizes reflect the size of charges EOD divers use to detonate mines in combat or real-world conditions.

The combustion products from the detonation of high explosives are commonly found in sea water – carbon monoxide, carbon dioxide, hydrogen, water, nitrogen, and ammonia. The primary contaminants that would be released from explosives used in mine warfare training are nitroaromatic compounds such as trinitrotoluene, cyclonite (RDX), and octogen (HMX) (URS, *et al*., 2000).

Initial concentrations of explosion by-products are not expected to be hazardous to marine life (DoN, 2001) and would not accumulate in the training area because exercises are spread out over time and chemicals rapidly disperse in the ocean. Therefore, no adverse effects from chemical by-products would be expected.

The chemical products of UNDETs are initially confined to a thin, circular area called the surface pool. After the turbulence of the explosion has dispersed, the pool stabilizes and the chemical products are diluted and become undetectable. The USEPA considers the contaminant levels released during the sinking of a target to be within the standards of the Marine Protection, Research and Sanctuaries Act (National Marine Fisheries Service, 2006).

Small-scale UNDETs, including development tests of underwater weapons, underwater explosive research testing, and shock survivability tests of shipboard equipment showed no significant environmental effects to the benthic environment, water quality, or marine biota of the global commons (DoN, 1992). Testing occurred 18 nm offshore from Key West, Florida, where the depth of the water column ranged from approximately 1,200 to 4,800 feet (200 to 800 fathoms).

Lake George Range

Mine laying exercises at Lake George Range involve dropping NEPMs within the designated target area. The majority of NEPMs would be concentrated around the four mine laying targets.

NEPMs, entering the water would not contain combustion chemicals found in the warheads of explosive bombs. They are typically made of concrete, steel, and iron. These components are consistent with the primary component building blocks of today's artificially built reef structures. The steel and iron, though durable, would corrode over time, with no noticeable environmental impacts. The concrete is also durable and would offer a beneficial substrate for benthic organisms. After sinking to the bottom, the physical structure of bombs would be incorporated into the marine environment by natural encrustation and/or sedimentation (DoN, 2006). Chemical effects to the marine environment and water quality are considered to be negligible from NEPMs (DoN, 2005b).

Flares are expended during helicopter missile evasion training. Combustion products from flares are non-hazardous, consisting of magnesium oxide, sodium carbonate, carbon dioxide, and water. The amounts of debris are negligible considering the altitude at which the flares are deployed and the total consumption of the flares; the chemical constituents do not substantially affect water quality resources.

Although these operations would occur in Lake George, which lies within Florida state territorial waters, no exceedance of state or federal water quality standards would be expected and thus no significant impact upon water quality is anticipated.

Rodman Range

Impacts to water quality (wetlands) at Rodman Range would be attributable to training and testing ordnance resulting from small caliber gunfire (*e.g.*, 7.62 mm, .50 cal.), which are typically blanks, MK-76 non-explosive bombs and BDU-48s.

Any changes in water quality would be negligible based on the number of rounds, dispersed nature of the expended rounds, slow breakdown rates, and dilution capacity of the surrounding water within the wetlands. No surface waters or wetlands are located in the impact area, no munitions constituents are used at the range, and no off range releases that could affect water quality have been reported (DoN, 2005c). Therefore, indirect effects resulting from changes in water quality would not occur.

3.3.3.2 Alternative 1

The JAX Range Complex training and testing activities involving potential water quality impacts would remain the same or increase by varying degrees from current levels under Alternative 1. Only the number of training operations would increase; no new training activities would be introduced.

Use of material with potential to impact water quality under Alternative 1, as compared to the No Action Alternative would be as follows:

- use of high explosive bombs would remain the same;
- use of non-explosive practice bombs would remain the same;
- use of high explosive missiles would increase by 136 percent;
- use of non-explosive practice missiles would increase by 7 percent;
- use of expended targets would increase by 10 percent;
- use of marine markers (smoke floats) would remain the same;
- use of high-explosive naval gun ammunition rounds would remain the same;
- use of non-explosive practice naval gun ammunition would increase by 9 percent;
- the use of grenades would remain the same;
- use of chaff would increase by 12 percent;
- use of defensive/decoy flares would increase by 42 percent; and
- use of 20-lbs charges would decrease from the No Action Alternative by 33 percent.

As indicated in Tables 2.2-4 and 2.2-5, amounts of MEM would increase and decrease in rough proportion to the overall increases and decreases in training operations. A summary of ordnance use by training area is provided in Table 2.2-6.

Training activities would introduce potential water pollutants to the water column. Based on the analysis presented above, however, these pollutants would be released in quantities and at rates that would not result in a violation of any water quality standard or criteria. Marine biota would not be substantially affected. Accordingly, these impacts would be less than significant, both individually and in the aggregate.

Expand Warfare Missions to Conduct Maritime Security Surface Strike Group Training

Maritime Security SSG training is not measurably different than training that already occurs within the JAX Study Area. Essentially, it is a repackaging of cruiser/destroyer training operations such that a three-ship SSG practices operating as an autonomous entity. MS SSG training does not involve the expenditure of ordnance. None of the MS SSG training would have a substantial effect on water quality under Alternative 1.

Accommodate Mission Requirements Associated with Force Structure Changes

Conduct MH-60R/S Training. The Navy proposes to conduct the MH-60R training missions in the JAX Study Area in accordance with the recent restructuring of Navy helicopter forces around the two linchpin airframes, the MH-60S and MH-60R. The MH-60R squadrons will be consolidated at NS Mayport and NAS Jacksonville. An additional 52 Hellfire missile capable airframes are expected in the JAX Study Area in the coming years. MH-60R/S training to accommodate mission requirements would not be expected to impact water resources in the JAX Study Area.

Organic Mine Countermeasures. Navy vessels, aircraft, and other military assets engaged in these operations would use minor quantities of hazardous material and generate minor quantities of used hazardous material during routine operations. This material would be managed in accordance with applicable laws and regulations; therefore, organic mine countermeasures would not be expected to impact water resources in the JAX Study Area. No mineshapes would be involved. Training would be conducted to establish and maintain proficiency in the airborne mine countermeasures mission. Potential effects to water resources associated with the active

sonar components are analyzed separately in the AFAST FEIS/OEIS and summarized in section 3.20 of this document.

Lake George Range

There would be a 42 percent change in in number of flares used for training activities at Lake George Range. The residual chemical constituents would be negligible considering the altitude at which the flares are deployed and the total consumption of the flares; and would not be expected to significantly affect water quality resources.

Rodman Range

There would be no changes in training activities at Rodman Range. Therefore, changes in water quality from baseline conditions would not occur from training activities.

3.3.3.3 Alternative 2 (Preferred Alternative)

JAX Range Complex training operations with potential impacts to water quality would increase by varying degrees under Alternative 2. Only the number of training operations would increase; no new training activities would be introduced. Use of material with potential to impact water quality under Alternative 2 would be the same as Alternative 1 except for the following:

- the Navy proposes to eliminate all BOMBEX training events that involve dropping explosive (live) ordnance on at-sea targets;
- use of NEPM would increase above the No Action Alternative by 67 percent; and
- use of 20-lbs charges would decrease from the No Action Alternative by 33 percent.

Training activities would introduce potential water pollutants to the water column. Based on the analysis presented for the No Action Alternative, however, these pollutants would be released in quantities and at rates that would not result in a violation of any water quality standard or criteria. Marine biota would not be substantially affected. Accordingly, these impacts would be less than significant, both individually and in the aggregate.

Lake George Range

As for Alternative 1, there would be a 42 percent increase in number of flares used for training exercises. The residual chemical constituents would be negligible and would not be expected to significantly affect water quality resources.

Rodman Range

There would be no changes in training activities at Rodman Range. Therefore, changes in water quality from baseline conditions would not occur from training activities.

3.3.4 Unavoidable Significant Environmental Effects

The analysis presented above indicates that the No Action Alternative, Alternatives 1 and 2 would not result in unavoidable significant adverse effects.

3.3.5 Summary of Environmental Effects (NEPA and EO 12114)

Training activities would introduce expended material and potential water pollutants to the water column. Based on the analysis presented above, however, these pollutants would be released in quantities and at rates that would not result in a violation of any water quality standard or criteria. Marine biota would not be substantially affected.

The combustion products from detonation of high explosives are commonly found in sea water – carbon monoxide, carbon dioxide, hydrogen, water, nitrogen, and ammonia. The primary constituent that would be released from explosives are nitroaromatic compounds such as trinitrotoluene, cyclonite (RDX), and octogen (HMX) (URS, *et al*. 2000). Initial concentrations of explosion by-products are not expected to accumulate in the training area because exercises are spread out over time and the constituents would rapidly disperse in the ocean. Therefore, no adverse effects from chemical by-products would be expected.

Table 3.3-4 provides a summary of water quality effects for the No-Action Alternative, Alternative 1, and Alternative 2 (Preferred Alternative). The analysis of environmental stressors indicated that implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in releases of hazardous constituents in violation of state or federal water quality standards; therefore, unavoidable significant adverse effects to water resources would not occur. The analysis of environmental stressors and alternatives indicated no significant impact to water resources in U.S. territorial waters; likewise, no significant harm in non-territorial waters would be expected.

TABLE 3.3-4
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES IN THE JAX STUDY AREA

Alternative and Stressor	Summary of Effects and Impact Conclusion	
	NEPA (U.S. Territory)	Executive Order 12114 (non-Territorial Waters, >12 nm)
No Action		
MEM	Long-term, minor, and localized accumulation of MEM on the ocean floor.	Long-term, minor, and localized accumulation of MEM on the ocean floor.
UNDETs and HE Ordnance	Temporary, short- term, minor, and localized changes to immediate surrounding water quality from potential releases of munitions constituents from explosives, ordnance and small arms rounds used during training exercises.	Temporary, short- term, minor, and localized changes to immediate surrounding water quality from potential releases of munitions constituents from explosives, ordnance and small arms rounds used during training exercises.
NEPM	Long-term, minor, and localized accumulation of MEM on the ocean floor.	Long-term, minor, and localized accumulation of MEM on the ocean floor.
MIW Deployment/Recovery	Negligible effects.	Negligible effects.
Conclusion	Less than significant impact.	Less than significant harm.
Alternative 1		
MEM	Long-term, minor, and localized accumulation of MEM on the ocean floor. Slight increase compared to No Action.	Long-term, minor, and localized accumulation of MEM on the ocean floor. Slight increase compared to No Action.

TABLE 3.3-4 (Continued)
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES IN THE JAX STUDY AREA

Alternative and Stressor	Summary of Effects and Impact Conclusion	
	NEPA (U.S. Territory)	Executive Order 12114 (non-Territorial Waters, >12 nm)
UNDETs and HE Ordnance	Temporary, short- term, minor, and localized changes to immediate surrounding water quality from potential releases of munitions constituents from explosives, ordnance and small arms rounds used during training exercises. Slight increase compared to No Action.	Temporary, short- term, minor, and localized changes to immediate surrounding water quality from potential releases of munitions constituents from explosives, ordnance and small arms rounds used during training exercises. Slight increase compared to No Action.
NEPM	Long-term, minor, and localized accumulation of MEM on the ocean floor. Slight increase compared to No Action.	Long-term, minor, and localized accumulation of MEM on the ocean floor. Slight increase compared to No Action.
Mine Warfare Deployment/Recovery	Negligible effects.	Negligible effects.
Conclusion	Less than significant impact.	Less than significant harm.
Alternative 2 (Preferred Alternative		
MEM	Long-term, minor, and localized accumulation of MEM on the ocean floor. Slight increase compared to No Action.	Long-term, minor, and localized accumulation of MEM on the ocean floor. Slight increase compared to No Action.
UNDETs and HE Ordnance	Temporary, short- term, minor, and localized changes to immediate surrounding water quality from potential releases of munitions constituents from explosives, ordnance and small arms rounds used during training exercises. Slight increase compared to No Action.	Temporary, short- term, minor, and localized changes to immediate surrounding water quality from potential releases of munitions constituents from explosives, ordnance and small arms rounds used during training exercises. Slight increase compared to No Action.
NEPM	Long-term, minor, and localized accumulation of MEM on the ocean floor. Slight increase compared to No Action.	Long-term, minor, and localized accumulation of MEM on the ocean floor. Slight increase compared to No Action.
MIW/Recovery	Negligible effects.	Negligible effects.
Conclusion	Less than significant impact.	Less than significant harm.

3.4 AIR QUALITY

3.4.1 Introduction and Methods

Air quality in a given location is described by the concentration of various pollutants in the atmosphere, generally expressed in units of parts per million or micrograms per cubic meter ($\mu g/m^3$), the size and topography of the air basin, and the prevailing meteorological conditions. The USEPA sets concentration levels for specific pollutants of concern with respect to the health and welfare of the general public. The six major pollutants of concern are carbon monoxide, sulfur dioxide, nitrogen dioxide, ozone, suspended particulate matter (PM_{10} and $PM_{2.5}$), and lead. The USEPA established the National Ambient Air Quality Standards (NAAQS) for these "criteria pollutants." The NAAQS establishes ambient concentrations of criteria pollutants considered protective of public health and welfare. Air quality criteria are set to protect the most susceptible sectors of the population such as children, the elderly, and people with asthma and breathing disorders.

Pollutant emissions typically refer to the amount of pollutants or pollutant precursors introduced into the atmosphere by a source or group of sources. Pollutant emissions contribute to the ambient air concentrations of criteria pollutants, either by directly affecting the pollutant concentrations measured in the ambient air or by interacting in the atmosphere to form criteria pollutants. Primary pollutants, such as carbon monoxide, sulfur dioxide, lead, and some particulates, are emitted directly into the atmosphere from emission sources. Secondary pollutants such as ozone, nitrogen dioxide, and some particulates are formed through atmospheric photochemical reactions that are influenced by meteorology, ultraviolet light, and other atmospheric processes.

Wind direction will determine the trajectory, or path, of air pollutants from their source to any receptor. Wind speed and the distance from the source will determine the time it will take air pollutants to travel from source to receptor. At high wind speeds, the air will experience more mechanical turbulence and pollutants released near ground level will disperse more rapidly. However, air pollutants emitted by elevated stack sources may be more rapidly transported to the ground during high wind speeds and can actually lead to higher ground-level pollutant concentrations. At low wind speeds, pollutants emitted from sources near ground level, such as vehicle exhaust, will disperse at a slower rate.

The combination of a strong temperature inversion and light winds may lead to a layer of cold, stagnant air near the ground. Pollutants emitted from low-level sources, such as vehicles, are trapped in this layer of air. A persistent temperature inversion over a long period of time may lead to increased concentrations of air pollutants in the lower atmosphere from low level sources.

The region of air that extends from the earth's surface to the base of the temperature inversion is referred to as the mixing layer. This layer of air is relatively well mixed due to heating from the sun and from human sources. The depth of the mixing layer defines the volume of air in which air pollutants can be mixed. The lower the depth of the mixing layer, the less volume available to disperse air pollutants. A persistent lack of a mixing layer or shallow mixing depth may lead to episodes of high pollution concentrations. The mixing layer is especially important in urban locations where large quantities of pollutants are released near ground level.

In general terms, the air quality of the JAX Range Complex is considered very good. This is reflective of the pollutant concentrations, the size and topography of the JAX Range Complex, and

the prevailing meteorological conditions. These conditions are further described in this section, but first is a discussion of the air quality regulatory framework.

3.4.1.1 Regulatory Framework

Federal Air Quality Requirements

The USEPA is the agency responsible for enforcing the federal Clean Air Act (CAA) of 1970 and its 1977 and 1990 amendments (42 U.S.C. §7401, *et seq*.). The purpose of the CAA is to establish NAAQS, classify areas as to their attainment status relative to the NAAQS, develop schedules and strategies to meet the NAAQS, and regulate emissions of criteria pollutants and air toxics to protect public health and welfare. Under the CAA, individual states are allowed to adopt ambient air quality standards and other regulations provided they are at least as stringent as federal standards.

The USEPA requires each state to prepare a State Implementation Plan (SIP) that describes how that state will achieve compliance with the NAAQS. A SIP is a compilation of goals, strategies, schedules, and enforcement actions that will lead the state into compliance with all federal air quality standards. The predominant air quality regulations promulgated under the CAA potentially applicable to the proposed action include:

- NAAQS; and
- General Conformity Rule.

Implementation of the CAA is carried out through rules promulgated by the states through their respective agencies. For the proposed action, these agencies include: North Carolina Department of Environment and Natural Resources; South Carolina Department of Health and Environmental Control; Georgia Department of Natural Resources; and Florida Department of Environment Protection.

NAAQS

The CAA requires USEPA to set NAAQS (40 CFR Part 50) for pollutants considered harmful to public health and the environment (See Appendix K for details). The CAA established two types of national air quality standards (primary and secondary). Primary standards set limits to protect public health, including the health of sensitive populations such as asthmatics, children, and the elderly. Secondary standards set limits to protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings.

As previously mentioned, the USEPA set NAAQS for six pollutants ("criteria pollutants"). Areas within a particular state that do not meet the NAAQS for a criteria pollutant are designated as being in "nonattainment" for that pollutant. Nonattainment status is further defined by the extent to which the standard is exceeded. Ozone nonattainment status is categorized by five classifications:, marginal, moderate, serious, severe, and extreme. Areas are designated either as Subpart 1 or Subpart 2. Under Subpart 2, the classifications are marginal, moderate, serious, severe and extreme. The 8-hour ozone implementation rule has been remanded to USEPA; carbon monoxide and particulates nonattainment status is categorized by two classifications: moderate and serious. The remaining criteria pollutants have designations of either "attainment," "nonattainment," or "unclassifiable." Areas that achieve the air quality standard after being designated in nonattainment are re-designated as in attainment following USEPA approval of a maintenance plan. These areas are commonly known as "maintenance areas," signifying that they are attainment areas with a

maintenance plan approved by USEPA. The maintenance plan must include emissions budgets demonstrating measures to be taken to ensure the area continues to meet the NAAQS.

General Conformity Rule

The USEPA rule implementing the conformity requirements, "Determining Conformity of General Federal Actions to State or Federal Implementation Plans," was published on 30 November 1993 at 58 FR 63214 and codified at 40 CFR Parts 51 and 93. 40 CFR Part 51, Subpart W, contains the General Conformity Rule provisions that must be incorporated into SIPs, including the requirement that States revise the SIPs to include the conformity requirements. Once a SIP has been revised and approved by USEPA, the conformity requirements become federally enforceable and federal agencies are subject to the conformity requirements as they appear in the SIP. In cases where a Federal Implementation Plan (FIP) is in effect, federal actions must conform to the requirements of the FIP. Each federal agency taking an action subject to the General Conformity Rule must make its own conformity determination (40 CFR Part 93.154).

A Conformity Review must be completed for every Navy action that generates air emissions. The action proponent is responsible for the documentation. The Conformity Review can be satisfied by (1) a determination that the action is not subject to the General Conformity Rule, (2) a Record of Non-Applicability, or (3) a Conformity Determination.

The action proponent may make a determination that the proposed action is not subject to the General Conformity Rule. Actions not subject to the rule are actions that occur in attainment areas, and that do not generate emissions in non-attainment areas; or actions where the criteria pollutant emitted (or its precursors) is one for which the area is in attainment. If NEPA documentation is prepared for the action, the determination shall be described in that documentation; otherwise, no documentation is required. This FEIS/OEIS includes the determination that all actions occurring in the attainment areas (*i.e.*, coastal counties of North Carolina, South Carolina, Georgia, and Florida) are not subject to the General Conformity Rule. State air quality requirements are set forth in Appendix K.

3.4.1.2 Assessment Methods and Data Used

The method used in this FEIS/OEIS to assess the air quality impacts associated with existing and proposed Navy training and testing within the JAX Range Complex include following the steps:

- Analyze existing federal and state air quality regulations applicable to the proposed action. Determine applicability of the General Conformity Rule;
- Analyze existing air quality in the range complex and the existing meteorological conditions;
- Analyze the types of emission sources associated with training and testing within the JAX Range Complex;
- Review existing air quality assessments associated with individual Navy platforms and weapons systems;
- Determine overall air quality impacts associated with existing Navy training and testing within the range complex given the regulatory framework; and
- Determine overall air quality impacts associated with the proposed increases in Navy training and testing within the range complex given the regulatory framework.

It was determined that no air quality modeling or monitoring was specifically required for further analysis.

3.4.1.3 Warfare Areas and Associated Environmental Stressors

The warfare areas associated with training in the JAX Range Complex are set forth in Table 3.4-1. For each warfare area, emission sources (environmental stressors) are listed. These sources/stressors are associated with either the training platform, the weapon system utilized during the exercise, or the target or support craft. Also included in the table are the distances from shore where the exercises take place and the percentage of training events which take place below 3,000 feet. Emissions occurring or that would occur above 3,000 feet are considered to be above the atmospheric inversion layer and are, therefore, without impact on the local air quality.

As shown in Table 3.4-1, in general, helicopter and small boat exercises take place closer to the shore, whereas fixed wing aircraft and large ship exercises take place at a great distance from shore. This is important from an air quality perspective because it helps to understand which Navy exercise emission sources would contribute to the overall air quality for human receptors. For example, FIREX with IMPASS exercises are always conducted at least 12 nm from shore. Emissions associated with these gunfire exercises would be minor cruiser or destroyer engine exhaust and gun barrel exhaust from firing the 5-inch guns. Another example would be helicopter flights in connection with CSAR training. These helicopter exercise flights are conducted overland at Rodman Range. When emissions occur near shore or over land, they have the chance to mix with the air breathed by human receptors. Helicopter emissions at NAS Jacksonville and NS Mayport have been studied in previous environmental assessments and are shown to have a *de minimis* impact. Table 3.4-1 summarizes the emissions sources associated with each exercise. These sources will be analyzed thoroughly in this section and conclusions as to the environmental consequences of the emissions will follow.

3.4.2 Affected Environment

The affected environment for purposes of air quality includes the SUA associated with the OPAREAs, and the air above adjoining cities/counties in North Carolina, South Carolina, Georgia, and Florida, whose air could mix with the Navy training space in the JAX Range Complex. The JAX Range Complex Study Area assessed in this FEIS/OEIS is almost entirely offshore training sea space, undersea space, and SUA. For air quality purposes, the majority of area assessed is the 28,460 nm^2 of SUA located above the OPAREAs (*e.g.,* W-132, W-133, W-134, W-157, W-158, and W-159). This vast area begins 3 nm from shore. Other smaller areas assessed for air quality impacts in this FEIS/OEIS include: 1) the restricted airspace (R-2906) that covers Rodman Range; and 2) the restricted airspace regions R-2907A and R-2907B that cover the Lake George Range.

Regional Climate

As mentioned in the introduction to this section, the climate of the region plays an important role in determining air quality. The Northeast Florida climate is considered mild with seasonal changes. For example, the average annual temperature for Jacksonville is between 68 and 69°F. The climate of Georgia's coastal region is classified as moist subtropical. Average daily maximum and minimum temperatures in Georgia are approximately 60.9°F and 39.2°F, respectively, for January, and 91.6°F and 72.3°F, respectively, for July based on the Historical Climate Summary for Savannah from 1948–2000 (Southeast Regional Climate Center, 2001).

TABLE 3.4-1
WARFARE AREAS AND ASSOCIATED AIR QUALITY ENVIRONMENTAL STRESSORS

		Stressors				Location			
Warfare Area and Operation	Training Areas	Surface Vessel Emissions	Helicopter Emissions	Fixed Wing Aircraft Emissions	Ordnance Emissions	Below 3,000 feet	Above 3,000 feet	Overland or within 12 nm from Shore	Beyond 12 nm from Shore
Mine Warfare (MIW)									
Mine Laying	Lake George Range			✓			✓	✓	
MCM	Carrier Operating Areas		✓			✓		✓	
Mine Neutralization	Charleston OPAREA (10L and 12I)	✓	✓			✓			✓
Surface Warfare (SUW)									
MINEX (A-S)	W-157A (Area 4X) and W-159A (Area 5X)		✓	✓	✓		✓		✓
GUNEX (A-S)	W-132, W-133, W-134, W-157, W-158		✓			✓			✓
GUNEX (S-S) Boat	Charleston OPAREA (Area 11J)	✓				✓		✓	
GUNEX (S-S) Ship	JAX OPAREA (Gunnery Areas AA, BB, and CC)	✓			✓	✓			✓
BOMBEX (A-S) (at sea)	HE, W-158A (31J); NEPM, W-157A/B, W-158A/B			✓			✓		✓
Laser Targeting	W-132, W-133, W-134, W-157, W-158		✓	✓		✓	✓		✓
GUNEX (S-S) (FAC/FIAC)	Amber Strait: Charleston OPAREA (Boxes Q-9&10, R-9&10)	✓				✓			✓
VBSS/MIO-Ship	JAX and Charleston OPAREAs	✓	✓			✓			✓
VBSS/MIO-Helicopter	W-157A (Area 4X) and W-159A (Area 5X)					✓			✓

TABLE 3.4-1 (Continued)
WARFARE AREAS AND ASSOCIATED AIR QUALITY ENVIRONMENTAL STRESSORS

		Stressors				Location			
Warfare Area and Operation	Training Areas	Surface Vessel Emissions	Helicopter Emissions	Fixed Wing Aircraft Emissions	Ordnance Emissions	Below 3,000 feet	Above 3,000 feet	Overland or within 12 nm from Shore	Beyond 12 nm from Shore
Air Warfare (AW)									
ACM	W-157A (Areas 3X & 4X)			✓			✓		✓
Air Intercept Control	W-132, W-133, W-134, W-157, W-158			✓			✓		✓
ACM Chaff Exercise	W-157A (Areas 3X & 4X)			✓	✓		✓		✓
ACM Flare Exercise	W-157A (Areas 3X & 4X)			✓	✓		✓		✓
MISSILEX (A-A)	W-132, W-133, W-134, W-157, W-158			✓	✓		✓		✓
MISSILEX (S-A)	JAX and Charleston OPAREs	✓			✓		✓		✓
Detect-to-Engage	W-132, W-133, W-134, W-157, W-158	✓		✓		✓	✓		✓
GUNEX (S-A)	JAX OPAREA (Gunnery Areas AA, BB, and CC)	✓		✓	✓	✓	✓		✓
GUNEX (A_A)	W-157A/W-133 (Area 2X)			✓			✓		✓
Amphibious Warfare (AMW)									
FIREX with IMPASS	JAX OPAREA (Gunnery Areas BB and CC)	✓			✓	✓			✓
Strike Warfare (STW)									
BOMBEX (A-G)	Rodman Range			✓	✓	✓	✓	✓	
CSAR and Convoy Operations	Rodman Range		✓			✓		✓	
Electronic Combat (EC)									
EC Operations- Aircraft	W-132, W-133, W-134, W-157, W-158			✓			✓		✓

TABLE 3.4-1 (Continued)
WARFARE AREAS AND ASSOCIATED AIR QUALITY ENVIRONMENTAL STRESSORS

		Stressors				Location			
Warfare Area and Operation	Training Areas	Surface Vessel Emissions	Helicopter Emissions	Fixed Wing Aircraft Emissions	Ordnance Emissions	Below 3,000 feet	Above 3,000 feet	Overland or within 12 nm from Shore	Beyond 12 nm from Shore
EC Operations- Surface Ships	JAX and Charleston OPAREAs	✓		✓		✓			✓
Chaff Exercise	JAX and Charleston OPAREAs	✓	✓		✓	✓			✓
Flare Exercise- Helicopter	Lake George Range		✓		✓	✓		✓	
Other Events									
SESEF Utilization	5-15 nm east of Naval Station Mayport	✓				✓		✓	
Precision Anchoring	NS Mayport	✓				✓		✓	
Small Arms with anti-swimmer grenades (MK3A2)	Charleston OPAREA (Area 10L, 12I)	✓						✓	

Class 3 and above wind resource occurs at exposed areas throughout much of the United States, except the southeastern United States where Class 3 and above is restricted to exposed mountain summits and ridge crests in the Appalachians and coastal areas from North Carolina northward. Much of the southeastern United States has an average wind resource of Class 1. Even along coastal areas, existing data from exposed sites indicate only Class 2 at 164 feet above ground. The only places in the Southeast region estimated to have Class 3 or higher annual average wind resource are the exposed ridge crests and mountain summits confined to northeastern Georgia and extreme northwestern South Carolina (Renewable Resource Energy Center, 2007). These mild temperatures and low wind conditions play a role in determining the existing air quality in the EIS/OEIS Study Area.

3.4.2.1 North Carolina Air Quality

The Study Area includes offshore waters adjacent to portions of North Carolina. The nearest North Carolina counties to the Study Area are Brunswick County and New Hanover County. These counties are part of the Southern Coastal Plain Intrastate Air Quality Control Region (AQCR) (40 CFR Part 81.152). Pursuant to 40 CFR Part 81.334, each of the North Carolina counties bordering the Study Area has been designated as being in attainment for all criteria pollutants. See Figure 3.4-1 for the location of the state's adjacent air quality control regions and those counties therein bordering the range complex.

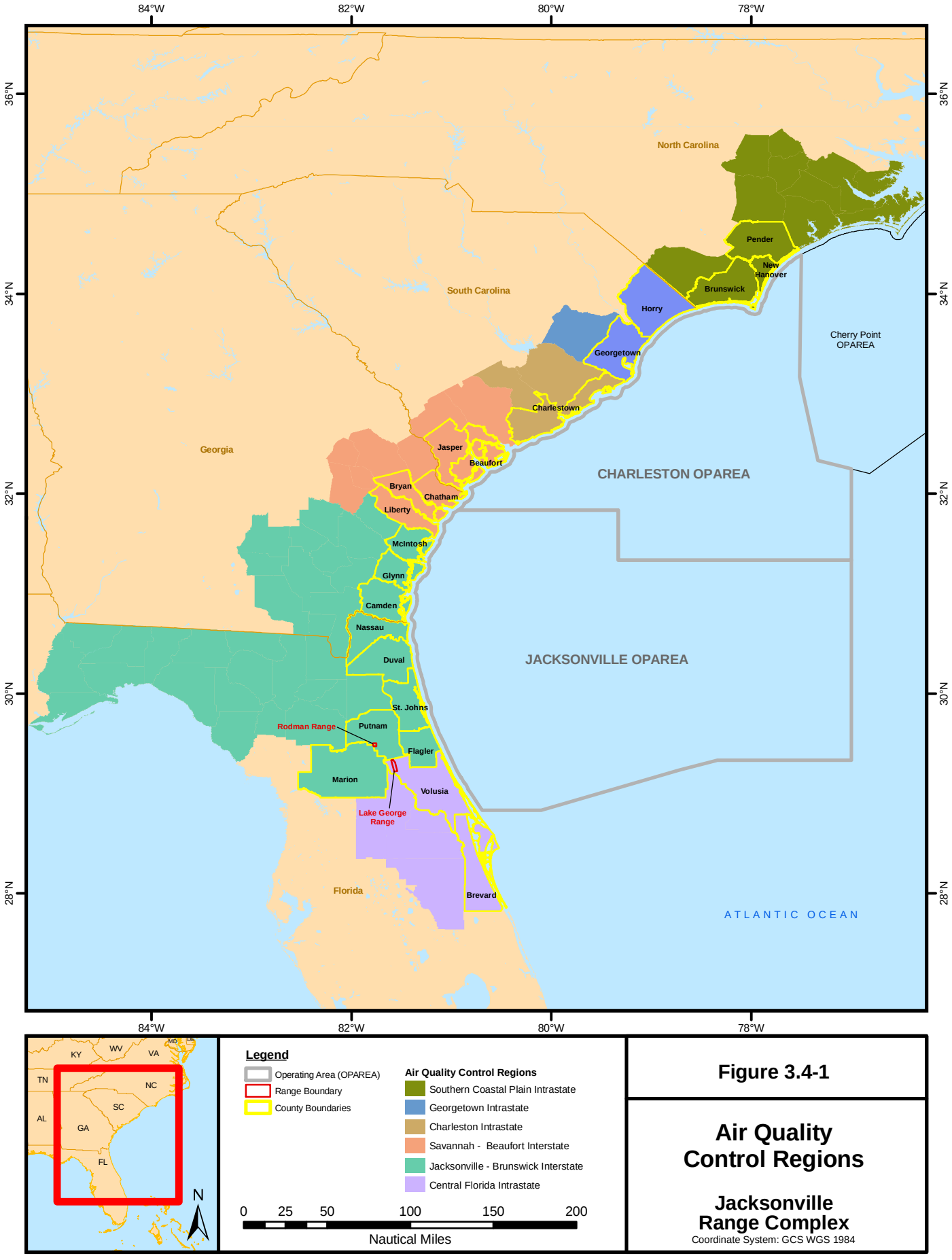


Figure 3.4-1

Air Quality Control Regions

Jacksonville Range Complex

Coordinate System: GCS WGS 1984

3.4.2.2 South Carolina Air Quality

The Study Area is in nearest geographic proximity to the South Carolina counties of Horry, Georgetown, Charleston, Beaufort, and Jasper. These counties fall into the Georgetown, Charleston, and Savannah (Georgia) - Beaufort (South Carolina) AQCRs. Pursuant to 40 CFR Part 81.341, each of these South Carolina counties bordering the Study Area has been designated as being in attainment for all criteria pollutants. See Figure 3.4-1 for the location of the state's adjacent AQCRs and those counties therein bordering the range complex.

South Carolina currently operates 24 air monitoring sites around the state. In addition to monitoring for the six NAAQS criteria pollutants, DHEC also monitors and samples for State standards, such as total suspended particulates and fluoride, and for other pollutants and effects (like acid rain) that are a concern (SCDHEC, 2007).

3.4.2.3 Georgia Air Quality

Portions of the Study Areas are adjacent to Georgia. The Georgia counties nearest the Study Area are Chatham, Bryan, Liberty, McIntosh, Glynn, and Camden. Chatham, Bryan, and Liberty Counties lie within the Savannah (Georgia) – Beaufort (South Carolina) AQCR. McIntosh, Glynn, and Camden Counties are in the Jacksonville (Florida) – Brunswick (Georgia) Interstate AQCR. Each of these Georgia counties bordering the Study Area has been designated as being in attainment for all criteria pollutants (USEPA, 2007b) (see also 40 CFR Part 81.311). See Figure 3.4-1 for the location of the state's adjacent air quality control regions and those counties therein bordering the range complex.

The Jacksonville (Florida) – Brunswick (Georgia) Interstate AQCR currently has two air quality monitoring stations operating in AQCR 49, and both are in Brunswick in Glynn County (Georgia Air National Guard, 2005, citing Georgia Department of Natural Resources, 2000). PM_{10}, $PM_{2.5}$, sulfur dioxide and ozone are monitored at the stations.

3.4.2.4 Florida Coastal Air Quality

The Study Area includes offshore waters adjacent to portions of Florida, as well as two interior training range locations (Lake George Range and Rodman Range). The nearest Florida counties to the offshore Study Area are the Counties of Nassau, Duval, Saint Johns, Flagler, Volusia, and Brevard. These counties are part of the Jacksonville (Florida) – Brunswick (Georgia) Interstate AQCR and the Central Florida Intrastate AQCR (40 CFR Part 81.149). Pursuant to 40 CFR Part 81.310, each of the AQCRs and component Florida counties bordering the Study Area is designated as being in attainment for all criteria pollutants. Florida is one of just three states east of the Mississippi that currently meets all NAAQS, and the only highly urbanized state (FDEP, 2007a). Figure 3.4-1 shows the location of the state's adjacent air quality control regions and those counties therein bordering the range complex.

Florida's statewide air quality monitoring network is operated by both state and local environmental programs. The air is monitored for CO, Pb, NO_2, O_3, $PM_{2.5}$, PM_{10} and SO_2. The monitors tend to be concentrated in areas with the largest population densities. Not all pollutants are monitored in all areas (FDEP, 2007b). Florida has approximately 200 air quality monitoring stations throughout the state (USEPA, 2007c).

3.4.2.5 Florida Interior Air Quality

Rodman Range lies mostly in Putnam County and a portion of Marion County in central Florida. The nearby Lake George Range lies in Volusia County, Florida, east of the Ocala National Forest. These counties are part of the Jacksonville (Florida) – Brunswick (Georgia) Interstate AQCR and the Central Florida Intrastate AQCR (40 CFR Part 81.149). Pursuant to 40 CFR Part 81.334, each of the Florida counties bordering the Study Area is designated as being in attainment for all criteria pollutants.

Air quality around the region and at the Lake George and Rodman Ranges is influenced by ambient conditions, the use of the range by military aircraft, ordnance delivery to the range targets, prescribed burns, and wildfires.

Aircraft using the interior ranges are a source of air pollutants. Aircraft first make an initial flyby to designate a positive target identification before entering the actual bomb pattern, releasing their ordnance, and leaving the area. The safety run, in which the targets are identified, and each individual training run, are counted as separate single operations. With each operation, aircraft approach the target area, release their ordnance, and leave the target area, either to circle back for another operation or to return to base.

Potential air pollution from ordnance use would be from the release of explosive by-products. The authorized ordnance at the Lake George Range includes NEPM bombs, defensive flares, and NEPM mineshapes. The authorized ordnance at Rodman Range includes blank machine gun ammunition and NEPM practice bombs only.

The spotting charge on NEPM is a small smoke charge activated by a mechanical fuze when the bomb hits the ground to readily see where the bomb hits the target for scoring purposes. Detonation of both live and NEPM consumes approximately 98 to 99 percent of the explosive component (DoN, 2002a). The 1 to 2 percent of explosive component not consumed is generally dispersed, with most falling to the soil in the immediate vicinity of the blast and the balance being dispersed in the air subject to wind currents and weather conditions.

3.4.3 Environmental Consequences

3.4.3.1 Jacksonville OPAREA and Charleston OPAREA

Evaluation of potential air quality impacts includes two separate analyses. Effects of air pollutant emissions from JAX Range Complex operations occurring within the U.S. Territory (within 12 nm of the coastline) are assessed under NEPA. Effects of air pollutant emissions from JAX Range Complex operations occurring outside the U.S. Territory are assessed under EO 12114.

For the purposes of assessing air quality effects under NEPA, all operations involving the use of aircraft and vessels at or below 3,000 feet in areas within U.S. territorial waters or overland were included in the assessment. This includes, for example, all operations within R-2906 and R-2907.

For the purposes of assessing air quality effects under EO 12114, only those aircraft, vessels, and missiles/targets operations occurring at or below 3,000 feet and outside U.S. territorial waters were considered in the evaluation.

The NEPA analysis involves evaluating emissions generated from the proposed activities and assessing potential impacts on air quality, including an evaluation of potential exposures to toxic air pollutant emissions. Trace amounts of air toxics emissions would be generated from

combustion sources and use of ordnance. Air toxics emissions include hazardous air pollutants not covered under ambient air quality standards. Potential hazardous air pollutant sources are associated with missile and target operations and include rocket motor exhaust and unspent missile fuel vapors. These emissions would be minor and would not result in significant impacts due to the distance from humans that could be affected by air toxics and the negligible levels of emissions.

The NEPA analysis does not include a CAA General Conformity Analysis because all adjacent AQCRs are designated in attainment for all criteria pollutants. As noted, the EIS/OEIS Study Area lies adjacent to following AQCRs:

- Southern Coastal Plain Intrastate Air Quality Control Region;
- Georgetown AQCR;
- Charleston AQCR;
- Charleston, Georgetown, Savannah (Georgia) - Beaufort (South Carolina) Interstate AQCR;
- Jacksonville (Florida) – Brunswick (Georgia) Interstate AQCR; and
- Central Florida AQCR.

Pursuant to 40 CFR Part 81, each of these AQCRs is designated as being in attainment for all criteria pollutants. Thus, the proposed action is not subject to the General Conformity Rule.

Surface Ship Operations

Marine vessel traffic in the OPAREAs is composed of military ship and boat traffic, including support vessels providing services for military training exercises and tests. A number of non-military commercial vessels and recreational vessels are regularly present within the OPAREAs. These vessels were not evaluated in the air quality analysis as they are not part of the Navy's action.

Evaluating marine vessel emissions typically involves examining the types of operation for each vessel type, the number of hours of operation for each vessel type, the type of propulsion engine in each vessel, and the type of generator used onboard each vessel type. For Alternative 1 and 2, operational estimates of future ship use percentages were obtained based on evolutionary changes in the Navy force structure and mission assignments. Where there were no major changes in types of ships, future operations estimates were based on the percentage distribution of historical operations. Detailed estimates of operations for baseline and future operations were obtained based on discussions with fleet Subject Matter Experts.

Because no time is spent by surface ships within a non-attainment AQCR, it was not necessary to investigate in detail, the time spent within particular locations, at what power level, or the path taken by the boat or ship within the Range Complex. Furthermore, no surface boat or ship training operations occur within 12 nm of the shoreline. EOD groups will use small boats to transit through state waters to Mine Neutralization training areas located between 3 nm and 12 nm from shore. Small harbor defense boats also produce minor amounts of outboard motor emissions in transit to gunfire training areas located 3 nm to 12 nm offshore from Charleston, South Carolina and Kings Bay, Georgia. Larger ships also transit through state waters on their way to training areas located beyond 12 nm from shore. Only minor boat engine emissions are involved in these transits. Other surface craft emissions can come from support craft used in training events or small powered target craft. Support craft may be used for target setup or

retrieval or aerial drone recovery. These support craft or powered targets would also present insignificant air quality impacts.

Aircraft Emissions

Evaluating aircraft emissions involves evaluating the type of operations for each type of aircraft, the number of hours of operation for each aircraft type, the type of engine in each aircraft, and the mode of operation for each type of aircraft engine. Aircraft emit the following CAA criteria pollutants: VOCs, NOx, CO, SO_2 and $PM_{10.}$ Emissions occurring above 3,000 feet are considered to be above the atmospheric inversion layer and, therefore, without impact on local air quality. Aircraft flights, for the most part, originate from onshore air stations (*e.g*., NAS Jacksonville, NS Mayport, or MCAS Beaufort), but some are from aircraft carriers offshore. It was assumed that all fixed wing aircraft would be traveling from their home base to the JAX Range Complex SUA at an elevation above 3,000 feet, and that transit to and from the range would not affect local air quality. The majority of aircraft emissions in the SUA above the OPAREAs occur above 3,000 feet. Such high-altitude aircraft emissions are associated with training events, including ACM, Electronic Combat (EC), MISSILEX (A-A), MISSILEX (A-S), Air Intercept Control (AIC), and BOMBEX (A-S).

Commercial air services (CAS) aircraft participate in EC, AIC, Gunex (S-A), and Detect-to-engage (DTE) training events. CAS aircraft will also be operated primarily above the 3,000 foot atmospheric inversion layer. Emissions from CAS aircraft are similar to Navy fixed wing aircraft. As mentioned in Chapter 2, CAS aircraft displace Navy fixed-wing aircraft used in such CAS supported events and thus do not add to overall event emissions in the Study Area. CAS flights in the JAX Range Complex depart from NAS Jacksonville. As shown in Table 2.2-3, there are few additional CAS flights proposed in support of range complex training (only 28 additional CAS flights per year under either Alternative 1 or 2). CAS aircraft departing from NAS Jacksonville thus represent an insignificant source of air emissions.

Aircraft emissions associated with P-3C and its replacement, the P-8A, are fully described in the EIS for the *Introduction of the P-8A Multi-mission Maritime Aircraft into the U.S. Navy Fleet*. According to the EIS, both temporary construction total annual emissions and projected annual operating emissions for the P-8A are below 250 tons per year for all criteria pollutants.

Aircraft operating in the JAX Range Complex SUA generally have reciprocating, turboprop, or jet engines. Most of these aircraft use JP-5 or JP-8 as a standard fuel. Emissions of concern are primarily hydrocarbons that disperse readily in the atmosphere. A portion of those emissions may be volatile organic compounds, which are associated with the generation of ground level ozone. However, the volume of aircraft operations in the JAX Range Complex SUA is relatively small, and adjacent areas are in attainment for ozone levels. Therefore, emissions related to aircraft activities in the JAX Range Complex over-ocean SUA are not anticipated to have a negative impact on the Study Area environment.

Emissions from Weapons and Explosives

Other common chemical emissions associated with Navy training are explosive compounds and oxidation products. Oxides of carbon, nitrogen and water are formed during this process, thus reducing the likelihood of parent chemicals (trinitrotoluene and cyclonite) entering surrounding environments. Other nitroaromatic compounds such as octogen, tetryl, and picric acid (used in fuzes and primers) produce the same reactions. Practice ordnance does not carry an explosive

charge; it carries only a smoke or marking charge, and thus, the incidence of emission particles is negligible (DoN, 2007a). The detonation of the marking charge or of the explosive bomb consumes approximately 98 to 99 percent of the explosive component. The one to two percent of explosive component not consumed is generally dispersed, with most falling to the water in the immediate vicinity of the blast and the balance being dispersed in the air subject to wind currents and weather conditions.

Many of the smokes and fumes given off by pyrotechnics and screening devices are considered nontoxic and only mildly irritating to the eyes and nasal passages when encountered in relatively light concentrations out-of-doors. Heavy concentrations in closely confined spaces, however, are dangerous and may be lethal because they reduce the amount of oxygen in the air (NAVSEA, 1996). Because smoke floats and flares are used infrequently, out-of-doors, and at great distances from land, associated air emissions would be considered non-toxic to residents in the JAX Range Complex.

Air emissions from an Army Hellfire missile launch, helicopter motor combustion, and warhead detonation were calculated in the *Life Cycle Environmental Assessment for Hellfire Modular Missile System, August 1994* (Department of the Army, 1994). The highest percentage (by weight) of motor combustion and warhead detonation products consists of nitrogen, water, carbon dioxide, carbon monoxide, carbon, and ammonia at totals between 95 percent (motor combustion) to 99.51 percent (warhead detonation). Air emissions that make up the additional 0.49 percent to 4.1 percent are from aluminum oxide, Pb, hydrogen cyanide, ethane, hydrogen, and methane. Due to the low concentrations and rapid dispersal of Hellfire combustion/detonation products, Hellfire testing should have no significant impact on air quality (Department of the Army, 1994). Other missiles used in the JAX Range Complex are expected to have similarly benign impacts on regional air quality.

Underwater detonations associated with EOD Mine Neutralization training utilize C4, consist of RDX plus a small amount of polyisobutylene binder. The principal explosive byproducts are water, carbon dioxide, carbon monoxide, nitrogen, and hydrogen. Like other underwater explosions, it creates a cavity filled with high-pressure gas, which pushes the water out radially against the opposing external hydrostatic pressure. At the instant of explosion, a certain amount of gas is instantaneously generated at high pressure and temperature, creating a bubble. In addition, the heat causes a certain amount of water to vaporize, adding to the volume of the bubble. This action immediately begins to force the water in contact with the blast front in an outward direction. It is estimated that 90 percent of the gaseous explosion products would become airborne (DoN, 2001). Airborne explosion products are assumed to stabilize in a spherical form and move downwind, with concentrations remaining for the first 100 feet. This "cloud" would not be visible. Then, the airborne cloud would continue to move at the speed of the wind and become diluted and dispersed by atmospheric turbulence (DoN, 2001). The UNDET explosive byproducts are not expected to significantly impact the regional air quality. The proposed new mine neutralization systems (AMNS and RAMICS) do not have air emissions associated with their use, other than the helicopter platforms used to deploy them.

Combustion products from BQM-74 and BQM-34 target launches are predominantly aluminum oxide, carbon monoxide, hydrogen chloride, water, nitrogen, carbon dioxide, and hydrogen (NASA, 2003). Table 3.4-2 details the air quality guidelines for exposure to these emittants. Combustion of fuel and self-contained oxidizers produces emissions per National Institute for

Occupational Safety and Health guidelines. Under normal launch conditions, these emissions are distributed along the flight vehicle trajectory.

TABLE 3.4-2
AIR QUALITY GUIDELINES FOR EXPOSURE TO ROCKET EXHAUST

Combustion Product	CAS NO.	TWA mg/m³	CEILING mg/m³	PEL mg/m³
Aluminum oxide (as Aluminum)	1344-28-1	-	-	15 (total)
Chlorine	7782-50-5	-	1.45	3
Hydrochloric acid	7647-01-0	-	7	7
Lead, inorganic Dusts and fumes (as lead)	7439-92-1	0.050	-	0.050

Abbreviations: CAS No. = Chemical Abstract System Number; TWA = Time-Weighted Average; PEL = Permissible Exposure Limits; mg/m³ = Milligrams per cubic meter

Source: NASA 2003.

The air quality impacts of chaff were evaluated by the Air Force in *Environmental Effects of Self-Protection Chaff and Flares* (USAF, 1997). The study concluded that most chaff fibers maintain their integrity after ejection. Although some fibers are likely to fracture during ejection, it appears this does not result in the release of particulate matter. Although not significant, tests indicated that the explosive charge in the impulse cartridge results in minimal releases of particulate matter. Therefore, it appears that chaff deployment would not result in an exceedance of the NAAQS. Chaff Exercises in the JAX Range Complex are conducted relatively infrequently, and are always conducted beyond 12 nm from shore. These facts further reduce any potential for impacts to NAAQS.

The overall volume of emissions from ordnance and explosives has a minimal impact on regional air quality. No significant impact is expected to the regional air quality, and no significant harm is expected to the global commons under EO 12114.

3.4.3.2 Inland Ranges: Lake George Range and Rodman Range

Aircraft operating in the SUA above the Lake George Range (P-3s) and Rodman Range (helicopters, F/A-18s) use JP-5 as a standard fuel. Emissions of concern are primarily hydrocarbons that disperse readily in the atmosphere. A portion of those emissions may be volatile organic compounds, which are associated with the generation of ground level ozone. However, the volume of aircraft operations in the over land SUA is relatively small and adjacent areas are in attainment for ozone levels. Therefore, emissions related to aircraft activities at Rodman Range and Lake George Range are not anticipated to have a negative impact on the Study Area environment.

Another potential stressor to air quality from bombing operations at the Lake George and Rodman Ranges would be from the release of bomb constituents or releases of pollutants from bombing targets (at Rodman Range the target is a surplus military vehicle). High explosive

ordnance is not permitted at either range. Bombs used at Rodman Range are NEPM with a small spotting charge attached to the bomb. The spotting charge is a small smoke charge activated by a mechanical fuze when the bomb hits the ground to readily see where the bomb hits the target for scoring purposes. Detonation of the spotting charge consumes approximately 98 to 99 percent of the explosive component (DoN, 2002a). The 1 to 2 percent of explosive component not consumed is generally dispersed, with most falling to the soil in the immediate vicinity of the impact and the balance being dispersed in the air subject to wind currents and weather conditions.

Ordnance dropped at Rodman Range imposes a short-term insignificant impact on air quality. In addition to by-products of the spotting charge, the impact of NEPM disturbs particulate matter in the form of organics, dust, and sand resulting in short-term clouds of particulate matter. Depending on the size and mass of the particulate matter and local wind conditions, it either settles out in the immediate vicinity or may be carried an unknown distance.

Air impacts from prescribed burns and wildfires at Rodman Range are expected to be similar to current conditions. Forest fires, including prescribed fires and wildfire, may result in temporary air pollution in the region. The major pollutants for forest fires are particulate, carbon monoxide and volatile organic compounds. The amount of air pollution that results from any forest fire can be highly variable.

Ordnance used at the Lake George Range is also NEPM, but due to the targets' in-water location, does not have the potential to create particulate matter in the form of organics, dust, or sand.

No significant impacts to regional air quality are expected from air operations, ordnance delivery, prescribed burns, or wild fire. The air quality in this region is in attainment with NAAQS for all criteria pollutants. Therefore, the proposed action is not subject to the General Conformity Rule. This FEIS/OEIS will be provided to USEPA in accordance with Section 309 of the CAA. Copies will also be provided to the FDEP to ensure conformity of the proposed action with Florida's SIP, in accordance with Section 176c of the CAA and the state's air quality regulations.

Aircraft operations associated with the two Florida inland ranges would not increase the likelihood of exceeding the air quality standards. Emissions from the proposed action are not regionally significant when compared to permitted stationary sources in the area. Aircraft operations have been occurring at the Lake George Range since 1989 and at Rodman Range since 1955, and air quality has not been noted as a problem within the region over this period of time.

3.4.3.3 Local Navy Air Stations: NAS Jacksonville and NS Mayport

NAS Jacksonville and NS Mayport are not within the Study Area, but are considered in context here, as aircraft from these locations (P-3s, and various helicopter airframes) are the primary local Navy aircraft that use the JAX Range Complex. Helicopter emissions were recently evaluated in the EA for the Homebasing of the MH-60R/S on the East Coast of the United States (DoN, 2002b). The new helicopter airframes will be assigned to five MH-60R CV squadrons, two MH-60R EXP squadrons, and one MH-60R FRS located in the Jacksonville Fleet Concentration Area, which includes NS Mayport and NAS Jacksonville.

Air emissions were calculated for aircraft emissions at NAS Jacksonville and NS Mayport. According to the findings of the air quality analysis in the Homebasing EA, the addition of air emissions under the proposed action were below the *de minimis* thresholds of 100 tpy for nitrous oxide and volatile organic compounds as required for evaluation by the Florida SIP. The proposed action was, therefore, exempt from the requirement for conformity under the General Conformity

Rule and was presumed to conform to the Florida SIP. Due to the *de minimis* emissions levels, the EA included a record of non-applicability as an appendix. At the time of the study, Duval County was under a maintenance plan for the control of ozone precursor compounds nitrous oxide and volatile organic compounds.

Due to the retirement of older helicopter airframes (HH-60H, SH-60B, and SH-60F), the proposed action, as described in Alternative 1 of the 2002 Homebasing EA, would result in an increase of four helicopters at NAS Jacksonville and a decrease of one helicopter at NS Mayport. That EA is incorporated by reference into this JAX Range Complex FEIS/OEIS. Since publication of the MH-60 R/S Homebasing Study EA, COMNAVAIRFOR has made slight adjustments to aircraft force structure within the Jacksonville Fleet Concentration Area and other U.S. air stations (Command Naval Air Force [CNAF], 2007). Table 3.4-3 and Table 3.4-4 set forth the estimated aircraft type numbers at NAS Jacksonville and NS Mayport, respectively, for the next 10 years. According to the latest estimates, NAS Jacksonville would experience a net increase of 12 helicopters by 2017 over the amount of helicopters stationed there in 2002. By 2017, NS Mayport would experience a net decrease of 17 helicopters over the amount of helicopters stationed there in 2002. Based on the estimates set forth in the CNAF Master Aviation Plan, the Jacksonville FCA would experience a net decrease of four helicopters over those numbers expected and evaluated in the 2002 Homebasing EA. As also shown in Table 3.4-3, should the P-8A be home-based at NAS Jacksonville, the result over the next ten years would be an increase in one aircraft.

TABLE 3.4-3
ESTIMATED TYPE AND NUMBER OF AIRCRAFT STATIONED AT NAS JACKSONVILLE

Aircraft Type	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
HH-60H	14	9	9	3	3	0	0	0	0	0
SH-60F	20	12	12	4	4	0	0	0	0	0
SH-60B	0	0	28	14	14	14	14	0	0	0
MH-60R	0	6	11	22	22	33	33	44	44	44
P-3C	47	43	43	43	39	33	23	17	4	3
P-8A[44]	0	0	0	0	TBD (8)	TBD (16)	TBD (24)	TBD (40)	TBD (47)	TBD (48)

Source: CNAF, 2008.

TABLE 3.4-4
ESTIMATED TYPE AND NUMBER OF AIRCRAFT STATIONED AT NS MAYPORT

Aircraft Type	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
SH-60B	79	79	51	51	51	39	34	20	6	0
MH-60R	0	0	5	8	15	16	18	27	34	50

Source: CNAF, 2008.

[44] The P-8A homeport location has not been determined other than this estimate to be assigned to the Atlantic Fleet.

Table 3.4-5 as set forth in the Homebasing EA illustrates the Duval County Airshed air quality impacts of the new helicopter platform at NAS Jacksonville and NS Mayport.

TABLE 3.4-5
AIR EMISSIONS ESTIMATES FOR MH-60R HOMEBASING AT NAS JACKSONVILLE AND NS MAYPORT

Total Net Change in Annual Air Emissions Under Alternative 1, Duval County Airshed, Florida					
	VOC	NOx	CO	SO_2	PM_{10}
NAS Jacksonville	0.20	0.84	1.82	0.06	0.56
NS Mayport	0.07	-0.57	-.82	-0.05	-0.48
Net Change	0.27	0.27	1.0	.01	.08

Key:
Source: DoN 2002b citing: USEPA 1992, Navy 2000a, E&E 2002.
Notes: Units of measure are in tons per year.
Key: CO = Carbon monoxide; NO_x=Nitrogen oxides; PM_{10} = Particulate matter; SO_2 = Sulfur dioxide; VOC = Volatile organic compound.

The aforementioned environmental study is considered here because it accounts for the bulk of the helicopter aircraft operating in the JAX Range Complex. The MH-60R aircraft typically conduct training events either over land or closer to shore than fixed-wing aircraft. This is shown in Table 3.4-1. Many of the increased training events are conducted by the MH-60R (*e.g.*, MISSILEX [A-S], and CSAR). The *de minimis* emission levels coupled with the attainment status of the AQCRs result in no significant impact on air quality.

Fixed-wing aircraft primarily conduct training operations in the far reaches of the JAX Range Complex, beyond the U.S. territorial limits (or at the Pinecastle Impact Range [evaluated separately]). Air quality may be temporarily compromised in locations where a high number of sorties engage in practice operations, but such consequence would be of limited duration and emissions would quickly disperse. Significant impacts to air quality beyond the U.S. territorial limits due to the high altitude of fixed-wing training operations (most above 3,000 feet) would not be expected.

3.4.3.4 No Action Alternative

The No Action Alternative consists of maintaining the current levels of training and testing in the JAX Range Complex. Thus, there would be no change in current levels of emissions associated with training or testing operations.

The primary source of air emissions under the No Action Alternative is fixed wing aircraft emissions. These emissions are primarily associated with ACM and EC training events. These events occur above 3,000 feet in altitude and beyond 12 nm from shore. Emissions are dispersed over the vast expanse of special use airspace. These factors prevent such emission from affecting Study Area air quality.

The cities/counties in North Carolina, South Carolina, Georgia, and Florida adjoining the range complex are currently designated as in attainment for all criteria pollutants. Included within this characterization of regional air quality are the existing Navy aircraft, surface ship, target, and weapon emissions. A continuation of baseline training and testing levels would not require a

General Conformity Rule determination because the training occurs in areas designated as attainment for all criteria pollutants. Therefore, there would be no significant impact to air quality from implementing the No Action Alternative.

The offshore reaches of the JAX and Charleston OPAREAs (beyond 12 nm) are not classifiable for priority pollutants under the CAA. Therefore, the CAA General Conformity Review is not applicable. Initial concentrations of air emissions over the ocean would disperse rapidly in the atmosphere. Because of the low initial concentrations and rapid dispersion of exhaust and explosion byproducts, there would not be any risk to human health. Therefore, there would be no significant harm to air quality from implementing the No Action Alternative.

3.4.3.5 Alternative 1

Under Alternative 1 there would be a minor increase in air pollutants within the Study Area in comparison to baseline levels. The CAA General Conformity Rules would not apply to the actions conducted within the North Carolina, South Carolina, Georgia, or Florida portions of the Study Area (those areas within the 12 nm jurisdiction of the CAA), as they are designated in attainment area for all criteria pollutants. The air quality impacts from surge level operations would be primarily from aircraft, target and missile emissions and associated mobile source emissions from support craft. These impacts would be minor, dispersed, and would be short-term in nature. Most of these training events take place above 3,000 feet above ground level (AGL). Air emissions above 3,000 feet AGL are not addressed in accordance with USEPA guidance (USEPA, 1992). Most training events also occur beyond 12 nm from shore, thus substantially reducing the likelihood that any of the associated emissions would mix with over land airsheds.

CAS usage would increase under Alternative 1 over current levels. Twenty-eight additional sorties are proposed in connection with CAS supported events (i.e., EC, AIC, DTE, and GUNEX (S-A)) under Alternative 1. CAS supported events would occur primarily above 3,000 feet and more than 12 nm from the shore. Thus, no significant impacts to air quality are expected from CAS flights or CAS supported events.

Under Alternative 1, there would be an increase in ACM, EC, MISSILEX (A-S) and Laser Targeting sorties. Emissions associated with these sorties would occur at least 12 nm from shore, and for ACM and EC would occur above the mixing layer. The increase in these aircraft emissions under Alternative 1 is, therefore, not likely to significantly impact neither the AQCRs nor global commons.

Certain events involving helicopters would increase under Alternative 2 (*e.g.*, MCM, Mine Neutralization); however, other helicopter events would not increase (*e.g.*, CSAR and GUNEX [A-S]). Overall, helicopter sorties are expected to increase slightly under Alternative 1. This increase is accounted for in helicopter sorties associated with infrequent major training events taking place well offshore in carrier operating areas. Therefore, these offshore emissions would be temporary and dispersed.

Baseline and future helicopter emissions levels were evaluated in the Jacksonville Fleet Concentration Area in the MH-60R/S Homebasing EA (DoN, 2002b). This EA has been incorporated by reference. According to the MH-60R siting study, the air emissions under the proposed action in the siting study were below the *de minimis* thresholds of 100 tpy for nitrogen dioxide and volatile organic compounds as required in the Florida SIP for NS Mayport. The MH-60 R/S Homebasing EA concluded that the proposed action (to base all MH-60R helicopters in the

Jacksonville Fleet Concentration Area) was exempt from the requirement for conformity under the General Conformity Rule and was presumed to conform to the Florida SIP.

As to other JAX Range Complex training events evaluated under Alternative 1, training levels are expected to be relatively consistent with baseline levels.

In conclusion, the actions evaluated under Alternative 1 generally take place either:

(i) within areas designated in attainment (North Carolina, South Carolina, Georgia, and Florida) for all criteria pollutants and, therefore, the CAA General Conformity Rule does not apply;

(ii) within offshore areas unclassified for priority pollutants, where surface ship and helicopter emissions are minimal and fixed wing aircraft typically produce emissions above the mixing layer.

Therefore, there would be no significant impact to air quality from implementing Alternative 1. Furthermore, there would be no significant harm to the air quality over non-territorial waters from implementing Alternative 1.

3.4.3.6 Alternative 2 (Preferred Alternative)

Like Alternative 1, under Alternative 2, there would be a minor increase in air pollutants within the EIS/OEIS Study Area in comparison to baseline levels. Under Alternative 2, there would be few additional increases in emissions over Alternative 1. These additional emissions would be derived from helicopter MCM and Mine Neutralization training during major exercises.

Like Alternative 1, emissions would increase under Alternative 2 due mostly to the increases in ACM and Laser Targeting sorties. Emissions associated with these sorties would occur at least 12 nm from shore, and for ACM would occur above the mixing layer. The increase in aircraft emissions under Alternative 2 is, therefore, not likely to significantly impact neither the AQCRs nor global commons. The air quality impacts from Alternative 2 operations would be primarily from aircraft, target and missile emissions, and associated mobile source emissions from support craft. These impacts would be minor, dispersed, and short-term in nature. As shown in Table 3.4-1, these events take place beyond the U.S. territorial waters, and associated emissions would not affect human receptors.

CAS usage would increase under Alternative 2 over current levels. Twenty-eight additional sorties are proposed in connection with CAS supported events (i.e., EC, AIC, DTE, and GUNEX (S-A)) under Alternative 2. CAS supported events would occur primarily above 3,000 feet and more than 12 nm from the shore. Thus, no significant impacts to air quality are expected from CAS flights or CAS supported events.

Under Alternative 2, there would be further slight increase in helicopter operations and an associated increase in helicopter emissions offshore from Charleston, South Carolina and within the Carrier Operating Area. Helicopter training events associated with the MIW Training Area proposed under Alternative 2 would constitute slight increases over those occurring under Alternative 1 for MIW exercises. These emissions would occur below 3,000 feet, but would occur no closer than 3 nm from shore. Because these emissions take place infrequently (during major exercises), and distant from shore, they are unlikely to impact the Charleston AQCR or other Study Area AQCRs. No significant additional emissions would be expected from use of the proposed MIW Training Area above the current emissions in that region.

In conclusion, the actions evaluated under Alternative 2 generally take place either:

(i) within areas designated in attainment (North Carolina, South Carolina, Georgia, and Florida) for all criteria pollutants and, therefore, the CAA General Conformity Rule does not apply;

(ii) within offshore areas unclassified for priority pollutants, where helicopter and surface ship emissions are minimal and fixed wing aircraft typically produce emissions above the mixing layer.

Therefore, there would be no significant impact to air quality from implementing Alternative 2. Furthermore, there would be no significant harm to the air quality over non-territorial waters from implementing Alternative 2.

3.4.4 Unavoidable Significant Environmental Effects

Under either proposed action alternative, participation of additional helicopter and fixed wing aircraft in Navy training within the JAX Range Complex would result in minor, short-term effects, such as minor increases of aircraft air emissions within the airsheds, but would have no unavoidable significant environmental effects.

3.4.5 Summary of Environmental Effects (NEPA and EO 12114)

Emissions associated with implementation of Alternatives 1 and 2 would result in minor increases in air emissions above baseline (No Action Alternative) conditions. Within U.S. territory, emissions are mainly associated with increased MH-60R operations, small boat, and range support craft motor emissions. Outside U.S. territory, emission increases are mainly associated with surface vessel operations, with additional contributions from aircraft operations. In conclusion, although Alternatives 1 and 2 would result in increases in emissions of air pollutants, all air impacts would be less than significant in scope and intensity for the following reasons:

- All training and testing events analyzed in this JAX FEIS/OEIS occur within areas designated by the USEPA as being in attainment for all criteria pollutants. Therefore, the General Conformity Rule does not apply.
- The majority of training event types and the majority of training event operations/sorties occur more than 12 nm from the shore and would not affect air quality for human receptors. Furthermore, the majority of aircraft training emissions occur above 3,000 feet (above the atmospheric inversion layer), and would have no impact on local air quality.
- MH-60R emissions associated with the Homebasing of the aircraft at NS Mayport were evaluated in an EA (DoN, 2002b) and determined to be below *de minimis* levels.
- Increases in helicopter emissions would occur mostly in connection with major training events and, therefore, would be infrequent, temporary and dispersed in nature.

As shown in Table 3.4-6, implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in significant adverse impacts to regional air quality. Implementation of the No Action Alternative, Alternative 1 or Alternative 2 would not result in significant harm to the air quality of the global commons.

TABLE 3.4-6
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON AIR QUALITY IN THE JAX RANGE COMPLEX STUDY AREA

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	NEPA (U.S. Territory)	Executive Order 12114 (Non-Territorial Waters, >12 nm)
No Action		
Surface ship Emissions	Minor localized emissions. Coastal counties in attainment for all criteria pollutants.	Minor at-sea emissions. No long-term harm to the global commons.
Helicopter emissions	Minor localized emissions. Coastal and interior FL counties in attainment for all criteria pollutants.	Minor at-sea emissions. No long-term harm to the global commons.
Fixed-wing aircraft emissions	Minor localized emissions. Coastal and interior FL counties in attainment for all criteria pollutants.	Minor at-sea emissions. No long-term harm to the global commons.
Weapon and target emissions	Negligible impacts.	Negligible harm to the global commons.
Conclusion	No significant impacts to Study Area air quality.	No significant harm to Study Area air quality.
Alternative 1		
Surface ship Emissions	Minor localized emissions. Coastal counties in attainment for all criteria pollutants.	Minor at-sea emissions. No long-term harm to the global commons.
Helicopter emissions	Minor localized emissions Coastal and interior FL counties in attainment for all criteria pollutants.	Minor at-sea emissions. No long-term harm to the global commons.
Fixed-wing aircraft emissions	Minor localized emissions. Coastal and interior FL counties in attainment for all criteria pollutants.	Minor at-sea emissions. No long-term harm to the global commons.
Weapon and target emissions	Negligible impacts.	Negligible harm to the global commons.
Conclusion	No significant impacts to Study Area air quality.	No significant harm to Study Area air quality.

TABLE 3.4-6 (Continued)
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON AIR QUALITY IN THE JAX RANGE COMPLEX STUDY AREA

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	NEPA (U.S. Territory)	Executive Order 12114 (Non-Territorial Waters, >12 nm)
Alternative 2		
Surface ship Emissions	Minor localized emissions. Coastal counties in attainment for all criteria pollutants.	Minor at-sea emissions. No long-term harm to the global commons.
Helicopter emissions	Minor localized emissions. Coastal and interior FL counties in attainment for all criteria pollutants.	Minor at-sea emissions. No long-term harm to the global commons.
Fixed-wing aircraft emissions	Minor localized emissions. Coastal and interior FL counties in attainment for all criteria pollutants.	Minor at-sea emissions. No long-term harm to the global commons.
Weapon and target emissions	Negligible impacts. Coastal and interior FL counties in attainment for all criteria pollutants.	Negligible harm to the global commons.
Conclusion	No significant impacts to Study Area air quality.	No significant harm to Study Area air quality.

3.5 AIRBORNE NOISE

3.5.1 Introduction and Methods

Sound is a physical phenomenon and a form of energy that can be described, measured, and represented with mathematical expressions. Noise, on the other hand, is not a physical process, but rather an implicit social value, defined generally as unwanted sound. Recognition of sound is based on the receptor's objective and reproducible response to sound's primary physical attributes: intensity (perceived by the receptor as loudness), frequency (perceived as pitch), frequency distribution and variation over time, and duration (whether continuous, sporadic, or impulse). Perception of sound, however, is subjective and circumstantial. Sounds that are soothing to some are annoying to others, and sounds barely noticed and generally ignored in one circumstance, may be considered highly objectionable in another circumstance.

Beyond subjective effects, however, sound at higher intensities or power levels can have physical consequences. The range of such impacts have been defined as falling into three categories as sound pressure levels increase: subjective effects (*e.g.,* annoyance, nuisance, dissatisfaction), interferences with activities (*e.g.,* communication, sleep, learning, behavioral changes), and physiological effects (*e.g.,* anxiety, hearing impacts, loss of hearing).

The analysis presented in this section is limited to potential impacts from airborne noise. Impacts of military-generated underwater sound on natural resources are addressed in Sections 3.6 (Marine Communities), 3.7 (Marine Mammals), 3.8 (Sea Turtles), 3.9 (Fish), and 3.10 (Seabirds and Migratory Birds). Impacts on terrestrial biological resources are addressed in Section 3.11.

3.5.1.1 Sound Characteristics

Sound Fundamentals

Sound is typically described by its magnitude (otherwise referred to as amplitude), intensity, and frequency and the changes in those values over time (*e.g.,* sudden impulse vs. continuous vs. repetitive). The physical phenomenon of sound is generated by mechanical vibrations traveling through an elastic medium (*i.e.,* air or water), resulting in a rapid change in pressure (high and low pressure fluctuations or waves) in the medium.

Sound waves are characterized by parameters such as amplitude, intensity, wavelength, frequency, and velocity. The amount of energy contained in a sound pressure wave is referred to as its amplitude, while the amount of energy passing through a unit area per unit of time is the sound wave's intensity. The units of sound intensity are watts per square meter (energy per unit of time per unit of area). Amplitude and intensity are directly and linearly related. Higher amplitude sounds are perceived to be louder than lower amplitude sounds. Sound pressures are usually represented in Pascals (Pa). A Pa is equal to one Newton of force distributed over one square meter. The maximum noise pressure level of a noise event is referred to as the "peak noise level."

The frequency of sound represents the rate at which the source produces sound waves (a complete cycle of high and low pressure waves) or the rate at which the sound-producing body completes one vibration cycle. Frequency is a precisely measurable quantity representative of a particular sound. Sounds are produced throughout a wide range of frequencies, including frequencies beyond the audible range of a given receptor. Most of the sounds heard in the environment do

not consist of a single frequency, but rather a broad band of frequencies differing in sound level. The intensities of each frequency add to generate perceptible sound.

The speed of sound is not affected by its intensity, amplitude, or frequency, but rather is dependent wholly on the characteristics of the medium through which it is passing. Sound generally travels faster as the density of the medium increases. Speeds of sound through air are primarily influenced by air temperature, and negligibly by the air's relative humidity and pressure, averaging about 1,115 ft/s (340 m/s) at standard barometric pressure. Sound speeds in air increase as air temperature increases. Speed of sounds in liquid is similarly influenced primarily by the liquid's density and temperature. Thus, the speed of sound in 32ºF water is 4,600 ft/s and in 68ºF water is 4,862 ft/s.

The speed of sounds in solids is a more complex matter, with longitudinal and transverse waves traveling at different speeds depending on the density of the material as well as its geometry and molecular structure.

The mathematical relationship between sound stimulus and sound perception by a receptor is logarithmic. This logarithmic relationship between magnitude and perception is the basis for the decibel (dB) scale used to express sound intensity. The dB scale measures relative sound intensities rather than absolute intensities; specifically, it measures the ratio of a given intensity (of sound) to the threshold sound intensity of human hearing (by definition 0 dB). For most humans, a sound wave pressure of 20 micro Pa (μPa) represents the hearing threshold. As sound stimuli increase geometrically (*i.e.,* multiplied by a fixed factor), the corresponding perception changes arithmetically (*i.e.,* additive by constant amounts). Thus, a tenfold increase in sound stimulus over the threshold of hearing is assigned a value of 10 dB but is perceived as a doubling of loudness; a hundredfold increase to 20 dB is perceived as sound four times louder, and so forth.

Although sound is a physical phenomenon that can be represented by mathematical expressions and measured with precision, perception of sound pressure levels (SPL) is the result of physiological responses as well as subjective factors, each influenced by current circumstances and past exposures. The SPL is the perception of a sound wave's pressure by a single receptor at a specified distance and direction from the sound source.

SPLs are measured by sound level meters, which typically contain filters that reduce the meter's sensitivity to frequencies of little or no relevance to the receptor. The method commonly used to quantify environmental sounds consists of determining all frequencies according to a weighting system that reflects the nonlinear response characteristics of the human ear. A meter that filters very low and very high frequency sounds thus acts as a general approximation of the human ear's response to sounds of medium intensity. This is called "A" weighting, and the decibel level measured is called the A-weighted sound level (dBA). In practice, the level of a noise source is conveniently measured using a sound level meter that includes a filter corresponding to the dBA curve.

Sound meters also can be used to measure loud high- and middle-frequency sound (B-weighted), very loud low-frequency sound (C-weighted), very loud sounds associated with aircraft (D-weighted), and infrasound (<20Hz), or low-frequency sound including frequencies below the lower limit of human auditory response (10 to 200 Hz (G-weighted)). Infrasound propagates farther than sound of higher frequencies, and typically is perceived not only as sound, but as tactile sensation such as vibration.

A closely related value to the SPL is the sound power level, expressed as PWL or LW. The sound power level represents the total sound power emanating from a source in all directions. While each individual receptor is experiencing the sound's pressure level, the overall impact of a sound source on the environment is properly represented by the sound power level because, in most circumstances and discounting the effects of reflection and absorption, sound waves will propagate spherically from a point source to impact many receptors at different pressure levels, depending on their distance from the source.

A common method of describing SPLs is by comparing commonly experienced sounds. Typical sound sources and their corresponding environments are listed in Figure 3.5-1. The sound levels indicated are for single events. Such events are discrete, and two or more events cannot simply be added together. Integrating varying noise levels and sources over a given period requires complex calculations or modeling.

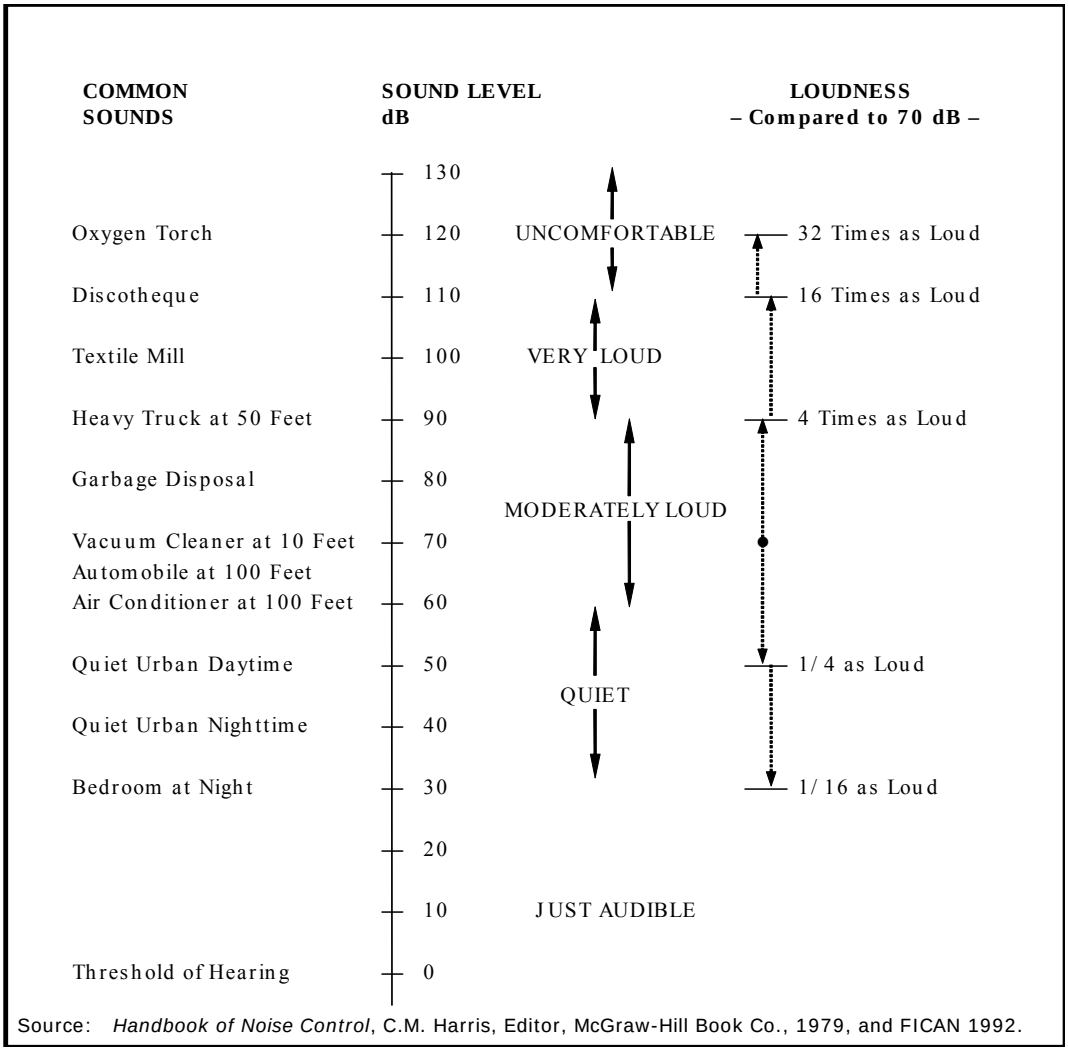
To describe the time-varying character of environmental noise, the statistical noise descriptors L_{10}, L_{50}, and L_{90} are commonly used. They are the noise levels equaled or exceeded during 10 percent, 50 percent, and 90 percent of a stated period, respectively. L_{10} values reflect transient or short-term events, while L_{90} values describe the most prevalent noise conditions. The acoustic range of the noise source is determined by measuring the maximum (L_{max}) and minimum (L_{min}) sound levels. The L_{min} value obtained for a particular monitoring location is the "acoustic floor" for that location.

A sound measure employed by federal agencies is known as the Day-Night Average Sound Level (L_{dn}). The L_{dn} is defined as the A-weighted average sound level for a 24-hour day. It is a calculated noise metric derived from measurements, but includes a 10-dB penalty for late-night (*i.e.*, 10:00 p.m. to 7:00 a.m.) sound levels. This penalty accounts for the increased sensitivity of humans to noise at night.

Sound Propagation

Understanding the impact of sound on a receptor requires a basic understanding of how sound propagates from its source. Sound propagation follows the inverse square law: the intensity of a sound wave deceases inversely with the square of the distance between the source and the receptor. Thus, doubling the distance between the receptor and a sound source results in a reduction in the intensity of the sound of one fourth of its initial value; tripling the distance results in one ninth of the original intensity, and so on.

The distinctions between airborne sound and underwater sound transmission are based upon the different physical characteristics of the two media. In general, sound is transmitted much more efficiently in water than in air. A simple rule-of-thumb is to add 62 dB to airborne sound levels to get the underwater equivalents.



Source: *Handbook of Noise Control*, C.M. Harris, Editor, McGraw-Hill Book Co., 1979, and FICAN 1992.

Figure 3.5-1. Sound Levels of Typical Airborne Noise Sources and Environments

3.5.1.2 Regulatory Framework

The Navy meets its noise management obligations at air-to-ground training ranges (*i.e.*, on-land targets) through the Range Air Installations Compatible Use Zone (RAICUZ) program found in OPNAV Instruction 3550.1A (DoN, 2008). RAICUZ Program implementation includes developing current and future Range Compatibility Zones and current and prospective noise analysis for the range, partnering with appropriate federal, state, and local government agencies (working with these agencies for compatible land use near and around the ranges), considering operational alternatives as necessary, implementing a complaint response program in the surrounding communities, and developing strategies to protect the long term viability of the range while maintaining a high degree of public safety (DoN, 2008). According to Appendix C of OPNAVINST 3550.1A, the only air-to-ground ranges within the JAX Range Complex, wherein the RAICUZ Program requirements must

be implemented are R-2906 Rodman Target, R-2907 Lake George Complex Targets, and R-2910 Pinecastle Complex Targets (DoN, 2008).

The JAX and Charleston OPAREAs are over water and distant from any noise receptors. The RAICUZ program is inapplicable to this vast area. On the other hand, RAICUZ studies have been developed for the Lake George Range and Rodman Range. These studies are discussed further in Section 3.5.6.2. The Pinecastle Complex Targets are not covered in this FEIS/OEIS.

DoD has a similar program for air stations, called the Air Installation Compatibility Use Zone (AICUZ) program (DoN, 2002c). The foundation of the AICUZ program is an active local command effort to work with local, state, regional, other federal agencies, and community leaders to encourage compatible development of land adjacent to military airfields. The Navy is particularly susceptible to such encroachment with many of its installations located in high growth urban areas. The AICUZ process involves four basic steps:

1. Develop, and periodically update, a study for each air installation to quantify aircraft noise zones and identify accident potential zones; develop a noise reduction strategy for impacted lands, both on and off the installation; prepare a compatible land use plan for the installation and surrounding areas; and develop a strategy to promote compatible development on land within these areas.
2. Develop a prospective long-term (5 to 10 years) AICUZ analysis to illustrate impact on known future missions and how it will be implemented by the AICUZ program.
3. Implement the AICUZ plan for the installation including coordination with federal, state and local officials to maintain public awareness of AICUZ.
4. Identify and program property rights acquisition and sound suppression projects when appropriate in critical areas, where action to achieve compatibility within AICUZ program guidelines through local land use controls is either impossible or has been attempted and proven unsuccessful.

Although not within the boundaries of the JAX Range Complex and not analyzed in this FEIS/OEIS, NAS Jacksonville and NS Mayport are mentioned due to their proximity to the Range Complex, and because the aircraft stationed there are primary users of the range complex. On June 27, 1978, the Jacksonville City Council passed an Air Installation Compatible Use Zone ordinance that proved to be landmark legislation. The AICUZ ordinance ultimately limited building around the three Naval Air Stations (NS Mayport, NAS Cecil Field, and NAS Jacksonville) and the civilian airport (NAS Jacksonville, 2007).

In February 2001, NS Mayport conducted noise studies in support of an update to its 1993 AICUZ. NS Mayport conducted this new noise study to assess current noise impacts of aircraft operations and establish new noise exposure contours. While helicopter operations make up the vast majority of the flight operations at NS Mayport, the extent of the noise contours is primarily influenced by fixed-wing transient aircraft to the installation. The main sources of noise at NS Mayport are aircraft operations, which include take-offs, landings, touch-and-go operations, and engine maintenance run-ups at the station. These noise sources impact land use on the installation as well as surrounding developed areas that are potentially incompatible with flight operations, such as residential developments, schools, and churches. Aircraft noise was the primary reason for the development of the AICUZ program.

Both DoD and Federal Aviation Administration AICUZ guidelines were incorporated into a City of Jacksonville Airport District Zoning Ordinance of which the Navy is in full compliance. Although

NS Mayport complies with all federal and local regulations regarding noise and land use, it still receives intermittent complaints from area residents. Complaints are resolved through open communication with the Air Operations Department which responds to all noise complaints. It is worth noting that since 1988 air operations at NS Mayport have decreased by 48 percent, thus decreasing local noise levels.

3.5.2 Assessment Methods and Data Used

The method used in this FEIS/OEIS to assess the noise environment impacts associated with existing and proposed Navy training and testing within the JAX Range Complex includes following the below steps:

- Analyze existing federal noise management regulations applicable to the proposed action;
- Consider existing Navy policies affecting noise production levels (*e.g.,* the RAICUZ Program and range Standard Operating Procedures);
- Analyze the natural ambient or background noise levels in the range complex;
- Analyze the various types of noise sources associated with training and testing within the JAX Range Complex (*e.g.,* continuous versus impulsive noises);
- Review existing noise studies performed in connection with homebasing decisions, individual exercises, or tests;
- Determine the overall noise environment impacts associated with existing Navy training and testing within the range complex given the regulatory/procedural framework; and
- Determine the overall noise environment impacts associated with the proposed Navy training and testing within the range complex given the regulatory/procedural framework.

The analysis presented in this section is limited to impacts of airborne sound on humans. Impacts of military-generated, including underwater sound, on natural resources are addressed in Sections 3.6 (Marine Communities), 3.7 (Marine Mammals), 3.8 (Sea Turtles), 3.9 (Fish), and 3.10 (Seabirds and Migratory Birds). Impacts on terrestrial biological resources are addressed in Section 3.11.

3.5.3 Warfare Areas and Associated Environmental Stressors

Table 3.5-1 illustrates the various training events that occur within the JAX Range Complex and the noise sources.

3.5.4 Affected Environment

Various activities and processes, both natural and anthropogenic, above and below the water's surface, contribute to the sound profile of the ocean environment. This section focuses on sound above the water's surface and its potential impacts to human receptors. Later sections of this FEIS/OEIS will describe the potential impacts of underwater sound on human divers and marine species. Section 3.5.6.1 describes the affected sound environment offshore, while Section 3.5.6.2 describes the affected sound environment nearshore and overland.

3.5.4.1 Jacksonville OPAREA and Charleston OPAREA

Sound in the Ocean Environment

Ambient airborne sound in the ocean environment typically consists of continuous noise sources emanating from breaking waves and wind. In general, ambient sound levels tend to be greatest in relatively shallow nearshore environments and appear to be directly related to wind speeds and

TABLE 3.5-1
WARFARE AREAS AND NOISE-RELATED ENVIRONMENTAL STRESSORS

		Stressors				Location			
Warfare Area and Operation	Training Areas	Surface Vessel Noise	Helicopter Noise	Fixed Wing Aircraft Noise	Ordnance Noise	Below 3,000 feet	Above 3,000 feet	Overland or within 12 nm from Shore	Beyond 12 nm from Shore
Mine Warfare (MIW)									
Mine Laying	Lake George Range			✓	✓		✓	✓	
MCM	Carrier Operating Areas		✓		✓	✓		✓	
Mine Neutralization	Charleston OPAREA (10L and 12I)	✓	✓		✓	✓			✓
Surface Warfare (SUW)									
MISSILEX (A-S)	W-157A (Area 4X) and W-159A (Area 5X)		✓	✓	✓		✓		✓
GUNEX (A-S)	W-132, W-133, W-134, W-157, W-158		✓		✓	✓			✓
GUNEX (S-S) Boat	Charleston OPAREA (Area 11J)	✓			✓	✓		✓	
GUNEX (S-S) Ship	JAX OPAREA (Gunnery Areas AA, BB, and CC)	✓			✓	✓			✓
BOMBEX (A-S) (at sea)	HE, W-158A (31J); NEPM, W-157A/B, W-158A/B			✓	✓		✓		✓
Laser Targeting	W-132, W-133, W-134, W-157, W-158		✓	✓		✓	✓		✓
GUNEX (S-S) (FAC/FIAC)	Amber Strait: Charleston OPAREA (Boxes Q-9&10, R-9&10)	✓				✓			✓
VBSS/MIO-Ship	JAX and Charleston OPAREAs	✓				✓			✓
VBSS/MIO-Helicopter	W-157A (Area 4X) and W-159A (Area 5X)		✓			✓			✓
Air Warfare (AW)									
ACM	W-157A (Areas 3X & 4X)			✓			✓		✓
Air Intercept Control	W-132, W-133, W-134, W-157, W-158			✓			✓		✓
ACM Chaff Exercise	W-157A (Areas 3X & 4X)			✓	✓		✓		✓

TABLE 3.5-1 (Continued)
WARFARE AREAS AND NOISE-RELATED ENVIRONMENTAL STRESSORS

		Stressors				Location			
Warfare Area and Operation	Training Areas	Surface Vessel Noise	Helicopter Noise	Fixed Wing Aircraft Noise	Ordnance Noise	Below 3,000 feet	Above 3,000 feet	Overland or within 12 nm from Shore	Beyond 12 nm from Shore
ACM Flare Exercise	W-157A (Areas 3X & 4X)			✓	✓		✓		✓
MISSILEX (A-A)	W-132, W-133, W-134, W-157, W-158			✓	✓		✓		✓
MISSILEX (S-A)		✓			✓		✓		✓
Detect-to-Engage	W-132, W-133, W-134, W-157, W-158	✓		✓		✓	✓		✓
GUNEX (S-A)	JAX OPAREA (Gunnery Areas AA, BB, & CC)	✓		✓	✓	✓	✓		✓
GUNEX (A_A)	W-157A/W-133 (Area 2X)			✓			✓		✓
Amphibious Warfare (AMW)									
FIREX with IMPASS	JAX OPAREA (Gunnery Areas BB and CC)	✓			✓	✓			✓
Strike Warfare (STW)									
BOMBEX (A-G)	Rodman Range			✓	✓	✓	✓	✓	
CSAR and Convoy Operations	Rodman Range		✓		✓	✓		✓	
Electronic Combat (EC)									
EC Operations- Aircraft	W-132, W-133, W-134, W-157, W-158			✓			✓		✓
EC Operations- Surface Ships	JAX and Charleston OPAREAs	✓		✓		✓			✓
Chaff Exercise	JAX and Charleston OPAREAs	✓	✓		✓	✓			✓
Flare Exercise- Helicopter	Lake George Range		✓		✓	✓		✓	
Other Events									
SESEF Utilization	5-15 nm east of NS Mayport	✓				✓		✓	
Precision Anchoring	NS Mayport	✓				✓		✓	

TABLE 3.5-1 (Continued)
WARFARE AREAS AND NOISE-RELATED ENVIRONMENTAL STRESSORS

		Stressors				Location			
Warfare Area and Operation	Training Areas	Surface Vessel Noise	Helicopter Noise	Fixed Wing Aircraft Noise	Ordnance Noise	Below 3,000 feet	Above 3,000 feet	Overland or within 12 nm from Shore	Beyond 12 nm from Shore
Small Arms with anti-swimmer grenades (MK3A2)	Charleston OPAREA (Area 10L, 12I)	✓						✓	

indirectly related to sea-state (Willie and Geyer, 1984). Intermittent airborne noise sources also include those from man-made sources. In addition to sound from shipping, other manmade sources of airborne noise include military, general aviation, and commercial aircraft; dredging; nearshore construction activities; military explosive use; oil and gas exploration and extraction; mineral exploration and extraction; and geophysical surveys.

Sound from Military Sources

Airborne noise attributable to military activities in the JAX Range Complex emanates from multiple sources including naval ship power plants, military aircraft, surface or airborne targets, bombs, missiles, small arms, and water-based demolitions. Sound from military sources in the JAX Range Complex is virtually all transitory, and can be widely dispersed or concentrated in small areas for varying periods. Though much less numerous, sound levels from individual naval ships are analogous to sound levels of commercial ships.

Aircraft Overflights

Aircraft flying over water contribute sound into the ocean environment. Motors, propellers, or rotors provide the major contributions, while aerodynamic turbulence also can contribute. In general, helicopters produce higher intensity sounds than fixed wing aircraft (Richardson, *et. al.*, 1995). Helicopter training activities are a common source of airborne sound in offshore areas. As with most manmade sounds, most aircraft sounds involve low frequencies. The angle of incidence of a sound wave propagating from an aircraft must enter the water at an angle of incidence of 13º from the vertical or less for the wave to continue propagating under the water's surface. At greater angles of incidence, the water surface acts as an effective reflector of the sound wave and very little penetration of the wave below the water occurs (Urick, 1972). Military activities involving aircraft generally are dispersed over large expanse of the open ocean, but can be highly concentrated in time and location near NS Mayport. Representative airborne sound levels associated with military aircraft are depicted in Table 3.5-2. Supersonic aircraft flights can occur from time to time within the SUA over the JAX and Charleston OPAREAs. Such flights are usually limited to altitudes above 30,000 feet and/or locations more

TABLE 3.5-2
REPRESENTATIVE AIRCRAFT AND ORDNANCE SOUND SOURCES IN THE JAX RANGE COMPLEX

Noise Source	Sound Level (dBA)	Typical Noise Environment
Jet Aircraft under Military Power	144 @ 50 ft.	OPAREAs at Aircraft Carrier
Jet Aircraft under Afterburner	148 @ 50 ft.	OPAREAs at Aircraft Carrier
H-60[45] Helicopter Hovering	90 @ 50 ft.	OPAREAs, Rodman Range
Smoke Marker MK-58, 25	60 @ 50 ft.	OPAREAs
Mineshapes (BDU-45)	105 @ 50 ft.	OPAREAs, Lake George Range
Chaff Packets (at impact) Aircraft	90 @ 50 ft.	OPAREAs
Aircraft Defensive Flares	65 @ 50 ft.	OPAREAs, Lake George Range
NEPM Bombs 25 lbs, spotting charge	60 @ 50 ft.	JAX OPAREA, Rodman Range
NEPM Bombs 500 lbs (at impact)	105 @ 50 ft.	JAX OPAREA, Lake George Range
NEPM Bombs 1,000 lbs (at impact)	108 @ 50 ft.	JAX OPAREA, Lake George Range
HE 2.75" Rockets	90 @50 ft.	JAX OPAREA
High Explosive (HE) MK-82*	136 dBP @ 1000 ft.	JAX OPAREA
HE MK-83*	138 dBP @ 1000 ft.	JAX OPAREA
HE MK-84*	141 dBP @ 1000 ft.	JAX OPAREA
Naval Gun Ammunition five inch	110 @ 50 ft.	JAX OPAREA
Cannon Shells 20mm (at source)	105 @ 50 ft.	JAX OPAREA
Cannon Shells 25mm (at source)	110 @ 50 ft.	JAX OPAREA
7.62mm M60 Machine Gun	90 @ 50 ft.	OPAREAs
.50 cal Machine Gun	98 @ 50 ft. (or 136dBP, at 50 ft)	OPAREAs

*Notes: 50 feet and 1,000 feet are standard reference distances; BDU - Bomb Dummy Unit; cal - caliber; dBA - decibels, A-weighted; ft - feet; lbs - pounds; mm - millimeters; NEPM: Non-explosive practice munition; HE: high explosive; dBP (peak sound level). * Noise levels predicted using US Army Corps of Engineers BNOISE 2 model Source: Investigative Science and Engineering (ISE), 1997; CDR Solberg, 2008.*

than 30 nm from shore (CINCLANTFLT, 1993). Several factors influence sonic booms: weight, size, shape or aircraft or vehicle; altitude; flight paths; and atmospheric conditions. A larger and heavier aircraft must displace more air and create more lift to sustain flight, compared with small, light aircraft. Therefore, larger aircraft create sonic booms that are stronger and louder than those of smaller, lighter aircraft. Consequently, the larger and heavier the aircraft, the stronger the shock waves will be (NASA, 2008).

Of all the factors influencing sonic booms, increasing altitude is the most effective method of reducing sonic boom intensity. The width of the boom "carpet" or area exposed to sonic boom beneath an aircraft is about 1 mile for each 1,000 feet of altitude. For example, an aircraft flying supersonic straight and level at 50,000 feet can produce a sonic boom carpet about 50 miles wide. The sonic boom, however, will not be uniform. Maximum intensity is directly beneath the aircraft, and decreases as the lateral distance from the flight path increases until shock waves refract away from the ground and the sonic boom attenuates. The lateral spreading of the sonic

[45] Noise Data for the SH-60B/F platform is considered comparable to the H-60 platform evaluated in this EIS/OEIS.

boom depends only on altitude, speed, and the atmosphere, and is independent of the vehicle's shape, size, and weight. The ratio of the aircraft length to maximum cross sectional area also influences the intensity of the sonic boom. The longer and more slender the aircraft, the weaker the shock waves. The wider and more blunt the vehicle, the stronger the shock wave can be (NASA, 2008).

Sonic booms are generated as aircraft reach Mach 1.0 (speed of sound) and increase in intensity as the Mach number increases. Increasing speeds above Mach 1.3 result in only small changes in shock wave strength. The direction of travel and strength of shock waves are influenced by wind, speed, direction, air temperature, and pressure. At speeds slightly greater than Mach 1.0, the effect of these factors can be significant, but their influence is small at speeds greater than Mach 1.3. Therefore, supersonic flight activity has been characterized for aircraft capable of supersonic flight at a fixed speed of Mach 1.3 and at various altitudes in standard atmospheric conditions (NASA, 2008). A detailed discussion of sonic booms is provided in Appendix H.

In addition to Navy aircraft, commercial air services (CAS) aircraft also produce airborne noise. CAS aircraft include Lear jets, tankers, small propeller drive aircraft, and Kafir jets. The noise generated by these CAS aircraft will occur during Electronic Combat (EC), Air Intercept Control (AIC), GUNEX (S-A), and Detect-to-Engage (DTE) events. Most noise generated by these aircraft will occur above 3,000 feet and greater than 12 nm from shore. Therefore, no significant impacts to the noise environment are expected to result from CAS aircraft participation in these events within the Study Area. CAS aircraft supporting JAX Range Complex training depart from NAS Jacksonville. The Proposed Action (either Alternative 1 or 2) includes only 28 additional sorties per year by CAS aircraft over baseline conditions. The takeoff and landings by CAS aircraft at NAS Jacksonville under any alternative will not affect the existing noise contours at NAS Jacksonville.

Ordnance Use

Sound results from ordnance use in the JAX Range Complex, both within the JAX and Charleston OPAREAs and at the Rodman and Lake George Ranges. Representative airborne sound levels associated with ordnance are depicted in Table 3.5-2.

Missile and Target Launch

Sound associated with missile and target launches occurs in the JAX OPAREA during scheduled events. Due to safety concerns over launch activities, a buffer zone of several square miles is always instituted and enforced. Sound due to missile and target launches is typically at a maximum at the point of initiation of the booster rocket, and rapidly fades as (1) the missile or target reaches optimal thrust conditions; and (2) the missile or target reaches a downrange distance where the booster burns out and the sustainer engine continues. For example, data for the BQM-34 show that its booster Jet Assisted Take-Off (JATO) bottles generate 113 dBA at the source at launch. Sound levels decrease to 99 dBA at 2,400 feet (732 m) (DoN, 1998). The BQM-34 is used in the JAX OPAREA (though much less frequently than the smaller BQM-74). The BQM-74, the typical target, is launched from surface vessels (*e.g.,* the Theater Support Vessel Prevail) via a rail by a solid rocket booster and sustained by a small conventional jet engine (Figure 3.5-2). The typical time that such target drones are launched is during the COMPTUEX conducted a few times per year. Missiles are launched from high-altitude aircraft and from surface ships in the offshore area. The sound of a Hellfire missile detonation is described in the Overseas Environmental Assessment of Testing the Hellfire Missile System's Integration with the H-60 Helicopter (NAVAIR, 2005). The greatest sound intensity

generated from the firing of a Hellfire missile is approximately 149 dB re 1 µPa at 15 feet altitude (NAVAIR, 2005). Due to the great distance from shore where these events occur, these explosions are not likely to impact human sound receptors ashore.

Non-Explosive Impact Noise

Non-explosive impact sound in the OPAREAs is generally from high-velocity "dummy" projectiles and NEPM training bombs. Sounds of this type are produced by the kinetic energy transfer of the object with the target surface, and are highly localized to the area of disturbance. Sound associated with the impact event is typically of low frequency (less than 250 Hz) and of a short enough duration (*i.e.*, impulse sound) that it produces negligible amounts of acoustic energy. These events occur on remote ranges that are restricted from the public, so they often go unobserved and unheard. The impacts may be scored by remote observers - participants in the exercise who are at a safe distance from the source.



Figure 3.5-2: Target Drone Launch

Explosives

Explosives detonated underwater introduce loud, impulsive, broadband sounds into the marine environment. The acoustic energy of an explosive is generally greater than that of sonar. The maritime environmental affects of explosives detonated at the water surface or underwater are discussed later in individual FEIS/OEIS sections on marine communities, sea turtles, marine mammals, and essential fish habitat. Three source parameters influence the effect of an explosive: the weight of the explosive warhead, the type of explosive material, and the detonation depth. The NEW accounts for the first two parameters. The NEW of an explosive is the weight of the explosive material in a given round, referenced to the explosive power of trinitrotoluene.

The detonation depth of an explosive is important due to a propagation effect known as surface-image interference. For sources located near the sea surface, a distinct interference pattern arises from the coherent sum of the two paths that differ only by a single reflection from the pressure-release surface. As the source depth and/or the source frequency decreases, these two paths increasingly, destructively interfere with each other, reaching total cancellation at the surface (barring surface reflection scattering loss). Since most explosive sources used in military activities in the OPAREAs are munitions that detonate essentially upon impact, the effective source depths are quite shallow and therefore the surface-image interference effect can be pronounced. Table 3.5-3 identifies explosive ordnance types used, corresponding NEWs, and expected detonation depths.

3.5.4.2 Inland Ranges: Lake George Range and Rodman Range

Sound Sources

Sound from Ordnance

Sound attributable to ordnance at the Lake George and Rodman Ranges results from bombing with NEPM ordnance. The types and quantities of ordnance expended, and thus the sound levels generated, depend on the training objectives and the range used. High explosive ordnance is not

permitted at either range. Bombs used at the Rodman Range have a small spotting charge attached to the bomb. The spotting charge is a small smoke charge activated by a mechanical fuse when the bomb hits the ground to readily see where the bomb hits the target for scoring

TABLE 3.5-3
EXPLOSIVE SOURCES IN THE JAX AND CHARLESTON OPAREAS

Ordnance	Net Explosive Weight	Detonation Depth
5" Naval gunfire	8.5 lbs	1 ft
Hellfire AGM-114 missile	8 lbs	At surface
Maverick missile	80 lbs	At surface
AIM-7 missile	86 lbs	N/A - High altitude above surface
AIM-9 missile	88 lbs	N/A - High altitude above surface
AIM-120 missile	340 lbs	N/A - High altitude above surface
MK-20 bomb	98.5 lbs	3.28 ft
MK-82 bomb	192.9 lbs	3.28 ft
MK-83 bomb	415.8bs	3.28 ft
MK-84 bomb	944.7 lbs	3.28 ft
MK3A2 Anti-swimmer grenade	0.5 lbs	Mid-Column
Underwater Demolition Charges[46]	20 lbs	Mid-Column

purposes. Table 3.5-2 depicts sound levels for representative ordnance types utilized in military training at the Lake George Range and Rodman Range. Like the NEPM ordnance used in the OPAREAs, the NEPM used at the Lake George and Rodman Range produce sound by the kinetic energy transfer of the object with the target surface, and are highly localized to the area of disturbance. Sound associated with the impact event is typically of low frequency (less than 250 Hz) and of a short enough duration (*i.e.*, impulse sound) that it produces negligible amounts of acoustic energy. These events occur on remote ranges that are restricted from the public, so they often go unobserved and unheard. The impacts may be scored by remote observers - participants in the exercise who are at a safe distance from the source.

Aircraft Overflights

Fixed-wing aircraft activities at the Lake George and Rodman Ranges are in the form of aircraft overflights associated with mine laying events (Lake George Range) and Air-to-Ground bombing events (Rodman Range). Helicopter overflights also occur at the Rodman Range associated with Combat Search and Rescue events, and at the Lake George Range associated with flare exercises. Noise associated with the Rodman Range use is generated primarily by low-level operation of rotary-wing aircraft and F/A-18 aircraft within the range boundaries.

The DoD NOISEMAP (MR_NMAP) program was used to generate noise level contours for existing Lake George Range and Rodman Range operations. Flight operations on the Rodman Range were modeled with MR_NMAP Version 2.2 (DoN, 2007a). Since HE ordnance is not authorized at this range, ordnance noise was not modeled. Model input consisted of a digitized representation of the ranges, departure and arrival flight tracks, and air operational data. Using these data, both sideline and takeoff noise emissions levels are selected for each class of aircraft,

[46] These charges occur within designated mine warfare training areas within the Charleston OPAREA.

applied to the flight track model, and summed over the total yearly number of operations (DoN, 2007a).

Figure 3.5-3 depicts the RAICUZ noise contours at the Rodman Range. Due to low sound levels at the Lake George Range, no noise contours were developed (Figure 3.5-4 illustrates the Lake George baseline aircraft flight tracks). Based on the noise values at Rodman Range, most of the area affected by aircraft operations lies within the range boundaries.

Rodman Range operational requirements are outlined in an Operations Manual published by Fleet Area Control and Surveillance Facility (FACSFAC JAX) (FACSFAC JAX INSTRUCTION 3000.1D). The air operations manual mandates a number of safety measures including specific flight paths and airspace restrictions. Pilots using the Rodman Range must follow specific speed, altitude, and direction requirements. These requirements are designed to protect both public and military personnel. Rodman Range operations normally occur any time between 7:00 a.m. and 11:00 p.m., Monday through Thursday, and 8:00 a.m. to Midnight on Friday, but can occur at other times by exception. The majority of operations occur during daylight hours. This fact reduces the potential for noise impacts at night, when people would be most sensitive to noise.

MR_NMAP was also used to calculate L_{dnmr} levels for FY2004 operations at the Lake George Range (DoN, 2007b). The resulting levels were below 55 dB and were thus are not depicted. According to the Noise Study accompanying the Lake George RAICUZ, time-averaged outdoor sound levels less than 45 dB are well below any currently accepted guidelines for aircraft noise compatibility. Even the most strict "proposed" guidelines suggest describing impacts no lower than 55dB; thus, the study reports noise levels 55 dB and greater (DoN, 2007b). To supplement the MR_NMAP analysis, and to give some sense of noise level that might be expected, SEL CALC was used to calculate a SEL versus varying distances for a single S-3 overflight on the Lake George Range. The nominal altitude for the weapon delivery flight track to the water target is 2000 feet AGL. At this altitude and at a power setting of approximately 85 percent revolutions per minute and airspeed of 350 KIAS, the SEL directly under the flight track would be approximately 81 dB. At a distance of 1,000 feet from the flight track centerline, the SEL would be reduced to 80 dB and at 5,000 feet from the flight track centerline the SEL would be further reduced to around 64 dB (DoN, 2007b). Table 3.5-4 provides some example information on individual aircraft noise levels for various military aircraft at certain altitudes.

Sensitive Receptors

Sensitive receptors are those noise-sensitive areas, including developed and undeveloped areas for land uses such as residences, business, schools, churches, libraries, hospitals, and parks. Military personnel are not considered to be sensitive receptors of airborne noise for purposes of environmental impact analyses. While persons on recreational or fishing vessels within the OPAREAs might be exposed to sound generated by military activities, the likelihood of such exposure is quite low, due to extensive SOPs employed by the Navy, such as Notice to Mariners (NOTAM) that notifies the public of training activities in the area, and visual surveillance of the area to ensure it is clear of boaters before training activities begin, to ensure civilians do not interfere and are not inadvertently affected by military activities.

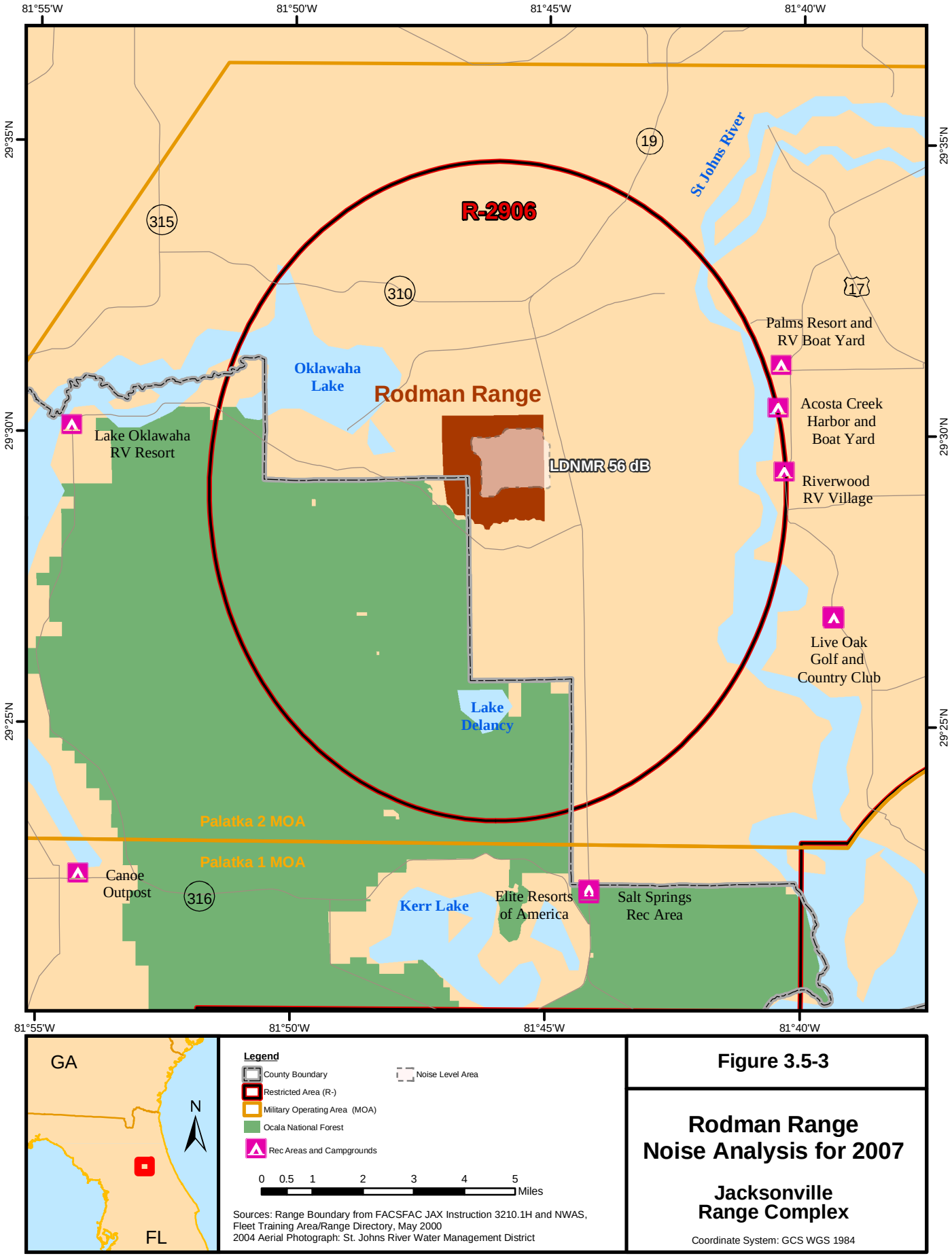


Figure 3.5-3

Rodman Range Noise Analysis for 2007

Jacksonville Range Complex

Coordinate System: GCS WGS 1984

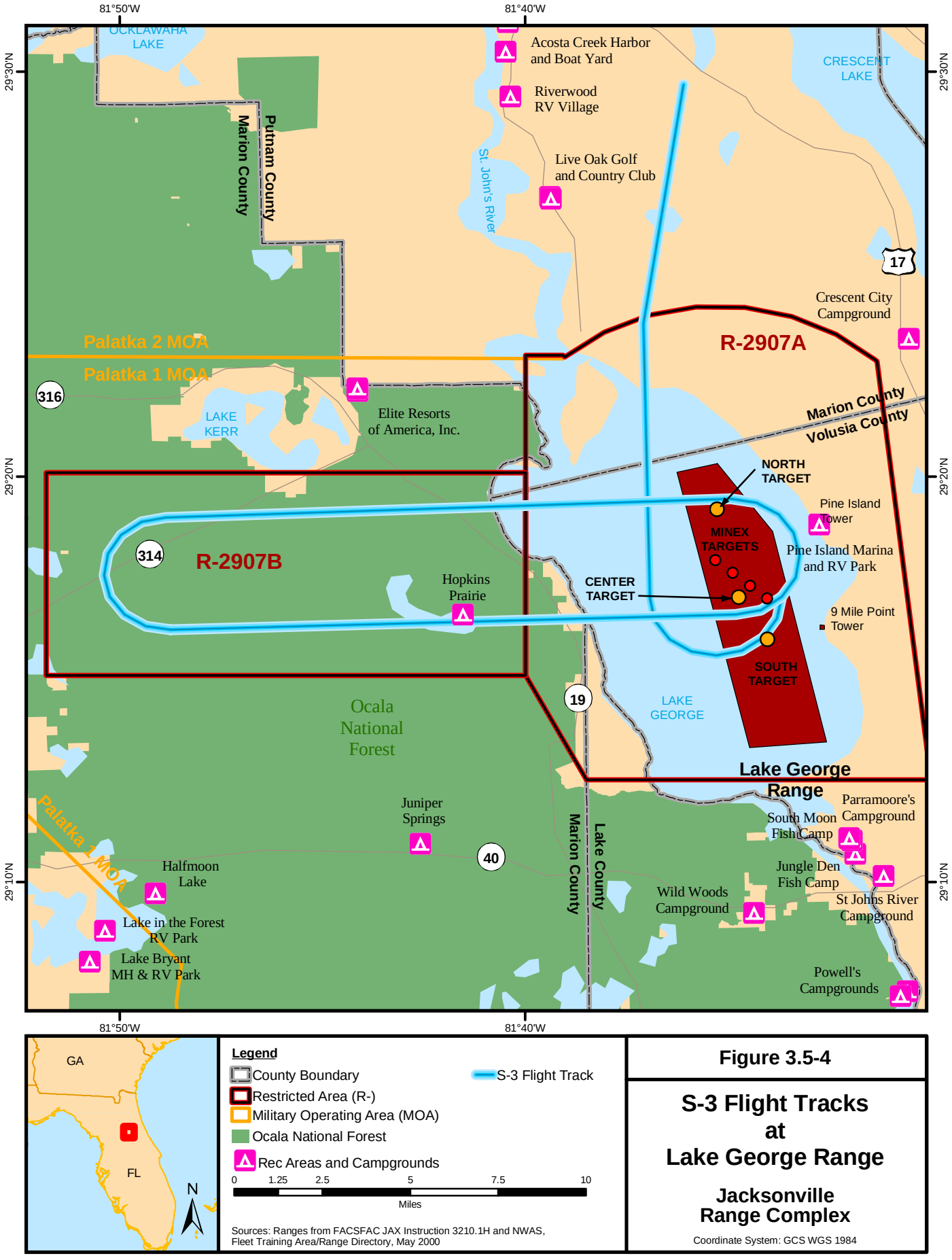


Figure 3.5-4

S-3 Flight Tracks at Lake George Range

Jacksonville Range Complex

Coordinate System: GCS WGS 1984

TABLE 3.5-4
AIRCRAFT NOISE LEVELS AT VARIOUS ALTITUDES

Aircraft	Power	Speed (KIAS)	Altitude in feet Above Ground Level							
			2000 ft		3000 ft		4000 ft		5000 ft	
			SEL	Lmax	SEL	Lmax	SEL	Lmax	SEL	Lmax
AV-8B	83% RPM	360	96	91.5	92	86.1	88	81.9	86	78.5
S-3	85% NC	350	81	77.5	75	70.1	70	64.2	66	59.4
P-3A	1400 ESHP	210	-	73.3	-	68.8	-	65.4	-	62.9
F/A-18E/F	83% NC	360	97	90.1	93	84.6	89	80.3	86	76.8
T-45	85.5% RPM	250	76	68.4	72	63.5	69	59.7	67	56.7

Notes: SEL: Sound Exposure Level-total noise energy produced from a single noise event; Lmax: Represents the maximum noise level that occurs during an event and is the noise level actually heard during the event; Temp: 70 F; Humidity: 59% relative humidity; Source: Flyover Noise Calculator, Version 1.0.2, beta, USAF/AFRL/HECB, Wright-Patterson AFB, OH, May 2002.

Use of the Ocala National Forest, wilderness areas, and state recreation and conservation lands for eco-tourism is expected to continue to grow. Although the majority of these activities occur outside of areas subject to appreciable noise generated by aircraft using the range, many people who participate in nature-oriented activities may consider any and all aircraft/weapons noise to be an annoyance. As use of the area's natural settings for eco-tourism-related activities grows, noise complaints relating to Navy range activities can be expected to increase (DoN, 2007b).

There are four National Wilderness Areas (Alexander Springs, Billies Bay, Juniper Prairie, and Little Lake George) located within the Ocala National Forest. The largest of these is the Juniper Prairie Wilderness Area located just west of Lake George's southwestern shore. The Little Lake George Wilderness area is located along the northeast corner of the forest, between the south bank of the Ocklawaha River and the west shore of Little Lake George. The FAA issued non-mandatory guidance (Advisory Circular AC 91-36) that requests pilots to maintain an altitude of 2,000 feet AGL in wilderness areas administered by the U.S. Forest Service.

The Navy tries to reduce the impacts of noise on civilian populations. The FACSFACJAX Operations Manual reminds pilots to avoid populated areas, prohibits use of afterburners 8:00 p.m. to 6:00 a.m., and other actions that could cause increased noise levels. The Navy has an established complaint line (1-800-874-5059) to receive noise complaints from the community. This is an automated system capable of receiving calls 24 hours a day. The messages are reviewed each day to provide an opportunity for a Navy official to follow-up with a phone call to the person placing the complaint if sufficient call return information is provided in the message. The incidents are investigated as to the nature of the offensive noise event, and the appropriate squadrons or users of the Range are notified if the pilot operated outside the approved parameters of range use (DoN, 2007b).

3.5.5 Environmental Consequences

3.5.5.1 No Action Alternative

Military activities in the OPAREAs, especially live firing of weapons and aircraft operations, are sources of intrusive noise. Military personnel who might be exposed to noise from these activities are required to take precautions such as the wearing of personal protective equipment,

to reduce or eliminate potential harmful effects of such exposure (military personnel are not considered sensitive receptors for purposes of impacts analysis). With regard to potential exposure of non-military personnel in ocean areas (such as fishermen in the JAX or Charleston OPAREAs) precautions are taken pursuant to SOPs to prevent such exposure (see Section 3.19). Fixed wing aircraft training in the OPAREAs typically occurs above 3,000 feet, which reduces the sound exposure to humans operating commercial or recreational surface vessels. Helicopter training in the OPAREAs occurs below 3,000 feet, but occurs infrequently and well off shore from sensitive receptors.

As shown on the RAICUZ Study maps for the Lake George Range and Rodman Range, noticeable noise levels are contained within the range and, therefore, do not present a significant impact to human receptors outside of the range boundaries. Because sound-generating events are intermittent, occur in remote areas or off-limits areas, they do not expose a substantial number of human receptors to high noise levels. Few off-range sensitive receptors are likely to be exposed to sound from such military activities.

Noise associated with weapons drop operations on Lake George Range is limited largely to the lake waters and the overall DNL is below 55 dB (DoN, 2007b). Consequently, there are no specific land use incompatibilities associated with noise generated on the Lake George Range (DoN, 2007b). Once within the restricted area, the flight tracks of aircraft using the Range overlie Lake George waters and the central portion of the Ocala National Forest (DoN, 2007b). These tracks overlie unpopulated Ocala National Forest land (DoN, 2007b). A single campground, Hopkins Prairie, is located beneath the flight track (DoN, 2007b).

Noise impacts to sensitive receptors throughout the Range Complex are further mitigated by current Navy procedures. The FACSFACJAX Operations Manual 3000.1E reminds pilots to avoid populated areas, prohibits use of afterburners from 8:00 pm to 6:00, and other actions that could cause increased noise levels (FACSFAXJAX, 2007). Therefore, there would be no significant impact on the human noise environment from implementing current Navy training and testing. Furthermore, there would be no significant harm to the human noise environment from implementing the No Action Alternative.

3.5.5.2 Alternative 1

Under Alternative 1, the number of noise generating training events conducted would increase above current levels. Certain events would increase more than others. In the OPAREAs, the increase in training events would not be expected to result in substantial increases of overall Study Area noise levels. Helicopter sorties in the OPAREAs (associated with MIW training) would increase under Alternative 1, with a commensurate increase in helicopter noise.

Certain events (*i.e.*, EC, AIC, DTE and GUNEX (S-A)) using commercial air services (CAS) will increase by twenty-eight sorties under Alternative 1. These CAS flights typically occur at altitudes over 3,000 feet and greater than 12 nm from shore. Thus, CAS flights and CAS supported events are not expected to produce significant impacts to the airborne noise environment under Alternative 1. The slight increase in CAS departures and landings at NAS Jacksonville will not alter the existing noise contours at the air station.

As previously noted, extensive precautions are taken to eliminate exposure of non-military personnel to unwanted sound from military activities. As with the No Action Alternative, sound-generating events under Alternative 1 are intermittent, occur in remote areas or off-limits areas, and do not expose a substantial number of human receptors to high noise levels. No sensitive

receptors are likely to be exposed to sound from the proposed Navy training events in the OPAREAs.

At the Lake George Range, noise levels under Alternative 1 are expected to increase slightly above existing conditions. No additional mine laying sorties are anticipated under Alternative 1. However, 24 additional annual helicopter sorties would occur under Alternative 1. As with P-3 overflight noise associated with mine laying events, helicopter noise associated with flare exercises at Lake George would be concentrated over the waters of Lake George and forested lands. Few sensitive receptors are present nearby the range. Therefore, the additional helicopter noise produced under Alternative 1 is not expected to produce significant impacts.

At Rodman Range, noise levels under Alternative 1 are not expected to increase above baseline conditions. As shown in Figure 3.5-3, noise levels of 56 dB are almost entirely contained within the range boundary. Few sensitive receptors are present nearby the range. No significant impacts are expected.

Therefore, there would be no significant impact on the human noise environment from implementing the Navy training and testing considered under Alternative 1. Furthermore, there would be no significant harm to the human noise environment from implementing Alternative 1.

3.5.5.3 Alternative 2 (Preferred Alternative)

The types of effects on humans from sound generated by military activities under Alternative 2 would be similar to those under Alternative 1. As with the No Action Alternative and Alternative 1, sound-generating events under Alternative 2 in the OPAREAs are intermittent, occur in remote areas or off-limits areas, and do not expose a substantial number of human receptors to high noise levels. Under Alternative 2, the Navy proposes to eliminate all BOMBEX training events that involve dropping explosive (live) ordnance on targets at-sea. This will eliminate the noise associated with the explosive ordnance.

Certain events (i.e., EC, AIC, DTE and GUNEX (S-A)) using commercial air services (CAS) will increase by twenty-eight sorties under Alternative 2. These CAS flights typically occur at altitudes over 3,000 feet and greater than 12 nm from shore. Thus, CAS flights and CAS supported events are not expected to produce significant impacts to the airborne noise environment under Alternative 2. The slight increase in CAS departures and landings at NAS Jacksonville will not alter the existing noise contours at the air station.

At the proposed MIW areas, there would be temporary increases in noise associated with helicopter engine noise and UNDETs. However, given the great distance from shore (6 nm - 11 nm for the Charleston underwater detonation boxes), the temporary localized increase in noise would not likely impact human receptors. The same is true for the increases in helicopter MIW training in the Carrier Operating Areas (at the proposed MIW training areas for major exercises). The associated noise would be short-term in nature, occurring infrequently with major exercises. Current Navy standard operating procedures ensure that training areas are clear for safety purposes, which has an ancillary benefit of reducing noise impacts. Few sensitive receptors are likely to be exposed to sound from such military activities.

At the Lake George Range, noise levels under Alternative 2 are expected to increase slightly above existing conditions. No additional mine laying sorties are anticipated under Alternative 2. However, 24 additional annual helicopter sorties would occur under Alternative 2. As with P-3 overflight noise associated with mine laying events, helicopter noise associated with flare

exercises at Lake George would be concentrated over the waters of Lake George and forested lands. Few sensitive receptors are present nearby the range. Therefore, the additional helicopter noise produced under Alternative 2 is not expected to produce significant impacts.

At Rodman Range, noise levels under Alternative 2 are not expected to increase above baseline conditions. As shown in Figure 3.5-3, noise levels of 56 dB are almost entirely contained within the range boundary. Few sensitive receptors are present nearby the range. No significant impacts are expected.

Therefore, there would be no significant impact on the human noise environment from implementing the Navy training and testing considered under Alternative 2. Furthermore, there would be no significant harm to the human noise environment from implementing Alternative 2.

3.5.6 Unavoidable Significant Environmental Effects

Increases in operational activity in the JAX Range Complex will increase airborne noise levels. However, because Navy training takes place in remote and cleared areas, airborne noise levels will primarily affect military personnel operating the equipment/weapon systems producing the noise. Military personnel wear personal protective equipment and are not considered sensitive receptors as such term is used in this FEIS/OEIS analysis. Underwater noise impacts to aquatic life are addressed in Sections 3.6 (Marine Communities), 3.7 (Marine Mammals), 3.8 (Sea Turtles), and 3.9 (Fish). There are not expected to be any unavoidable significant environmental effects associated with proposed action-generated noise.

3.5.7 Summary of Environmental Effects (NEPA and EO 12114)

Implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in significant impacts to the area sound environment. Implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in significant harm to the sound environment of the global commons. Airborne noise levels generated by the proposed action under the No Action Alternative and Alternatives 1 and 2 would be less than significant because:

- Noise from training activities in the OPAREAs would be dispersed and intermittent, which would not contribute substantially to long-term noise levels, and few or no sensitive receptors (non-participants) would be exposed to these noise events;
- Training areas at the Lake George Range and Rodman Range are remote, and isolated from the general public;
- Noise would be generated in training areas that have been in similar use for more than 50 years - no new public areas would be exposed to noise from training and testing activities.
- No high explosives are used at the Lake George Range or Rodman Range;
- The incremental increases in the numbers of range events would not substantially increase long term average noise levels; hourly average equivalent noise levels are and would remain relatively low; and
- Increased helicopter operations at NS Mayport were evaluated in the MH-60R/S Siting Study Environmental Assessment and determined to be less than significant (DoN, 2002b).
- At the Rodman Range and Lake George Range, noise levels under both Alternatives 1 and 2 are expected to remain nearly constant with baseline levels.

Table 3.5-5 summarizes noise effects for the No Action, Alternative 1, and Alternative 2.

TABLE 3.5-5
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON THE SOUND ENVIRONMENT IN THE JAX RANGE COMPLEX STUDY AREA

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	NEPA (U.S. Territory)	Executive Order 12114 (Non-Territorial Waters, >12 nm)
No Action		
Surface ship noise	Minor localized engine noise. Few to no sensitive receptors present.	Minor at-sea noise. Few to no sensitive receptors present.
Aircraft noise	Short-term noise generation during transits to and from range areas.	Short-term noise generation, including sonic booms. Few to no sensitive receptors present.
Weapon and target noise	Very short-term noise production. Few to no sensitive receptors present.	Very short-term noise production. Few to no sensitive receptors present.
Conclusion	No significant impact to Study Area sound environment.	No significant harm to Study Area sound environment.
Alternative 1		
Surface ship noise	Minor localized engine noise. Few to no sensitive receptors present.	Minor at-sea noise. Few to no sensitive receptors present.
Aircraft noise	Short-term noise generation during transits to and from range areas.	Short-term noise generation, including sonic booms. Few to no sensitive receptors present.
Weapon and target noise	Very short-term noise production. Few to no sensitive receptors present.	Very short-term noise production. Few to no sensitive receptors present.
Conclusion	No significant impact to Study Area sound environment.	No significant harm to Study Area sound environment.
Alternative 2		
Surface ship noise	Minor localized engine noise. Few to no sensitive receptors present.	Minor at-sea noise. Few to no sensitive receptors present.
Aircraft noise	Short-term noise generation during transits to and from range areas.	Short-term noise generation, including sonic booms. Few to no sensitive receptors present.
Weapon and target noise	Very short-term noise production. Few to no sensitive receptors present.	Very short-term noise production. Few to no sensitive receptors present.
Conclusion	No significant impact to Study Area sound environment.	No significant harm to Study Area sound environment.

3.6 MARINE COMMUNITIES

3.6.1 Introduction and Methods

A community is an assemblage of plants and/or animal populations sharing a common environment and interacting with each other and with the physical environment. This section specifically addresses the following marine communities occurring within the JAX Study Area: plankton and macroalgae, benthic communities, and artificial habitats. Seagrasses/submerged aquatic vegetation are not addressed because they are limited to nearshore estuarine environments and do not occur in the Atlantic Ocean portion of the Study Area. Marine mammals are addressed in Section 3.7, sea turtles are addressed in Section 3.8, fish and essential fish habitat are addressed in Section 3.9, and seabirds and migratory birds are addressed in Section 3.10 of this FEIS/OEIS. Marine species listed under the Endangered Species Act (ESA) are addressed in Sections 3.7 through 3.10, as applicable.

3.6.1.1 Regulatory Framework

The various federal laws and regulations that afford protection and management of marine communities are primarily aimed at specific community components such as ESA-listed species and designated critical habitat; marine mammals; federally managed fish species and essential fish habitat; and migratory birds. Regulatory frameworks for these marine community components, as well as the National Marine Sanctuaries Act and EO 13089, *Coral Reef Protection*, are discussed in Appendix K.

3.6.1.2 Assessment Methods and Data Used

General Approach to Analysis

Each alternative analyzed in this FEIS/OEIS includes several warfare areas (*e.g.*, Mine Warfare, Air Warfare, *etc.*) and most warfare areas include multiple types of training operations (*e.g.*, Mine Neutralization, MISSILEX (A-S), *etc.*). Likewise, several activities (*e.g.*, ship maneuver, aircraft overflights, weapons firing, *etc.*) are accomplished under each operation, and those activities typically are not unique to that operation. For example, many of the operations involve Navy ship maneuvers and aircraft overflights. Accordingly, the analysis for biological resources is organized by specific activity and/or stressors associated with that activity, rather than warfare area or operations.

The following general steps were used to analyze the potential environmental consequences of the alternatives to marine communities and biological resources as a whole:

- Identify those aspects of the proposed action likely to act as stressors to biological resources by having a direct or indirect effect on the physical, chemical, and biotic environment of the Study Area. As part of this step, the spatial extent of these stressors, including changes in that spatial extent over time, were identified. The results of this step identified those aspects of the proposed action that required detailed analysis in this FEIS/OEIS and defined the Study Area.
- Identify resources that may occur in the Study Area.
- Identify the biological resources likely to co-occur with the stressors in space and time, and the nature of that co-occurrence (exposure analysis).
- Determine whether and how biological resources are likely to respond given their exposure and available data (response analysis).

- Determine the risks those responses pose to biological resources and the significance of those risks.

Study Area

The Study Area for marine communities is described in Section 1.5, is shown in Figure 1.5-1, and includes waters of the Atlantic Ocean. Inland ranges (Rodman Range and Lake George Range) are not part of the Study Area for marine communities.

Data Sources

A comprehensive and systematic review of relevant literature and data was conducted to complete this analysis for marine communities to ensure that best available information was used. Of the available scientific literature (both published and unpublished), the following types of documents were utilized in the assessment: journals, books, periodicals, bulletins, Department of Defense operations reports, EISs, Range Complex Management Plans, and other technical reports published by government agencies, private businesses, or consulting firms. The scientific literature was also consulted during the search for geographic location data on the occurrence of marine resources within the Study Area. The primary sources of information used to describe the affected environment for marine communities were in the Navy's Marine Resources Assessment report for Charleston/Jacksonville Operating Area (DoN, 2008). The Marine Resources Assessment report provides a compilation of the most recent data and information on the occurrence of marine resources in the Study Area. Descriptions of literature and data searches conducted during preparation of the Marine Resources Assessment report are described in detail in that document.

Factors Used to Assess Effects

The factors used to assess significance of the effects to marine communities include the extent or degree to which implementation of an alternative would result in permanent loss or long-term degradation of the physical, chemical, and biotic components that make up a marine community.

3.6.1.3 Warfare Areas and Associated Environmental Stressors

The Navy used a screening process to identify aspects of the proposed action that could act as stressors to marine communities. Navy subject matter experts de-constructed the warfare areas and operations included in the proposed action to identify specific activities that could act as stressors. Public and agency scoping comments, previous environmental analyses, previous agency consultations, laws, regulations, Executive Orders, and resource-specific information were also evaluated. This process was used to focus the information presented and analyzed in the affected environment and environmental consequences sections of this FEIS/OEIS. As summarized in Table 3.6-1, potential stressors to marine communities include vessel movements (disturbance and collisions), aircraft overflights (disturbance), towed MIW devices (strikes), non-explosive mine shape deployment/recovery (habitat alteration), NEPM (strikes), UNDETs and HE ordnance (explosions), and MEM (ordnance-related material, targets, chaff, self-protection flares, and marine markers). The potential effects of these stressors on marine communities are analyzed in detail in Section 3.6.3.

As discussed in Section 3.3 – Water Resources and Section 3.4 – Air Quality, some water and air pollutants would be released into the environment as a result of the proposed action. The analyses presented in Sections 3.3 and 3.4 indicate that any increases in water or air pollutant

concentrations resulting from Navy training in the Study Area would be negligible and localized, and impacts to water and air quality would not be significant. Based on the analyses presented in Sections 3.3 and 3.4, water and air quality changes would have no effect or negligible effects on marine communities. Accordingly, the effects of water and air quality changes on marine communities are not addressed further in this FEIS/OEIS.

TABLE 3.6-1
SUMMARY OF POTENTIAL STRESSORS TO MARINE COMMUNITIES

Warfare Area and Operation	Training Areas	Vessel Movements (Disturbance)	Vessel Movements (Collisions)	Aircraft Overflights (Disturbance)	Towed Mine Warfare Devices	Mine Warfare Deployment/Recovery	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Material
Mine Warfare (MIW)									
Mine Laying	Lake George Range			✓			✓		✓
MCM	Carrier Operating Areas	✓	✓	✓	✓				
Mine Neutralization	Charleston OPAREA (North and South UNDET Boxes)	✓	✓	✓		✓	✓	✓	✓
Surface Warfare (SUW)									
MISSILEX (A-S)	W-157A (Area 4X) and W-159A (Area 5X)			✓			✓	✓	✓
GUNEX (A-S)	W-132, W-133, W-134, W-157, W-158			✓			✓		✓
GUNEX (S-S) Boat	Charleston OPAREA (Areas 11J)	✓	✓				✓		✓
GUNEX (S-S) Ship	JAX OPAREA (AA, BB, and CC)	✓	✓				✓		✓
BOMBEX (A-S) (at sea)	HE, W-158 (31J) NEPM, W157A/B and W-158 A/B			✓			✓	✓	✓
Laser Targeting	W-132, W-133, W-134, W-157, W-158			✓					

TABLE 3.6-1 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO MARINE COMMUNITIES

Warfare Area and Operation	Training Areas	Vessel Movements (Disturbance)	Vessel Movements (Collisions)	Aircraft Overflights (Disturbance)	Towed Mine Warfare Devices	Mine Warfare Deployment/Recovery	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Material
GUNEX (S-S) (FAC/FIAC)	Amber Strait: Charleston OPAREA (Boxes Q-9&10, R-9&10)	✓	✓						
VBSS/MIO-Ship	JAX and Charleston OPAREAs	✓	✓						
VBSS/MIO-Helicopter	W-157A (Area 4X) and W-159A (Area 5X)			✓					
Air Warfare (AW)									
ACM	W-157A (Areas 3X & 4X)			✓					✓
Air Intercept Control	JAX and Charleston OPAREAs			✓					
ACM Chaff Exercise	W-157A (Areas 3X & 4X)			✓					✓
ACM Flare Exercise	W-157A (Areas 3X & 4X)			✓					✓
MISSILEX (A-A)	W-132, W-133, W-134, W-157, W-158			✓			✓	✓[1]	✓
MISSILEX (S-A)	JAX and Charleston OPAREAs								✓
Detect-to-Engage	W-132, W-133, W-134, W-157, W-158	✓	✓	✓					
GUNEX (S-A)	JAX OPAREA (AA, BB, and CC)	✓	✓	✓			✓		✓
GUNEX (A-A)	W-157A/W-133 (Area 2X)								✓
Amphibious Warfare (AMW)									
FIREX (S-S) with IMPASS	JAX OPAREA (BB and CC)	✓	✓				✓	✓	✓

TABLE 3.6-1 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO MARINE COMMUNITIES

Warfare Area and Operation	Training Areas	Vessel Movements (Disturbance)	Vessel Movements (Collisions)	Aircraft Overflights (Disturbance)	Towed Mine Warfare Devices	Mine Warfare Deployment/Recovery	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Material
Strike Warfare (STW)									
BOMBEX (A-G)	Rodman Range								
CSAR and Convoy Operations	Rodman Range								
Electronic Combat (EC)									
EC Operations - Aircraft	W-132, W-133, W-134, W-157, W-158			✓					
EC Operations- Surface Ships	JAX and Charleston OPAREAs	✓	✓						
Chaff Exercise	JAX and Charleston OPAREAs	✓	✓	✓					✓
Other Training									
SESEF Utilization	5-15 nm east of Mayport	✓	✓						
Precision Anchoring	NS Mayport	✓							
Small Arms with anti-swimmer grenades (MK3A2)	Charleston OPAREA (Area 10L, 12I)	✓	✓					✓	✓

[1] Missile explodes in air, no explosive sound in the water.

3.6.2 Affected Environment

3.6.2.1 Plankton and Macroalgae

Plankton are organisms that float or drift with the sea and cannot maintain distribution against the movement of water masses (Parsons *et al.*, 1984). Plankton include phytoplankton (plant-like/algae), zooplankton (animals), ichthyoplankton (fish eggs and larvae, a form of zooplankton), and bacterioplankton (bacteria). In general, this group of organisms is very small or microscopic, although there are exceptions. Jellyfish and pelagic *Sargassum*, for example, are unable to move

against the surrounding currents and are considered part of the plankton group even though some jellyfish can grow to approximately 10 feet in diameter.

Phytoplankton are single-celled organisms similar to plants because they use sunlight and chlorophyll to photosynthesize. At the base of the marine food chain, phytoplankton are very important to the overall productivity of the ocean. Their growth and distribution are influenced by several factors, the most important of which are temperature (Eppley, 1972), light (Yentsch and Lee, 1966), and nutrient concentration (Goldman *et al*., 1979). Phytoplankton distribution is patchy, occurring in environments that have optimal light, temperature, and nutrient conditions. In general, the concentration of phytoplankton is higher in nearshore areas where there is input of nutrients from land sources. In continental shelf and slope waters, the concentration of phytoplankton generally decreases with distance from shore and with increasing bottom depth. Concentrations can be higher in upwellings and eddies along the Gulf Stream. In the Study Area, chlorophyll *a* concentrations (a measure of phytoplankton biomass) are fairly uniform seasonally over the continental shelf with only the seaward extent of the chlorophyll minimum changing seasonally. This relative homogeneity of the chlorophyll *a* indicates that nutrients are probably plentiful year round and that temperatures found in the Study Area do not limit growth (DoN, 2008).

Zooplankton are a taxonomically and structurally diverse group of aquatic animals. They range in size from microscopic, unicellular organisms such as protozoans to large, multicellular organisms such as jellyfish (Wiebe *et al.,* 1987). Although many are able to swim sizable distances at moderate speeds, their large-scale horizontal distributions are determined by ocean currents and the suitability of the physical, chemical, and biological components of their environment. Zooplankton cannot photosynthesize and, thus, rely on phytoplankton as a source of food. Zooplankton may be herbivorous (consuming plants), carnivorous (consuming animals), detrivorous (consuming dead organic material), or omnivorous (consuming a mixed diet). Examples of zooplankton include foraminifera, pteropods, copepods, and myctophid fish. In offshore waters zooplankton are expected to be most abundant in areas of high primary productivity, including the Gulf Stream and associated upwellings and eddies.

Ichthyoplankton are the eggs and larvae of fish found mainly in the upper 200 m of the water column. The eggs are passive and drift in the ocean along with the water currents. Most fish larvae have almost no swimming ability initially; however, half way through their development they are active swimmers. Ichthyoplankton are a relatively small but vital component of total zooplankton. They feed on smaller plankton and are prey for larger animals (Southwest Fisheries Science Center, 2007). Larval fish survival and recruitment success of shelf-spawned estuarine species are likely tied to oceanographic conditions on the inner shelf related to upwelling and downwelling conditions and plume dynamics, rather than to simple, wind-driven recruitment mechanisms (Reiss and McConaugha, 1999). Circulation features, such as large frontal eddies associated with Gulf Stream meandering, transport fish larvae normally associated with Gulf Stream waters into mid-shelf waters (Powell *et al.*, 2000). The Charleston Gyre retains tropical larvae transported in the Gulf Stream onto the South Carolina shelf.

Pelagic *Sargassum*, or gulfweed, is a type of large, brown seaweed (algae) characterized by a brushy, highly branched structure with numerous leaf-like blades and berry-like gas-filled floats (pneumatocycts). These floats, containing mostly oxygen, maintain its pelagic existence. *Sargassum* often occurs in extensive floating mats on the surface. These mats are valuable habitat as they provide shelter and a food source for a diverse community of attached and swimming

organisms. Throughout the Sargasso Sea and Gulf Stream, these mats frequently aggregate into large windrows in response to wind forcing, or shear forcing along frontal boundaries (Coston-Clements *et al*., 1991). *Sargassum* can regularly be encountered in the waters of the OPAREAs (DoN, 2008). Quantities of drifting *Sargassum* separate from the main circular flow of the Sargasso Sea and, depending on prevailing surface currents, may travel over the continental shelf for extended periods of time, wash ashore, or remain entrained in the Gulf Stream (SAFMC, 1998). Downstream (north) of the Charleston Bump, a somewhat permanent cyclonic circulation (the Charleston Gyre) is generated as Gulf Stream Current encounters this sudden physiographic change. This area off South Carolina is a highly dynamic area where pelagic *Sargassum* can become concentrated (SAFMC, 1998; Govoni and Hare, 2001). The presence of the gyre may aid in the retention of *Sargassum* mats that have been entrained in the Gulf Stream Current (SAFMC, 1998).

3.6.2.2 Benthic Communities

Live/Hard Bottom Communities, Corals, and Coral Reefs

Benthic or bottom-dwelling communities are strongly dependent on the type of bottom habitat or substrate that exists in an area. While some benthic organisms burrow into soft bottom sediments, others attach themselves to any hard substrate available. Live/hard bottom communities are typically areas of low, rough, or broken relief consisting of naturally occurring hard or rocky outcroppings. The geological and biological architecture of these three-dimensional substrates provide shelter and substrate for benthic and demersal organisms (Cahoon *et al.*, 1990). Live/hard bottom communities can sometimes contain rich sessile biological assemblages (sea fans, sea whips, ascidians, bryozoans, hard/soft corals, hydroids, anemones, and sponges) and favor relatively dense aggregations of turtles, commercial/recreational fishes, and other fauna (Thompson *et al.*, 1999). It is important to note that not all hard bottom habitats support a live bottom community (Kirby-Smith and Ustach, 1986; SAFMC, 1998).

On the continental shelf between Cape Fear, North Carolina and Cape Canaveral, Florida, live/hard bottom communities and assemblages of isolated non-reef building corals appear to occur as three general morphotypes (Henry and Giles, 1977; Barans and Henry, 1984):

- Type I live/hard bottoms are relatively smooth, flat-lying rock outcrops (<0.5 m relief) covered by a thin, sandy layer. This type of live/hard bottom is widely distributed with a sparse to moderately abundant sponge/octocoral community in relatively shallow water (approximate water depth: 19 to 27 m).
- Type II live/hard bottoms occur as rocky outcrops exhibiting moderate relief (0.5 to 2.0 m). Their distribution is restricted to the inner and mid-shelf with a moderately abundant to abundant sponge/octocoral community (approximate water depth: 28 to 55 m).
- Type III live/hard bottoms occur as discontinuous but generally well-defined, high relief (2.0 to 15.0 m) outcrops manifested as rocky ridges, scarps, and pinnacles. They are located along the shelf margin with a moderately abundant to abundant sponge/octocoral community in depths of approximately 56 to 100 m.

While NOAA's Office of Coastal Zone Management reports that 3 percent to 30 percent of the shelf region in the South Atlantic Bight is covered by live/hard bottom habitats (Figures 3.6-1 and 3.6-2) (SAFMC, 1998), much of the continental shelf from Cape Hatteras to Cape Canaveral has yet to be fully surveyed to assess the distribution of these communities. Menzies *et al*. (1966) and Macintyre and Milliman (1970) show that Pleistocene algal communities account for the

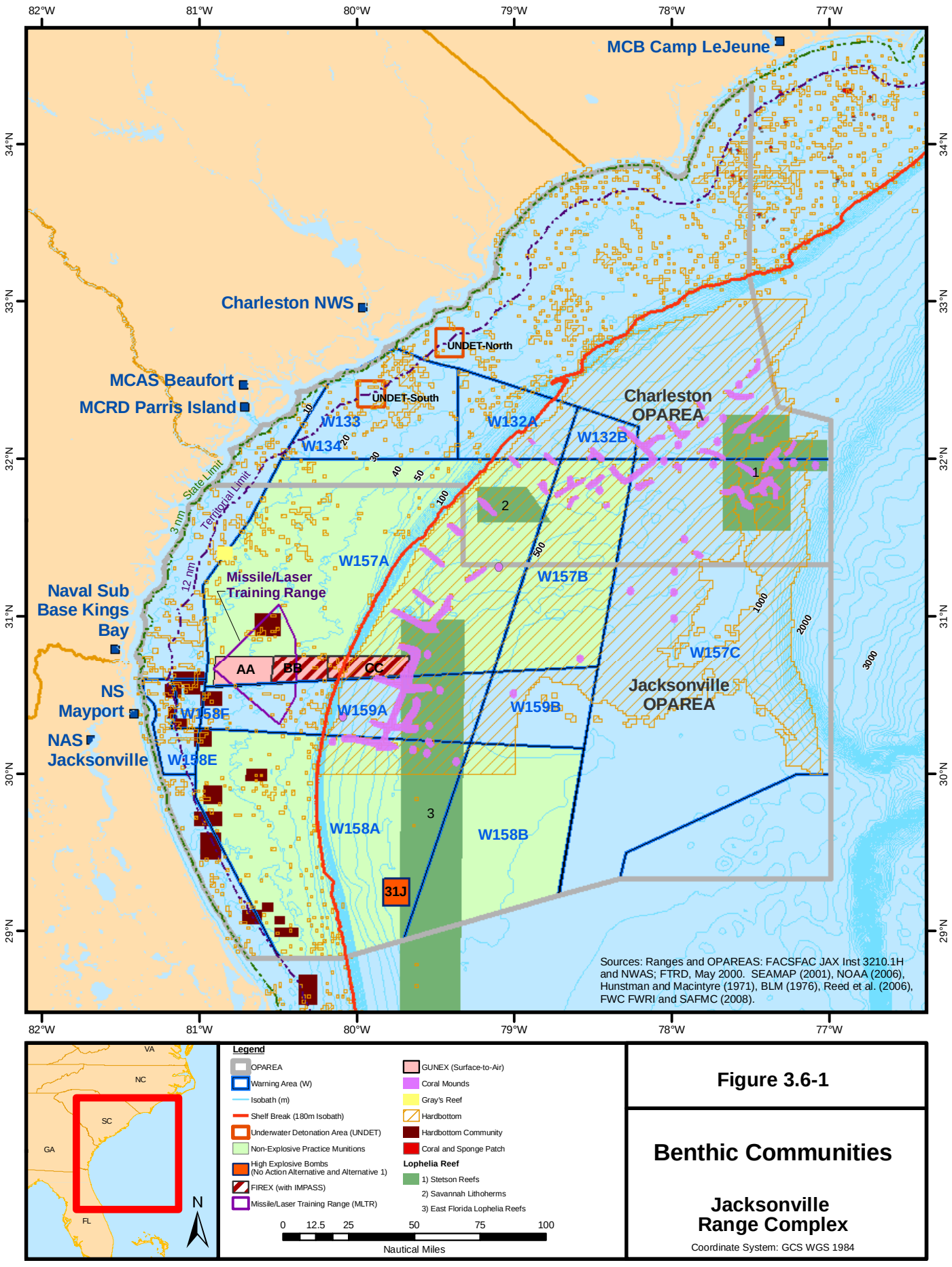


Figure 3.6-1

Benthic Communities

Jacksonville Range Complex

Coordinate System: GCS WGS 1984

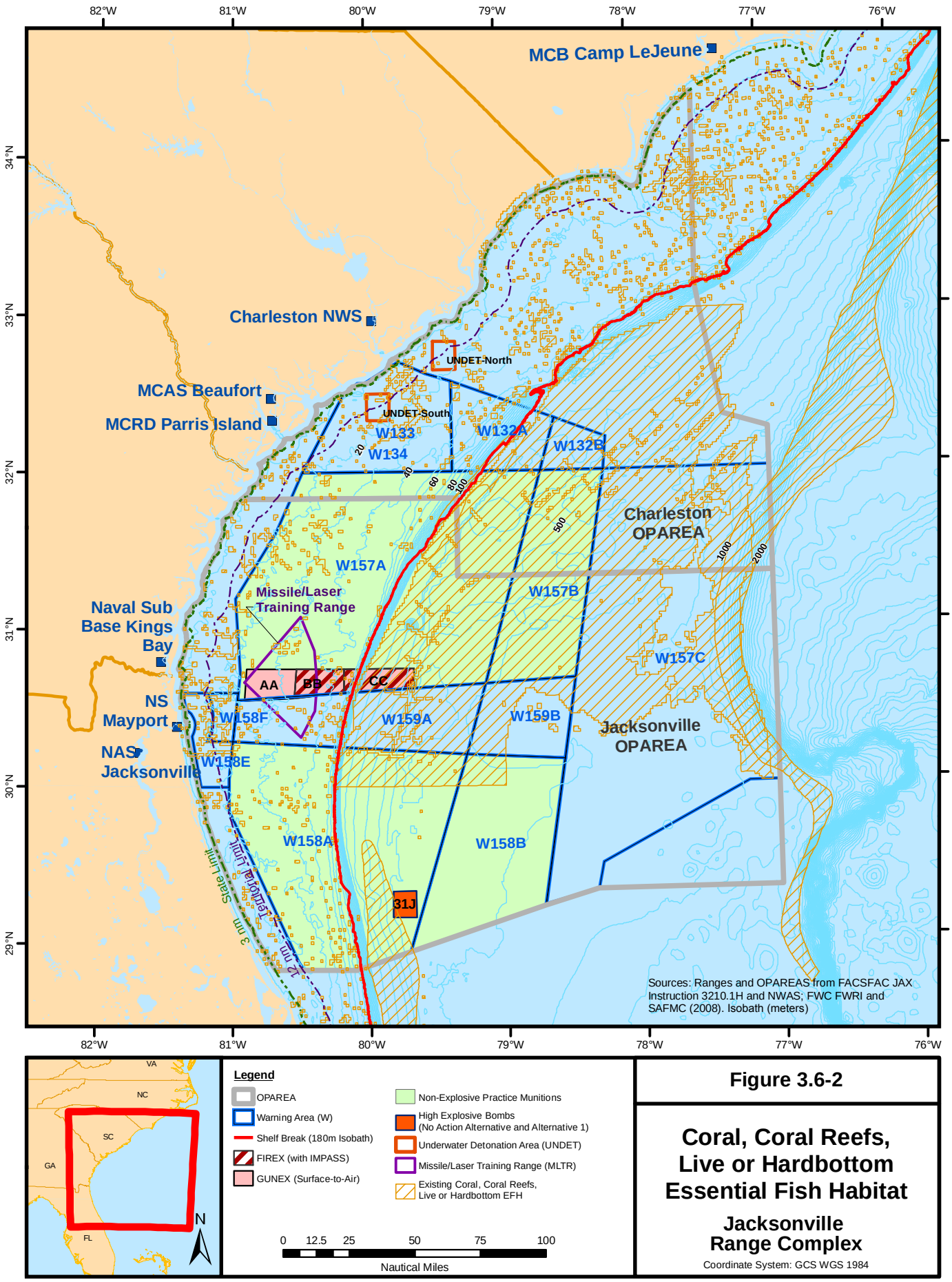


Figure 3.6-2

Coral, Coral Reefs, Live or Hardbottom Essential Fish Habitat

Jacksonville Range Complex

Coordinate System: GCS WGS 1984

ledges, small terraces, and slight rises of the continental margin off North Carolina and South Carolina. Benthic surveys conducted in the Study Area revealed over 230 live/hard bottom communities shoreward of the 200 m isobath (BLM, 1976). The highest concentration of live/hard bottom communities on the inner shelf occurs off Cape Fear and between the area north of Jacksonville and Cape Canaveral (Figure 3.6-1).

On the outer shelf, the highest concentrations of live/hard bottom communities occur off South Carolina and northern Florida (Figure 3.6-1). The shelf break and several large offshore areas running parallel to the shelf break are other potential locations of live/hard bottom communities (BLM, 1976). Parker *et al*. (1983) suggest that rock-coral-sponge habitat accounts for 29.8 percent, or 7,403 km^2 of the substrate between the 27 and 101 m isobaths from Cape Fear to Cape Canaveral. Barans and Burrell's (1976) estimate of hard bottom cover within the 19 to 55 m depth range accounted for 6,524 km^2. Furthermore, the high relief habitat (Type III) within the 37 to 100 m depth range totaled 267 km^2, and most of it occurred off the Carolinas and northern Florida (87.7% of the high relief habitat is located between the 37 to 100 m isobaths) (Barans and Henry, 1984).

While the Study Area contains isolated coral patches or mounds, it does not contain "true" coral reefs like those found farther south in the Florida reef tract from Miami to the Dry Tortugas. Yet, the reef-building *Siderastrea* corals occur in isolated patches at depths of 20 to 40 m in at least five locations on the inner continental shelf southeast of Cape Fear (Macintyre and Pilkey, 1969; Huntsman and Macintyre, 1971). Non-reef building corals occur on the shelf (***e.g.,*** ***Oculina arbuscula*** and ***Astrangia danae***) as well as along the shelf edge and on the continental slope (***e.g.,*** ***Lophelia prolifera*** and ***Enallopsammia profunda***) of the Study Area.

The U.S. Department of Commerce designated the rocky outcrops and ridges known as Gray's Reef off Georgia (Figure 3.6-1) as a National Marine Sanctuary in 1981 because of their exceptional live cover and associated organisms (Gilligan, 1989). Although Gray's Reef is not a true coral reef, a number of corals and other tropical organisms colonize its rocky substrate. The sessile marine life found there includes bryozoans, hydroids, ascidians, barnacles, tubeworms, sponges, hard corals, and gorgonians (sea whips and sea fans). The soft sand bottom surrounding Gray's Reef is suitable habitat for sea pens, sea pansies, sea cucumbers, sea biscuits, worms, mollusks, and crustaceans.

Forming a discontinuous ribbon of reef habitat at the edge of the continental shelf, the Savannah Scarp is a popular recreational fishing ground. Consisting of numerous deep reef-fishing areas (***e.g.***, Deli, Sow Pen, Pinkie Pa, Pig's Ear), the Savannah Scarp is dominated by moderate to heavy growth of sponges, bryozoans, and octocorals as well as an abundant and diverse fish fauna (Barans and Henry, 1984). Submersible studies conducted as part of the 2001 NOAA Ocean Explorer Program confirmed the presence of deepwater whip-like corals, sponges, and numerous tropical, subtropical, and temperate fish species within the diverse habitats of the Savannah Scarp (Sedberry, 2001).

Deepwater, non-reef forming corals and sponges are also present across the western Blake Plateau off South Carolina, growing wherever hard surfaces exist. In certain areas, large accumulations of corals with trapped carbonate mud form mounds that are sometimes greater than 30 m high. The *Oculina* Bank is located off central eastern Florida on the outer shelf and upper slope ranging to depths of 50 to 100 m (Reed, 1992). In some places on *Oculina* Bank, colonies of the branching scleractinian ivory tree coral coalesce to form dense thickets attaining

heights of 0.3 to 5 m and covering several hundred meters of seafloor (Reed, 1980). In other areas *Oculina* growth produces isolated ridges and mounds up to 25 m high. Cairns (1979) reported 28 species of deepwater corals (gorgonians and scleractinians) in the region between northern Florida and Cape Hatteras, North Carolina.

There are three areas that represent substantial deep sea coral habitat within the Study Area: Stetson Reefs, Savannah lithoherms, and East Florida *Lophelia pertusa* reefs (Figure 3.6-1). The Stetson Reefs are located off the coast of South Carolina between depths of 640 to 869 m in the Charleston Bump. They average heights between 46 to 102 m and encompass 6,174 km^2 at the base of the Florida-Hatteras slope (Stetson *et al*., 1962; Reed *et al*., 2006; SAFMC, 2006c). The Stetson Reefs contain well over 200 *L. pertusa* mounds and pinnacles and some of the largest *L. pertusa* mounds (152 m tall) recorded to date (Reed *et al*., 2006). There is abundant live *L. pertusa* coral covering the peaks of pinnacles. Various other corals also exist amidst the Stetson Reefs biota including scleractinians (*E. profunda*, *S. variabilis*), stylasterid corals and octocorals (including Primnoidae, Paramuriceidae, Keratoisidinae, and Nephtheidae) (Reed and Ross, 2005; Reed *et al*., 2006). Abundant sponge species grow on the flanks of the pinnacles between depths of 625 to 671 m and include tube sponges (Pachastrellidae), Corallistidae, glass sponges (Hexactinellida), *Geodia* spp., and *Leiodermatium* spp. (Reed *et al*., 2006).

The Savannah lithoherms consist of dense mounds of *L. pertusa* and *E. profunda* and are located off the coast of Savannah, Georgia (90 nm) along the western edge of the Blake Plateau in water depths of 490 to 550 m (Reed and Ross, 2005; Reed *et al*., 2006). The *L. pertusa* mounds reach 30 to 60 m in height and form along the Florida-Hatteras slope on the Charleston Bump (450 to 850 m) (Reed *et al*., 2006). The north faces of the lithoherms have exposed black phosphoritic pavements that support coral mounds. The mounds have a NNE-SSW orientation, are 10 m wide, average 1 km in length, and have 25° to 37° slopes (Reed *et al*., 2006). In addition to *L. pertusa* there are other coral and sponge species (10% of the total live coverage) found on the north faces of the high relief mounds such as black coral (*Antipathes* sp.), octocorals (gorgonians), numerous species of sponges (fan sponges [*Phakellia* sp.], plate sponges [Astrophorida], and glass sponges [Hexactinellida]) (Reed *et al*., 2006). The south slopes of the lithoherms have less of a slope (10°) and 90 percent of their substrate consists of dead *L. pertusa* and coarse sand (Reed *et al*., 2006).

The Florida *L. pertusa* reefs comprise two areas: Southern Georgia to Jacksonville, Florida (northern reefs) and St. Augustine to Jupiter, Florida (southern reefs) both contained roughly within the 700 m to 800 m depth range (Reed and Ross, 2005; Reed *et al*., 2006). The northern reefs consist mainly of live coral thickets of *L. pertusa* that grow on top of dead coral rubble (Reed *et al*., 2006). The southern reefs (northern region in JAX and Charleston OPAREAs) are mainly composed of *L. pertusa* and *E. profunda* that grow on top of dead coral rubble (Reed *et al*., 2006). Commonly found with *L. pertusa* from Jacksonville to Jupiter, Florida are various sponge species (*Geodia* spp., *Phakellia* spp., *Spongosorites* spp.), black corals (*Antipathes* sp.), bamboo corals (Isididae), and octocorals (gorgonians) as well as crustaceans and fish species (Reed *et al*., 2006).

In response to research revealing the distribution, importance, and uniqueness of deepwater coral habitats in the South Atlantic, the South Atlantic Fishery Management Council has proposed establishment of four new deepwater coral habitat areas of particular concern (HAPC) (Figure 3.6-3) (SAFMC, 2008). Portions of the largest proposed deepwater coral HAPC (Stetson Reef/Savannah and East Florida Lithoherms/Miami Terrace) are located within the JAX and

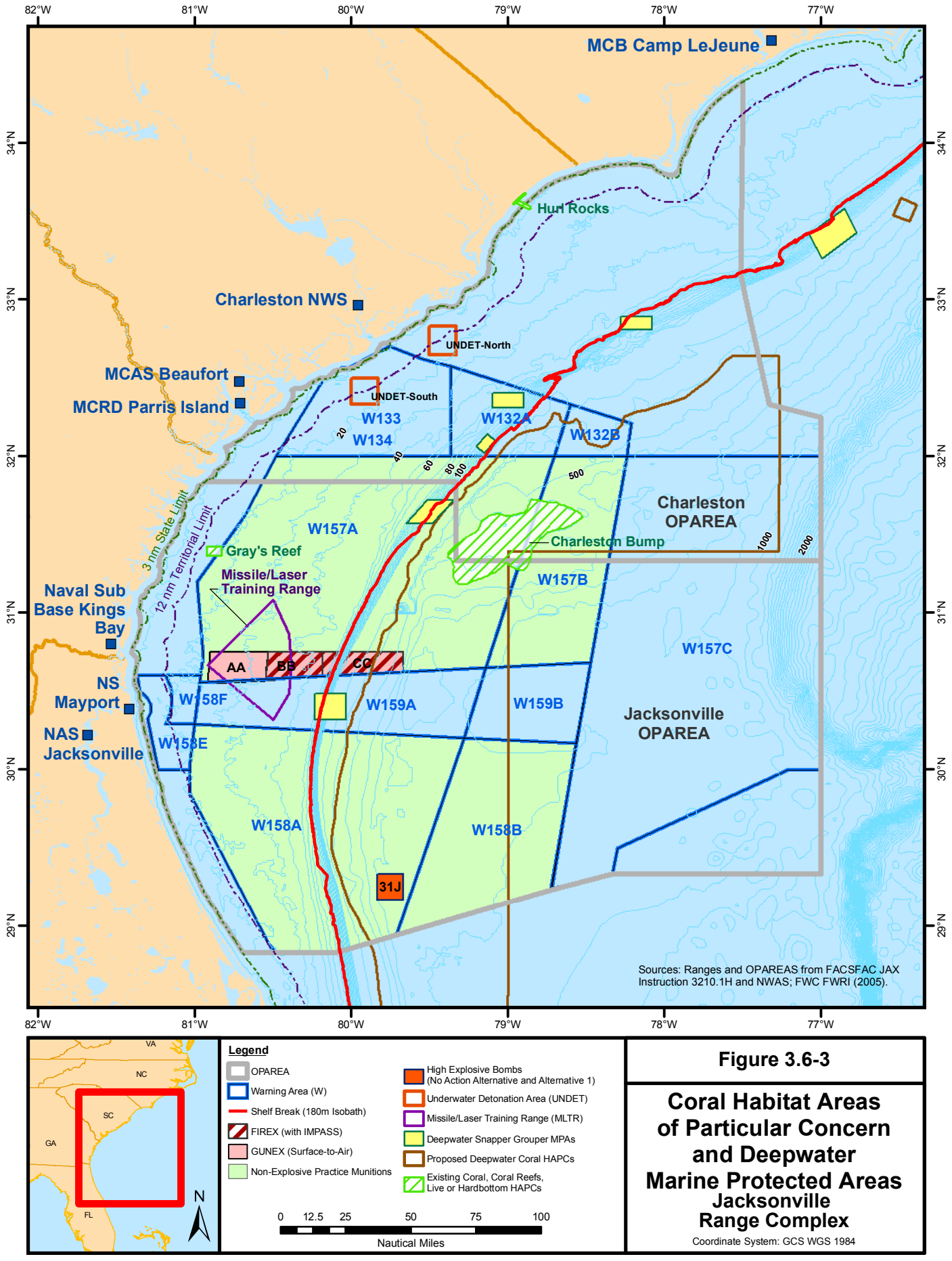


Figure 3.6-3

Coral Habitat Areas of Particular Concern and Deepwater Marine Protected Areas
Jacksonville Range Complex

Coordinate System: GCS WGS 1984

Charleston OPAREAs. This proposed HAPC encompasses about 12,490 nm^2 within the JAX and Charleston OPAREAs west of the shelf break, in waters ranging from 300 to 1,100 m deep. Action to establish the new deepwater coral HAPCs will be taken through the Comprehensive Fishery Ecosystem Plan Amendment, which was under development as of October 2008 (SAFMC, 2008).

The South Atlantic Fishery Management Council has recently designated a series of eight deepwater marine protected areas in the South Atlantic region. The marine protected areas are designed to protect a portion of the long-lived, deepwater snapper grouper species and their habitat from directed fishing pressure (NMFS, 2008). Juvenile and adults of most snapper grouper species are demersal and associate with live/hard bottom that has moderate to high relief (*e.g.*, coral reef systems, artificial reef structures, rocky hard bottom substrates, and limestone outcroppings) (SAFMC and NMFS, 2006). Therefore, the marine protected areas represent areas of important live/hard bottom habitat. Five of the proposed marine protected areas (from north to south; Northern South Carolina, Edisto, Charleston Deep Artificial Reef, Georgia, and North Florida) are located within the JAX and Charleston OPAREAs (Figure 3.6-3).

Soft Bottom Communities

Areas where the bottom is covered by soft sediments, like much of the Study Area, (Figure 3.1-2) are largely vacant of benthic organisms that require hard substrate for attachment, growth, and development. Common benthic animals found in soft bottom communities in the Atlantic Ocean include polychaetes (worms), amphipods, archiannellids (worms), bivalves, and asteroids (star fish) (Brooks *et al*., 2004). Factors affecting distribution and abundance can include depth, sediment type, grain size, temperature, and salinity. A literature review conducted by Brooks *et al*. (2004) found inconsistent trends concerning the relationship between benthic macrofaunal density and depth off the U.S. east coast.

Chemosynthetic communities are persistent, deep-sea aggregations of bacteria, sessile tubeworms, epibenthic and infaunal clams, and mussels. These communities are unusual because they use a carbon source independent of sunlight and photosynthesis, unlike the photosynthetic food chains that support the majority of life on earth. Chemoautotrophic bacteria (usually symbionts) are the basis of these deep-sea trophic systems; chemosynthetic bacteria and their byproducts (carbon) support thriving assemblages of sessile invertebrates through symbiosis. Chemosynthesis is a microbial pathway that generates organic carbon, in the absence of light, by use of energy from chemical reactions. Chemosynthetic communities typically occur where cracks in the seafloor form seeps that concentrate certain inorganic reducing compounds on the seafloor (>400 m) for utilization by opportunistic benthic biota. Hot water seeping from the subsurface transports methane, hydrogen sulfide, and organic matter to the sediment surface where chemosynthetic bacteria metabolize these compounds (MMS, 1992; MacDonald, 2001).

During ocean-drilling activities that explored a small area (only 3,000 km^2) on the Blake Outer Ridge in 1992, chemosynthetic mussels were discovered as part of the first cold-seep (methane leaking from a gas-hydrate bed) community found along the U.S. east coast. Communities supported by chemosynthesis are well documented between the longitudes of 94°W and 88°W, at depths of 400 and 2,200 m on the northern continental slope of the Gulf of Mexico (MacDonald,

2001). Recent explorations conducted by the NOAA's Ocean Explorer Program confirmed the presence of chemosynthetic bacteria (feeding on methane) and associated organisms on the Blake Outer Ridge (NOAA, 2001). In addition to the large bacterial mats of *Beggiatoa*, mussels, clams, benthic foraminiferans, xenophyophores (giant [up to 25 cm] deep-sea, benthic protozoans), and alvinocarid shrimp comprise the components of the chemosynthetic community observed at this 2,155-m deep site (NOAA, 2001). The types of invertebrates found on the Blake Outer Ridge differ from those invertebrates (tube worms, mussels) collected and observed in the Gulf of Mexico. For example, the species of clams collected in the South Atlantic Bight have yet to be seen at seeps in the Gulf of Mexico, and the occurrence of xenophyophores at Blake Outer Ridge is the first documented finding of these single-celled organisms at seep sites (NOAA, 2001).

3.6.2.3 Artificial Habitats

In addition to the natural hard bottom habitats in the Study Area, artificial habitats provide suitable hard substrate for epibenthic marine organisms (organisms that live on the top of the sea floor) such as algae, sponges, anemones, barnacles, and tunicates to attach, develop, and grow on (Bohnsack *et al.*, 1991). Artificial reefs may have been created accidentally (shipwrecks) or deliberately (National Artificial Reef Plan, Liberty Ship Act, and various state artificial reef programs). The National Fishing Enhancement Act of 1984 defined an artificial reef as a man-made structure created in the navigable waters of the United States or in waters adjacent to the outer continental shelf (Seaman, 2000). Artificial reefs consist of such materials as rock or concrete rubble, decommissioned military vehicles, culverts, and even retired offshore oil/gas production platforms. The deliberate purpose underlying construction of artificial reefs is to create and enhance marine benthic habitat as well as help improve recreational fishing. An additional effect of artificial reef construction has been broadening the distribution of some species into previously unoccupied habitat (Seaman, 2000).

Whether purposefully or accidentally created, artificial reefs are so successful at enhancing habitat and improving fishing that they are called fish havens on some nautical charts. In addition to recreational fishing, artificial reefs and shipwrecks also support the recreational diving and commercial fishing industries. Commercial use may involve setting pots or gillnets adjacent to reefs or trawling along the outer margins of a reef (Polovina, 1991). Commercial and recreational use of these areas varies from state to state, as do restrictions that regulate individual species. Fishermen commonly target shark, king mackerel, amberjacks, barracuda, cobia, and bluefish at productive artificial habitat sites (Myatt, 1978). Other targeted fishes such as black sea bass, scup, monkfish, and summer flounder seasonally seek out artificial reef habitats for shelter and food. This is also generally true of members of the snapper and grouper families that aggregate around physical structures in the ocean (SCWMRD and Georgia Department of Natural Resources, 1981).

State marine resources management agencies off all four South Atlantic states in the Study Area are actively involved in various aspects of artificial reef planning, development, and management in their own waters as well as in contiguous federal waters. All four states have their own state artificial reef management plans. North Carolina, South Carolina, and Georgia control all artificial reef development through programs within their respective natural resources management agencies, while individual county or municipal programs carry out Florida's efforts with a limited degree of oversight conducted by state agencies (SAFMC, 1998).

Approximately 160 artificial reef complexes, consisting of 679 artificial reefs, have been established within the bounds of the Study Area (Figure 3.6-4). Reef complexes can be composed of more than one type of reef material and consist of separate aggregations of artificial reef material located within 500 m of one another. In addition to artificial reef complexes, there are approximately 208 individual artificial reefs within the Study Area (SAFMC, 1998). The Study Area contains numerous shipwrecks, some of which are located in nearshore waters outside the OPAREAs (Veridian Corporation, 2001).

Off the State of Georgia, a set of naval towers, which closely resemble smaller versions of oil drilling structures found in the Gulf of Mexico, act as artificial habitats that attract many different species of fish (*e.g.*, snapper-grouper complex, coastal migratory pelagics, and highly migratory pelagics) (Georgia Sportsman, 2002). The Navy "R" tower rectangular grid, consisting of eight towers, covers an area measuring approximately 133 by 57 km and encompasses the entire Georgia coastline (Figure 3.6-4). The towers range from 46 to about 102 km offshore in water depths ranging from 21 to 43 m.

3.6.2.4 National Marine Sanctuaries

The NOAA designates and manages national marine sanctuaries under the National Marine Sanctuary Program. These areas of the marine environment possess special national significance because of their conservation, recreational, ecological, historical, scientific, cultural, archaeological, educational, or esthetic qualities. The primary objective of the National Marine Sanctuary Program is to manage marine resources.

Gray's Reef National Marine Sanctuary (see Figure 3.6-1), located in the JAX Study Area, was established in 1981 and is one of the largest nearshore live/hard bottom reefs in the southeastern United States (NOAA, 2008). The 17.5 nm^2 that constitute Gray's Reef are located 17.5 nm off Sapelo Island, Georgia (NOAA, 2008), in the JAX OPAREA. Most of the sanctuary is located in Area 18C and portions of the sanctuary lie under the western edge of W-157A.

Gray's Reef is popular for recreational fishing and diving because of its "live bottom habitat" that supports an unusual assemblage of organisms and temperate and tropical marine flora and fauna that attach to the rocky platform. The area is characterized by a series of rock ledges and sand expanses that have created deep burrows, troughs, and caves that attract an array of different species including black sea bass, snapper, grouper, and mackerel. The composition of fish populations change seasonally because the reef lies in a transition area between temperate and tropical waters. Dominant invertebrates that inhabit the area include sponges, barnacles, sea fans, hard coral, crabs, lobsters, and snails. The area supports endangered and threatened species such as loggerhead turtles, which are present year-round. The reef is also part of the only known winter calving grounds for the North Atlantic right whale (NOAA, 2008).

Sport fishing and diving occurs year-round at Gray's Reef. However, certain types of equipment are restricted in the area such as wire fish traps, bottom trawls, and explosives. Commercial fishing, mineral extraction, and ocean dumping is restricted. Alteration of the seabed is prohibited in the area, including removal or damage to bottom formations and other natural or cultural resources (NOAA, 2008). The National Marine Sanctuary Program Regulations (15 CFR Part 922) state the following with respect to military activities: "All activities currently carried out by the Department of Defense within the Sanctuary are essential for the national defense and,

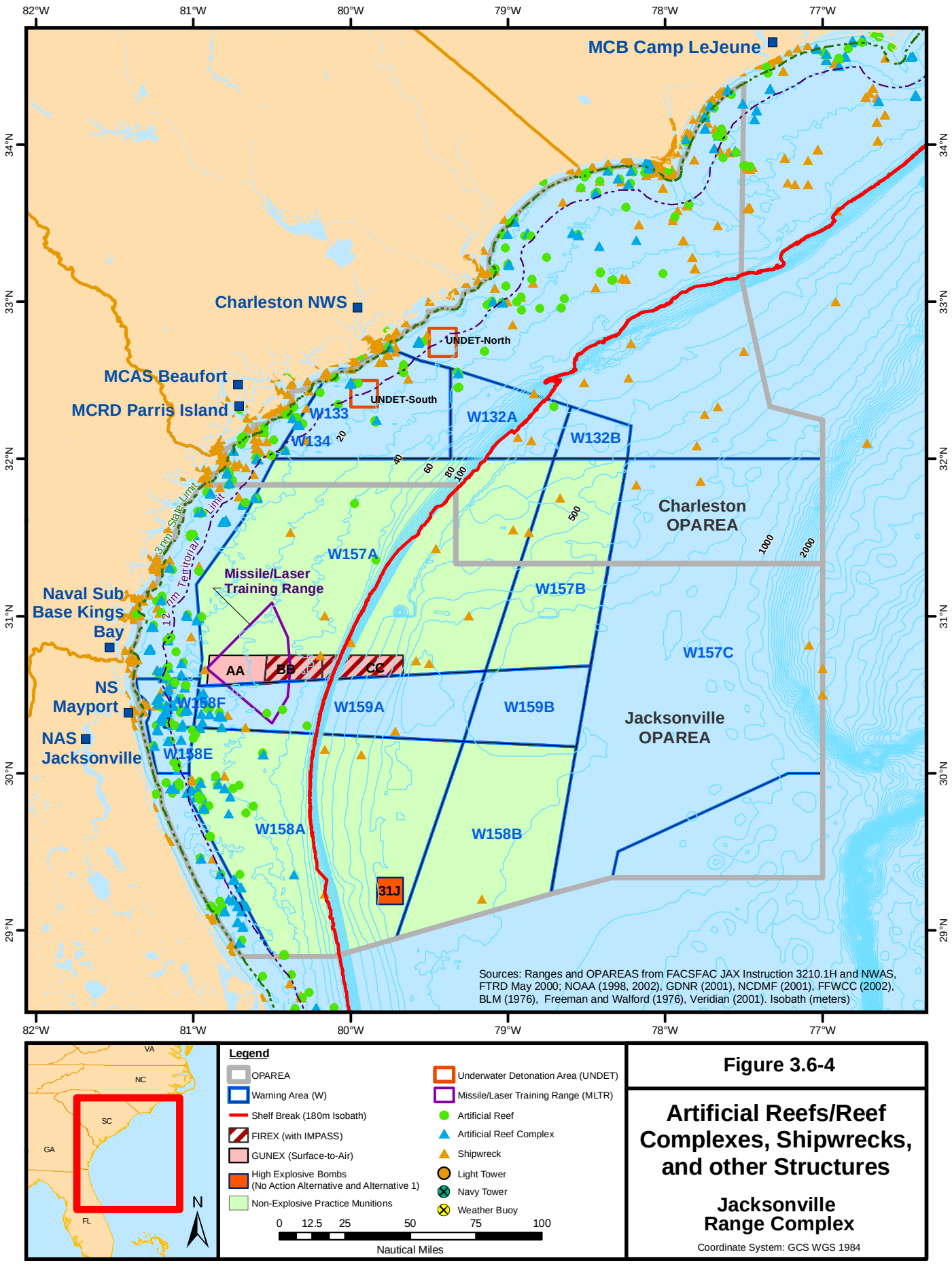


Figure 3.6-4

Artificial Reefs/Reef Complexes, Shipwrecks, and other Structures

Jacksonville Range Complex

Coordinate System: GCS WGS 1984

therefore, not subject to the prohibitions in this section. The exemption of additional activities having significant impacts shall be determined in consultation between the Director and the Department of Defense."

3.6.3 Environmental Consequences

3.6.3.1 No Action Alternative

Vessel Movements

Many of the ongoing and proposed operations within the Study Area involve maneuvers by various types of surface ships, boats, and submarines (collectively referred to as vessels) (see Tables 2.2-4 and 2.2-5). Currently, the number of Navy ships operating in the Study Area varies based on training schedules and can range from 0 to about 10 ships at any given time. Ship sizes range from 362 feet for a nuclear submarine to 1,092 feet for a nuclear powered aircraft carrier. During training and operations, speeds generally range from 10 to 14 knots. Operations involving vessel movements occur intermittently and are short in duration, ranging from a few hours up to a few weeks. These operations are widely dispersed throughout the Study Area, which is a vast area encompassing 50,090 nm^2. The Navy would log about 1,000 total steaming days[47] within the Study Area during a typical year under the No Action Alternative. Vessel movements would have no direct effect on benthic communities or artificial habitats because Navy vessels are operated in relatively deep waters and have navigational capabilities to avoid contact with these habitats.

Vessel movements would result in short-term and localized disturbances to water column and *Sargassum* habitats. Phytoplankton, zooplankton, and ichthyoplankton in the upper portions of the water column could be displaced, injured, or killed by vessel and propeller movements. However, no measurable effects on plankton populations would occur because the number of organisms exposed to vessel movements would be low relative to total plankton biomass. Navy mitigation measures include avoidance of large *Sargassum* mats by vessels (Chapter 5). Vessel movements in territorial waters would have no significant impact on marine communities under the No Action Alternative. Similarly, vessel movements in non-territorial waters would not cause significant harm to marine communities under the No Action Alternative.

Aircraft Overflights

Various types of fixed-wing aircraft and helicopters are used in training exercises throughout the Study Area (see Chapter 2 and Appendix D). These aircraft overflights would produce airborne noise and some of this energy would be transmitted into the water. The potential affects of aircraft noise on various marine community components are analyzed in detailed in Sections 3.7 – Marine Mammals, 3.8 – Sea Turtles, and 3.9 – Fish and Essential Fish Habitat. Based on the analyses presented in those sections, aircraft overflights over territorial waters would have no significant impact on marine communities under the No Action Alternative. In addition, aircraft overflights over non-territorial waters would not cause significant harm to marine communities under the No Action Alternative.

[47] Steaming days are a measurement of time; a single vessel within a 24 hour timeframe.

Towed Mine Warfare Devices

As described in Chapter 2 and Appendix D, MIW Exercises conducted in the Study Area include the use of various underwater mine detection and countermeasures systems towed through the water by helicopters flying approximately 75 feet above the water at low airspeeds. Seventy-eight towed Mine Warfare device sorties would be conducted in Amber Strait and Kaiser Carrier Operating Area (Figure 2.2-1) under the No Action Alternative. The use of towed Mine Warfare devices would result in short-term and localized disturbances to the water column, but benthic habitats would not be affected because the devices are not towed on the bottom and the training areas are located in deep waters (about 30 to 800 m). *Sargassum* mats are likely to occur in the training areas based on their proximity to the Gulf Stream and the western frontal boundary of the Gulf Stream. While towed Mine Warfare devices could result in short-term and localized disturbances to *Sargassum* habitats, Navy mitigation measures specify that the crew monitor for *Sargassum* rafts prior to and during the exercise. Visible *Sargassum* would be avoided to prevent fouling of the towed devices. Air crews operating the helicopters are expected to be able to see and avoid most *Sargassum* mats. Therefore, any disturbance to *Sargassum* would be limited to very small patches not visible to the air crew. Other types of plankton in the upper portions of the water column could be displaced, injured, or killed by towed devices. However, no measurable effects on plankton populations would occur because the number of organisms exposed would be low relative to total plankton biomass. In accordance with EO 12114, towed MIW device use in non-territorial waters under the No Action Alternative would not cause significant harm to marine communities. Towed Mine Warfare devices would not be used in territorial waters under the No Action Alternative.

Mine Warfare Training (Non-explosive Mine Shape Deployment / Recovery)

The No Action Alternative does not include establishment of MIW training areas where non-explosive mineshapes would be deployed.

Non-Explosive Practice Munitions

Current Navy operations in the Study Area include firing a variety of weapons and employ a variety of NEPM, including bombs, missiles, naval gun shells, cannon shells, and small caliber ammunition. NEPM use occurs in several training areas, but it is not used in state waters (0 to 3 nm from shore) (see Table 2.2-6 for a summary of ordnance use by training area).

NEPM and associated shrapnel have the potential to directly strike marine life and marine habitats as it travels through the water column and comes in contact with the sea floor. The potential effects of direct NEPM strikes at or near the sea surface and within the water column are analyzed in Sections 3.7.3 – Marine Mammals, Section 3.8.3 - Sea Turtles, and Section 3.9.3 – Fish and Essential Fish Habitat. This section analyzes the potential effects of NEPM strikes on benthic communities and artificial habitats.

The potential for NEPM strikes to adversely affect benthic communities depends on several factors, including the size and speed of the ordnance, water depth, the number of rounds delivered, the frequency of training, and the presence/absence of sensitive benthic communities. As described in Section 3.6.2.2, both soft bottom and hard bottom communities occur in the Study Area. While a broad area of soft and hard bottom benthic habitat could be exposed to direct ordnance strikes, the training exercises are intermittent and widely dispersed, which decreases the likelihood that a given area would be subjected to repeated exposure. Most

ordnance firing occurs in areas greater than 12 nm offshore in waters ranging from about 15 m deep to over 900 m deep. NEPM velocity would rapidly decrease upon contact with the water and as it travels through the water column. Consequently, NEPM strikes would cause little or no physical damage to soft bottom benthic habitat and any damage would be localized.

Live hard bottom habitats would be more vulnerable to damage from NEPM strikes. This is particularly true for areas that support coral because coral is fragile and could be easily broken by contact with larger objects such as non-explosive practice bombs. Repopulation and recovery of damaged hard bottom habitats would be relatively slow (*e.g.*, years to a decade or more) compared to soft bottom areas (*e.g.*, less than one year) (NRC, 2002).

Large, heavy items such as non-explosive practice bombs, missiles, and naval gun shells (Table 3.6-2) could cause damage if they struck sensitive hard bottom habitat. Small caliber ammunition has little potential to disturb the bottom because these materials are relatively small and light, and their velocity would decrease through the water column. A total of 360 non-explosive practice bombs would be dropped per year under the No Action Alternative; 180 per year in W-157A/B (10,423 nm^2) and 180 per year in W-158A/B (8,597 nm^2). Assuming an even distribution within each area, the relative concentration of non-explosive practice bombs would be 1.7 per 100 nm^2/year in W-157A/B and 2.1 per 100 nm^2/year in W-158A/B. Actual concentrations would vary based specific training scenarios, but would nonetheless be extremely low. Non-explosive practice missiles use (14 per year for No Action Alternative) would be widely dispersed in W-132, w-133, W-134, W-157, and W-158A total of 14 non-explosive practice. A total of 2,174 non-explosive naval gun shells (5 in and 76 mm) would be fired per year in under the No Action Alternative in Surface Gunnery Areas AA, BB, and CC.

The maximum area of benthic habitat affected by non-explosive practice bomb, missile, and naval gun shell strikes would be approximately 7,151 ft^2 (0.00019 nm^2) per year or 71,510 ft^2 (0.00195 nm^2) over a ten-year period for the No Action Alternative, assuming that the area affected by a single NEPM would be two time its footprint (Table 3.6-3).

TABLE 3.6-2
SIZE OF NON-EXPLOSIVE PRACTICE BOMBS, MISSILES, AND NAVAL GUN SHELLS USED IN THE OPAREAS

NEPM Type	Weight (pounds)	Length (inches)	Diameter (inches)	Footprint (ft^2)[1]
BDU-45	500	66	11	5.0
MK-76	25	25	4	0.7
MK-20 Rockeye Cluster (each dispenses 247 bomblets)	1.32 (per bomblet)	6.5 (per bomblet)	2 (per bomblet)	22.3 (total per bomb)
MK-83(I)[1]	1,000	119	14	11.6
AIM-7	500	144	8	8
AIM-9	190	113	5	3.9
AIM-120	350	144	7	7
5 in	70	26	5	0.9
76 mm	14	14	3	0.3

[1]Footprint = length x diameter.

TABLE 3.6-3
ESTIMATES OF MARINE BENTHIC HABITAT THAT WOULD BE AFFECTED BY NON-EXPLOSIVE PRACTICE BOMBS, MISSILES, AND NAVAL GUN SHELLS IN THE OPAREAS

NEPM Type	No Action Alternative		Alternative 1		Alternative 2	
	#/Yr	Area Affected/Yr (ft^2)(1)	#/Yr	Area Affected/Yr (ft^2)(1)	#/Yr	Area Affected/Yr (ft^2)(1)
Non-Explosive Practice Bombs – W-157A/B and W-158A/B						
BDU-45	180	1,822	180	1,822	360	3,643
MK-76	129	179	129	179	129	179
MK-20	51	2,274	51	2,274	51	2,274
MK-83(I)	0	0	0	0	12	278
Subtotal =	360	4,275	360	4,275	552	6,374
Non-Explosive Practice Missiles (Air-to-Air) – W-132, W-133, W-134, W-157, and W-158						
AIM-7	5	80	5	80	5	80
AIM-9	4	31	5	39	5	39
AIM-120	5	70	5	70	5	70
Subtotal =	14	181	15	189	15	189
Non-Explosive Practice Naval Gun Shells – Surface Gunnery Areas AA, BB, and CC						
5 in	1,135	2,049	1,220	2,203	1,220	2,203
76 mm	1,039	646	1,152	716	1,152	716
Subtotal =	2,174	2,695	2,372	2,919	2,372	2,919
Total =		7,151		7,383		9,482

(1)Assumed that the area of marine benthic habitat affected per year = footprint x 2 x #/yr.

As shown in Figures 3.6-1 through 3.6-4, live hard bottom and artificial habitats are found in portions of the areas where non-explosive practice bombs, missiles, and naval gun shells would be used, including hard bottom EFH, a proposed deepwater coral HAPC, and a deepwater snapper grouper marine protected area. The probability of non-explosive practice bombs, missiles, and naval gun shells striking artificial habitats would be low because these resources occupy a relatively small area and most are located relatively close to shore, outside of the training areas where these munitions are used. The probability of a strike in the snapper grouper marine protected area would also be low because it covers a relatively small area in W-157A.

Based on the distribution of hard bottom EFH (Figure 3.6-2) and proposed deepwater coral HAPC (Figure 3.6-3), it is expected that some non-explosive practice bombs, missiles, and naval gun shells would strike in these areas. The potential for strikes to adversely affect benthic communities in these areas would depend on the substrate and community types found at the point of physical impact. Given the dispersed nature of the training activities, often patchy distribution of community types, and relatively limited bottom mapping data, it is not possible to accurately determine the number of non-explosive practice bombs, missiles, and naval gun shells that would strike soft bottom habitats versus more sensitive areas such as live hard bottom or coral mounds. Nonetheless, the total area of benthic habitat affected by non-explosive practice bomb, missile, and naval gun shell strikes would be small (about 7,151 ft^2 per year) and only a percentage of the total area affected (less than 7,1515 ft^2 per year) would be sensitive benthic habitat such as live hard bottom or coral mounds. Based on geographic information system data obtained through the South Atlantic Fishery Management Council, the Study Area contains about

18,919 nm^2 of live hard bottom EFH. The total benthic habitat affected represents less than 0.000001 percent of the total live hard bottom EFH in the Study Area.

Non-explosive practice bomb, missile, and naval gun shell strikes could result in long-term, minor effects to live hard bottom communities, but the effects would be localized and no long-term changes to community structure or function would be expected. NEPM strikes in territorial waters would have no significant impact on marine communities under the No Action Alternative. Similarly, NEPM strikes in non-territorial waters would not cause significant harm to marine communities under the No Action Alternative.

Underwater Detonations and Explosive Ordnance

Explosions that occur in the OPAREAs are associated with training exercises that use HE ordnance, including bombs (BOMBEX), missiles (MISSILEX), and naval gun shells (FIREX with IMPASS, 5-inch HE rounds), small arms (anti-swimmer grenades, 8 oz HE) as well as UNDETs associated with Mine Neutralization training (MINEX). Underwater detonation and HE ordnance use is limited to a few specific training areas (see Table 2.2-7 for a summary of explosions by training area) and does not occur in state waters (0 to 3 nm from shore). The potential effects of explosions on marine mammals, sea turtles, fish, and their habitat are analyzed in Sections 3.7.3, 3.8.3, and 3.9.3, respectively. This section analyzes the potential effects of UNDETs and HE ordnance use on plankton, benthic communities, and artificial habitats.

Explosions associated with BOMBEX, MISSILEX, FIREX with IMPASS, and small arms (anti-swimmer grenades) occur at or near the water's surface in areas where depths range from 20 m to over 900 m. Of the ordnance types that would be used during these exercises under the No Action Alternative, the MK-84 HE bomb has the highest net explosive weight (NEW) (944.7 lbs). Using the equation presented in Swisdak (1978), the maximum radius of the gas bubble produced by a MK-84 HE bomb explosion would be about 11.9 m. The gas bubble would not extend to the sea floor based on the minimum water depth (20 m) and a detonation depth of 1 m below the surface. Likewise, the gas bubbles produced by other ordnance types used in BOMBEX, MISSILEX, FIREX with IMPASS, and small arms would not extend to the bottom because they have smaller NEWs. Therefore, explosions during these exercises are expected to have minimal effects on benthic communities and artificial habitats. These explosions would result in short-term and localized disturbances to the water column. Plankton in the immediate vicinity of explosions would be injured or killed. However, no measurable effects on plankton populations would occur because the number of organisms affected would be low relative to the total plankton biomass. Effects of explosions on *Sargassum* would be minimal because Navy mitigation measures (see Chapter 5) include avoidance of *Sargassum* mats.

Underwater detonations would be associated with mine neutralization training exercises, where explosive ordnance disposal detachments place explosive charges next to or on non-explosive practice mines. Under the No Action Alternative 18 charges with 20-lbs NEW would be detonated per year in the North and South Underwater Detonation Areas (10L and 12I), where water depths range from about 10 to 20 m. Some charges would be detonated directly on the bottom and the others would be detonated in the water column.

The Navy does not set explosive charges within 1,000 ft of known live/hard bottom, artificial reefs, and shipwrecks. (see Chapter 5 for detailed description of Navy mitigation measures). Therefore, only unconsolidated, soft bottom and water column habitats would be exposed to impacts from UNDETs. Cratering of soft bottom sea floor and water column disturbance would

result from UNDETs. For a specific size of explosive charge, crater depths and widths would vary depending on depth of the charge and sediment type, but crater dimensions generally decrease as bottom depth increases. A 20-lbs NEW charge detonated on the bottom can create depressions in the substrate up to 4 to 5 feet in diameter (12.6 to 19.6 ft^2) and 1-foot deep (DoN, 2000). Assuming a worst-case scenario where all UNDETs occurred on the bottom, about 227 to 353 ft^2 of benthic habitat would be affected per year (based on 18 detonations per year and 12.6 to 19.6 ft^2 affected per detonation). Crater effects are usually temporary in sand and mud bottoms. Short-term increases in turbidity, resuspension of bottom sediments, and localized mortality to a small number of benthic organisms and plankton would be expected. Repopulation of displaced sediments should be relatively rapid compared to hard bottom areas (NRC, 2002). Underwater detonations would not result in long-term population- or community-level effects.

Underwater detonations and HE ordnance use in territorial waters would have no significant impact on marine communities under the No Action Alternative. Furthermore, UNDETs and HE ordnance use in non-territorial waters would not cause significant harm to marine communities under the No Action Alternative.

Military Expended Material

The Navy uses a variety of MEM during training exercises conducted in the OPAREAs. The types and quantities of MEM used and information regarding fate and transport of this material within the marine environment are discussed in Section 3.2. Soft and hard bottom benthic communities throughout the OPAREAs would be exposed to MEM because use is widely dispersed and a majority of the material rapidly sinks to the sea floor. The analysis presented in Section 3.2 indicates that MEM would become encrusted by natural processes and incorporated into the sea floor, with no significant accumulations in any particular area and no negative effects to water quality. Some of the material is the same as that often used in artificial reef construction (*e.g.*, concrete and metal) and would be colonized by benthic organisms that prefer hard substrate. This colonization could result in localized increases in species richness and abundance, but no significant changes in community structure or function would be anticipated based on the limited amount and dispersed nature of the material. Military expended material use in territorial waters would have no significant impact on marine communities under the No Action Alternative. Furthermore, MEM use in non-territorial waters would not cause significant harm to marine communities under the No Action Alternative.

National Marine Sanctuaries

Gray's Reef National Marine Sanctuary encompasses about 17.5 nm^2 in the JAX OPAREA. Most of the sanctuary is located in Area 18C and portions of the sanctuary lie under the western edge of W-157A. Potential stressors associated with operations that may occur in the area include vessel movements, aircraft overflights, NEPM, and MEM. Based on the analyses presented above and elsewhere in this FEIS/OEIS, these stressors are not expected to destroy, cause the loss of, or injure any sanctuary resource under the No Action Alternative. Underwater detonations and HE ordnance use do not occur in the vicinity of Gray's Reef National Marine Sanctuary and would have no effect on sanctuary resources. The No Action Alternative would have no significant impact on national marine sanctuaries.

Precision Anchoring

Ship crews conduct Precision Anchoring during the training cycle to fulfill qualification requirements. These exercises are conducted at two designated anchorage areas located about 3 nm offshore from Naval Station Mayport (Figure 2.2-5). Each exercise involves several practice anchor drops and the final drop is graded. Anchors are dropped as close as possible to the coordinates for the designated anchorage area. Drops occur within 1,000 ft of the designated point. About 168 Precision Anchoring exercises would be conducted per year under the No Action Alternative and each exercise would include several anchor drops. An aircraft carrier anchor weighs about 60,000 pounds. The total anchor weight including the chain is about 735,000 pounds.

Precision Anchoring would result in short-term and localized disturbances to water column habitats and long-term disturbances to benthic habitats. Bottom sediments would be disturbed and localized increases in turbidity would occur when an anchor makes contact with the sea floor, but turbidity would quickly dissipate following the exercise. Available geographic information system mapping data indicates that no hard bottom habitat exists within about 6,500 ft of the designated anchorage areas and no artificial habitats are located within about 10,000 ft. Therefore, only soft bottom benthic habitats would be affected. The soft bottom benthic habitat present in the designated anchorage areas has likely suffered some degradation from long-term, historical use of the areas for anchoring. A limited number of benthic organisms would be crushed by the anchors, but no population-level effects would be anticipated. Baseline conditions would not be expected to change under the No Action Alternative. Confining these exercises to two relatively small areas (approximately 0.09 nm^2 each) that lack hard bottom and artificial habitats minimizes impacts to marine communities. In accordance with NEPA, Precision Anchoring in territorial waters under the No Action Alternative would have no significant impact on marine communities. Precision Anchoring would not take place in non-territorial waters.

3.6.3.2 Alternative 1

Vessel Movements

Vessel movements would increase by about 5 percent per year in the Study Area under Alternative 1 (Table 2.2-5). These changes would result in increased potential for phytoplankton, zooplankton, and ichthyoplankton in the upper portions of the water column to be displaced, injured, or killed by vessel and propeller movements compared to baseline conditions. However, no measurable effects on plankton populations would occur because the number of organisms exposed to vessel movements would continue to be low relative to total plankton biomass. Navy mitigation measures would continue to include avoidance of large *Sargassum* mats by vessels (Chapter 5). Vessel movements in territorial waters would have no significant impact on marine communities under Alternative 1. Similarly, vessel movements in non-territorial waters would not cause significant harm to marine communities under Alternative 1.

Aircraft Overflights

Alternative 1 would include an 8 percent increase in fixed-wing aircraft sorties per year and a 34 percent increase in helicopter sorties per year in the Study Area (Table 2.2-5). The potential affects of aircraft noise on various marine community components are analyzed in detailed in Sections 3.7 – Marine Mammals, 3.8 – Sea Turtles, and 3.9 – Fish and Essential Fish Habitat. Based on the analyses presented in those sections, aircraft overflights over territorial waters

would have no significant impact on marine communities under Alternative 1. In addition, aircraft overflights over non-territorial waters would not cause significant harm to marine communities under Alternative 1.

Towed Mine Warfare Devices

Towed Mine Warfare device sorties would increase from 78 to 150 sorties per year (92% increase) under Alternative 1. These operations would continue to occur in Amber Strait and the Kaiser Carrier Operating Area. Similar to the No Action Alternative, use of towed Mine Warfare devices would result in short-term and localized disturbances to the water column, but benthic habitats would not be affected because the devices are not towed on the bottom and the training areas are located in deep waters (about 30 to 800 m). While towed Mine Warfare devices could result in short-term and localized disturbances to *Sargassum* habitats, Navy mitigation measures specify that the crew monitor for *Sargassum* rafts prior to and during the exercise. Visible *Sargassum* would be avoided to prevent fouling of the towed devices. Air crews operating the helicopters are expected to be able to see and avoid most *Sargassum* mats. Therefore, any disturbance to *Sargassum* would be limited to very small patches not visible to the air crew. Other types of plankton in the upper portions of the water column could be displaced, injured, or killed by towed devices. These impacts would increase relative to the No Action Alternative. However, no measurable effects on plankton populations would occur because the number of organisms exposed would be low relative to total plankton biomass. In accordance with EO 12114, towed Mine Warfare device use in non-territorial waters under Alternative 1 would not cause significant harm to marine communities. Towed Mine Warfare devices would not be used in territorial waters under Alternative 1.

Mine Warfare Training (Non-explosive Mine Shape Deployment / Recovery)

Alternative 1 does not include establishment of MIW training areas where non-explosive mineshapes would be deployed.

Non-Explosive Practice Munitions

The amount of NEPM used in the JAX Study Area would increase under Alternative 1 (Tables 2.2-5 and 2.2-6). These changes would result in increased potential for NEPM to strike benthic communities and artificial habitats compared to baseline conditions. The number of non-explosive practice bombs, which are some of the largest types of NEPM, would not change under Alternative 1. One additional non-explosive practice missile and 198 additional non-explosive practice naval gun shells would be used under Alternative 1; increasing the total area of benthic habitat affected from 7,151 ft2 per year to 7,383 ft2 per year. Otherwise, the analysis presented for non-explosive practice bombs, missiles, and naval gun shells and the No Action Alternative is applicable to Alternative 1. As discussed for the No Action Alternative, NEPM velocity would rapidly decrease upon contact with the water and as it travels through the water column. Consequently, NEPM strikes would cause little or no physical damage to soft bottom benthic habitat and any damage would be localized. Non-explosive practice bomb, missile, and naval gun shell strikes could result in long-term, minor effects to live hard bottom communities, but the effects would be localized and no long-term changes to community structure or function would be expected. NEPM strikes in territorial waters would have no significant impact on marine communities under Alternative 1. Similarly, NEPM strikes in non-territorial waters would not cause significant harm to marine communities under Alternative 1.

Underwater Detonations and High Explosive Ordnance

The number and location of explosions occurring in the Study Area would not change under Alternative 1, with the exception of missiles and 20-lbs NEW underwater detonation charges (Tables 2.2-5 and 2.2-7). Forty additional Hellfire missile explosions would occur in W-157A/W-159A. These explosions would continue to occur at or near the water's surface in relatively deep water. As discussed for the No Action Alternative, explosions at or near the surface are expected to have minimal effects on benthic communities and artificial habitats because the explosions' gas bubbles would not reach the sea floor. These explosions would result in short-term and localized disturbances to the water column. Plankton in the immediate vicinity of explosions would be injured or killed. However, no measurable effects on plankton populations would occur because the number of organisms affected would be low relative to the total plankton biomass. Effects of explosions on *Sargassum* would be minimal because Navy mitigation measures (see Chapter 5) include avoidance of *Sargassum* mats.

The number of 20-lbs NEW underwater detonation charges in the North and South Underwater Detonation Areas (10L and 12I) would decrease from 18 to 12 per year. The types of impacts would be the same as those discussed for the No Action Alternative, but a smaller area would be affected per year under Alternative 1 based on the decrease in operations. A 20-lbs NEW charge detonated on the bottom can create depressions in the substrate up to 4 to 5 feet in diameter (12.6 to 19.6 ft^2) and 1-foot deep (DoN, 2000). Assuming a worst-case scenario where all UNDETs occurred on the bottom, about 151 to 235 ft^2 of benthic habitat would be affected per year under Alternative 1 (based on 12 detonations per year and 12.6 to 19.6 ft^2 affected per detonation). Underwater detonations and HE ordnance use in territorial waters would have no significant impact on marine communities under Alternative 1. Furthermore, underwater detonations and HE ordnance use in non-territorial waters would not cause significant harm to marine communities under Alternative 1.

Military Expended Material

The amount of MEM entering the marine environment would increase in the Study Area under Alternative 1 (Table 2.2-5). These changes would result in increased exposure of benthic communities to MEM. However, the analysis presented in Section 3.2 indicates that no significant accumulations of MEM would occur in any particular area and water quality would not be negatively affected by MEM. Some of the material would be colonized by benthic organisms that prefer hard substrate, resulting in localized increases in species richness and abundance. No significant changes in community structure or function would be anticipated based on the limited amount and dispersed nature of the material. Military expended material use in territorial waters would have no significant impact on marine communities under Alternative 1. Furthermore, MEM use in non-territorial waters would not cause significant harm to marine communities under Alternative 1.

National Marine Sanctuaries

Similar to the No Action Alternative, potential stressors associated with Alternative 1 operations that may occur in the vicinity of Gray's Reef National Marine Sanctuary include vessel movements, aircraft overflights, NEPM, and MEM. Based on the analyses presented above and elsewhere in this FEIS/OEIS, these stressors are not expected to destroy, cause the loss of, or injure any sanctuary resource. UNDETs and HE ordnance use do not occur in the vicinity of Gray's Reef National Marine Sanctuary and would have no effect on sanctuary resources. Alternative 1 does not

include conducting any new military activities in the vicinity of the sanctuary, but a slight increase in ongoing operations such as vessel movements or aircraft overflights could occur. Alternative 1 would have no significant impact on national marine sanctuaries.

Precision Anchoring

Precision Anchoring would not change under Alternative 1. Therefore, the analysis presented for the No Action Alternative is applicable to Alternative 1. In accordance with NEPA, Precision Anchoring in territorial waters under Alternative 1 would have no significant impact on marine communities. Precision Anchoring would not take place in non-territorial waters.

3.6.3.3 Alternative 2 (Preferred Alternative)

Vessel Movements

Vessel movements under Alternative 2 would be the same as Alternative 1 (Table 2.2-5). Therefore, the analysis presented above for Alternative 1 is applicable to Alternative 2. Vessel movements in territorial waters would have no significant impact on marine communities under Alternative 2. Similarly, vessel movements in non-territorial waters would not cause significant harm to marine communities under Alternative 2.

Aircraft Overflights

Alternative 2 would include 9 percent increase in fixed-wing aircraft sorties per year and a 103 percent increase in helicopter sorties per year in the OPAREAs (Table 2.2-5). Many of the new helicopter sorties would be associated with Mine Warfare exercises in Amber Strait, Kaiser Carrier Operating Area, and the Charleston OPAREA (10L and 12I, Figure 2.2-1). The potential affects of aircraft noise on various marine community components are analyzed in detailed in Sections 3.7 – Marine Mammals, 3.8 – Sea Turtles, and 3.9 – Fish and Essential Fish Habitat. Based on the analyses presented in those sections, aircraft overflights over territorial waters would have no significant impact on marine communities under Alternative 2. In addition, aircraft overflights over non-territorial waters would not cause significant harm to marine communities under Alternative 2.

Towed Mine Warfare Devices

Towed Mine Warfare device sorties would increase from 78 per year under the No Action Alternative to 456 per year under Alternative 2 (485% increase). These operations would continue to occur in Amber Strait and the Kaiser Carrier Operating Area. Similar to the No Action Alternative, use of towed Mine Warfare devices would result in short-term and localized disturbances to the water column, but benthic habitats would not be affected because the devices are not towed on the bottom and the training areas are located in deep waters (about 30 to 800 m). While towed Mine Warfare devices could result in short-term and localized disturbances to *Sargassum* habitats, Navy mitigation measures specify that the crew monitor for *Sargassum* rafts prior to and during the exercise. Visible *Sargassum* would be avoided to prevent fouling of the towed devices. Air crews operating the helicopters are expected to be able to see and avoid most *Sargassum* mats. Therefore, any disturbance to *Sargassum* would be limited to very small patches not visible to the air crew. Other types of plankton in the upper portions of the water column could be displaced, injured, or killed by towed devices. These impacts would increase relative to the No Action Alternative and Alternative 1. Despite the substantial increase in towed Mine Warfare device sorties under Alternative 2, no measurable effects on plankton populations would occur because the number of organisms exposed would be low relative to total plankton

biomass. In accordance with EO 12114, towed Mine Warfare device use in non-territorial waters under Alternative 2 would not cause significant harm to marine communities. Towed Mine Warfare devices would not be used in territorial waters under Alternative 2.

Mine Warfare Training (Non-explosive Mine Shape Deployment / Recovery)

As discussed in Chapter 2, Mine Warfare Training Areas would be designated in the North (10L) and South (12I) Underwater Detonation Areas under Alternative 2 (Figure 2.2-1). This section addresses potential effects associated with establishing and maintaining these training areas (*i.e.*, non-explosive mine shape deployment/recovery). The Navy proposes to conduct mine hunting and sweeping operations in the same general area used for other major exercise events. Since water depth there is too deep for routine retrieval of submerged objects, these operations would take place without target mineshapes. The water depth in areas currently designated for UNDET training is much shallower, thereby allowing placement of expendable inert mineshapes to simulate mine threats. The effects of conducting training exercises in these areas are the same as those analyzed under aircraft overflights and NEPM.

The training mine shape assemblies deployed in the Underwater Detonation Areas would include a concrete anchor, mooring line (steel cable or chain), and the mine shape. Approximately 54 mine shape assembiles would be deployed per year under Alternative 2. The process of deploying mine shapes assemblies would result in localized disturbances to benthic habitat. Soft bottom habitats and live/hard bottom habitats are expected to occur in the proposed training areas, but shipwrecks are not known to be present (Figures 3.6-1 and 3.6-4). Artificial reef structures exist near the northwestern boundary of the North Underwater Detonation Area (12I). Major reef systems such as Gray's Reef, Stetson Reefs, Savannah Lithoherms, and East Florida Lophelia Reefs are located outside of the proposed training areas and would not be impacted. In accordance with Navy mitigation measures, mine shapes would not be deployed in locations with known hard bottom, artificial reefs, or shipwrecks. Therefore, only soft bottom habitat would be disturbed. Approximately 12.5 ft^2 of benthic habitat would be disturbed when a concrete anchor makes contact with the sea floor(assuming the affected area is two time the anchor footprint of 6.25 ft^2). The total area affected per year would be small (675 ft2 per year based on 54 deployments). No population- or community-level effects are expected based on the small area affect and the ability of soft bottom habitats to recover relatively quickly (*i.e.*, less than one year). Establishment of Mine Warfare Training Areas in territorial waters under Alternative 2 would have no significant impact on marine communities. Furthermore, establishment of Mine Warfare Training Areas in non-territorial waters would not cause significant harm to marine communities under Alternative 2.

Non-Explosive Practice Munitions

The amount of NEPM used in the Study Area under Alternative 2 would be the same as Alternative 1, with the exception of 193 additional non-explosive practice bombs per year (96 each in W-157A/B and W-158A/B, Table 3.6-3). The potential effects would be similar to those described for the No Action Alternative and Alternative 1, but the area affected by non-explosive practice bombs, missiles, and naval gun shells would increase compared to the No Action Alternative. The relative non-explosive practice bomb concentration would increase from 1.7 to 2.6 per 100 nm^2/year in W-157A/B and from 2.1 to 3.2 per 100 nm^2/year in W-158A/B. The probability of non-explosive practice bombs, missiles, and naval gun shells striking hard bottom, artificial habitats, proposed deep water coral HAPC, and proposed deepwater snapper grouper marine protected areas would increase under Alternative 2. However, the total area of benthic

habitat affected would continue to be small. As shown in Table 3.6-3, the maximum area of benthic habitat affected by non-explosive practice bomb, missile, and naval gun shell strikes would increase from 7,151 ft^2 (0.00019 nm^2) per year to 9,482 ft^2 (0.00026 nm^2) per year or 94,820 ft^2 (0.0026 nm^2) over a ten-year period. Only a percentage of the total area affected (less than 9,482 ft^2 per year) would be sensitive benthic habitat such as live hard bottom or coral mounds. Based on geographic information system data obtained through the South Atlantic Fishery Management Council, the Study Area contains about 18,919 nm^2 of live hard bottom EFH. The total benthic habitat affected represents less than 0.000001 percent of the total hard bottom EFH in the Study Area. As such, non-explosive practice bomb, missile, and naval gun shell strikes could result in long-term, minor effects to live hard bottom communities, but the effects would be localized and no long-term changes to community structure or function would be expected. NEPM strikes in territorial waters would have no significant impact on marine communities under Alternative 2. Similarly, NEPM strikes in non-territorial waters would not cause significant harm to marine communities under Alternative 2.

Underwater Detonations and High Explosive Ordnance

The number and location of explosions that would occur under Alternative 2 would be the same as Alternative 1, with the exception of HE bombs, which would not be used in the Study Area under Alternative 2 (Tables 2.2-5 and 2.2-7). As such, water column disturbances and plankton mortality associated with BOMBEX explosions would not occur. Otherwise, impacts would be the same as those described for Alternative 1. Underwater detonations and HE ordnance use in territorial waters would have no significant impact on marine communities under Alternative 2. Furthermore, UNDETs and HE ordnance use in non-territorial waters would not cause significant harm to marine communities under Alternative 2.

Military Expended Material

The amount of MEM entering the marine environment under Alternative 2 would be the same as Alternative 1, with the exception of an increase in non-explosive practice bombs (Table 2.2-6). These changes would result in increased exposure of benthic communities to MEM. However, the analysis presented in Section 3.2 indicates that no significant accumulations of MEM would occur in any particular area and water quality would not be negatively affected by MEM. Some of the material would be colonized by benthic organisms that prefer hard substrate, resulting in localized increases in species diversity and abundance. No significant changes in community structure or function would be anticipated based on the limited amount and dispersed nature of the material. Military expended material in territorial waters would have no significant impact on marine communities under Alternative 2. Furthermore, MEM in non-territorial waters would not cause significant harm to marine communities under Alternative 2.

National Marine Sanctuaries

Similar to the No Action Alternative and Alternative 1, potential stressors associated with Alternative 2 operations that may occur in the vicinity of Gray's Reef National Marine Sanctuary include vessel movements, aircraft overflights, NEPM, and MEM. Based on the analyses presented above and elsewhere in this FEIS/OEIS, these stressors are not expected to destroy, cause the loss of, or injure any sanctuary resource. Underwater detonations and HE ordnance use do not occur in the vicinity of Gray's Reef National Marine Sanctuary and would have no effect on sanctuary resources. Alternative 2 does not include conducting any new military activities in the vicinity of the sanctuary, but a slight increase in ongoing operations such as vessel

movements or aircraft overflights could occur. Alternative 2 would have no significant impact on national marine sanctuaries.

Precision Anchoring

Precision Anchoring would not change under Alternative 2. Therefore, the analysis presented for the No Action Alternative is applicable to Alternative 2. In accordance with NEPA, Precision Anchoring in territorial waters under Alternative 2 would have no significant impact on marine communities. Precision Anchoring would not take place in non-territorial waters.

3.6.4 Unavoidable Significant Environmental Effects

The analysis presented above indicates that the No Action Alternative, Alternative 1, and Alternative 2 would not result in unavoidable significant adverse effects to marine communities.

3.6.5 Summary of Environmental Effects

As summarized in Table 3.6-4, the No Action Alternative, Alternative 1, and Alternative 2 would have no significant impact on marine communities in territorial waters. Furthermore, the No Action Alternative, Alternative 1, and Alternative 2 would not cause significant harm to marine communities in non-territorial waters.

TABLE 3.6-4
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON MARINE COMMUNITIES IN THE JAX STUDY AREA

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	NEPA (U.S. Territory)	EO 12114 (Non-Territorial Waters, >12 nm)
No Action		
Vessel Movements	Localized disturbance, injury, and mortality to plankton. No long-term population or community-level effects.	Localized disturbance, injury, and mortality to plankton. No long-term population or community-level effects.
Aircraft Overflights	Potential exposure to aircraft noise. No long-term population or community-level effects.	Potential exposure to aircraft noise. No long-term population or community-level effects.
Towed Mine Warfare Devices	No effect.	Short-term localized disturbance to water column. No long-term population or community-level effects.
Mine Warfare Training	No effect.	No effect.
NEPM	Localized disturbance to benthic communities. No long-term population or community-level effects.	Localized disturbance to benthic communities. No long-term population or community-level effects.
UNDET and HE Ordnance	Short-term, localized disturbance to soft bottom benthic communities. Localized disturbance, injury, and mortality to plankton and benthic organisms. No long-term population or community-level effects.	Short-term, localized disturbance to soft bottom benthic communities. Localized disturbance, injury, and mortality to plankton and benthic organisms. No long-term population or community-level effects.
MEM	Long-term, minor, and localized accumulation of expended material in benthic communities. No long-term changes in community structure or function.	Long-term, minor, and localized accumulation of expended material in benthic communities. No long-term changes in community structure or function.
Conclusion	No significant impact to marine communities.	No significant harm to marine communities.
Alternative 1		
Vessel Movements	Localized disturbance, injury, and mortality to plankton. Slight increase compared to No Action. No long-term population or community-level effects.	Localized disturbance, injury, and mortality to plankton. Slight increase compared to No Action. No long-term population or community-level effects.
Aircraft Overflights	Potential exposure to aircraft noise. Slight increase compared to No Action. No long-term population or community-level effects.	Potential exposure to aircraft noise. Slight increase compared to No Action. No long-term population or community-level effects.

TABLE 3.6-4 (Continued)
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON MARINE COMMUNITIES IN THE JAX STUDY AREA

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	NEPA (U.S. Territory)	EO 12114 (Non-Territorial Waters, >12 nm)
Towed Mine Warfare Devices	No effect.	Short-term localized disturbance to water column. Slight increase compared to No Action. No long-term population or community-level effects.
MIW Training	No effect.	No effect.
NEPM	Localized disturbance to benthic communities. Slight increase compared to No Action. No long-term population or community-level effects.	Localized disturbance to benthic communities. Slight increase compared to No Action. No long-term population or community-level effects.
UNDETs and HE Ordnance	Short-term, localized disturbance to soft bottom benthic communities. Localized disturbance, injury, and mortality to plankton. Slight decrease compared to No Action. No long-term population or community-level effects.	Short-term, localized disturbance to soft bottom benthic communities (slight decrease compared to No Action). Localized disturbance, injury, and mortality to plankton (slight increase compared to No Action). No long-term population or community-level effects.
MEM	Long-term, minor, and localized accumulation of expended material in benthic communities. Slight increase compared to No Action. No long-term changes in community structure or function.	Long-term, minor, and localized accumulation of expended material in benthic communities. Slight increase compared to No Action. No long-term changes in community structure or function.
Conclusion	No significant impact to marine communities.	No significant harm to marine communities.
Alternative 2		
Vessel Movements	Localized disturbance, injury, and mortality to plankton. Slight increase compared to No Action. No long-term population or community-level effects.	Localized disturbance, injury, and mortality to plankton. Slight increase compared to No Action. No long-term population or community-level effects.
Aircraft Overflights	Potential exposure to aircraft noise. Slight increase compared to No Action. No long-term population or community-level effects.	Potential exposure to aircraft noise. Slight increase compared to No Action. No long-term population or community-level effects.
Towed Mine Warfare Devices	No effect.	Short-term localized disturbance to water column. Increase compared to No Action. No long-term population or community-level effects.

TABLE 3.6-4 (Continued)
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON MARINE COMMUNITIES IN THE JAX STUDY AREA

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	NEPA (U.S. Territory)	EO 12114 (Non-Territorial Waters, >12 nm)
MIW Training	Short-term and localized disturbance of benthic habitat from mine shape deployment. No long-term population or community-level effects.	Short-term and localized disturbance of benthic habitat from mine shape deployment. No long-term population or community-level effects.
NEPM	Localized disturbance to benthic communities. Slight increase compared to No Action. No long-term population or community-level effects.	Localized disturbance to benthic communities. Slight increase compared to No Action. No long-term population or community-level effects.
UNDETs and HE Ordnance	Short-term, localized disturbance to soft bottom benthic communities. Localized disturbance, injury, and mortality to plankton. Slight decrease compared to No Action. No long-term population or community-level effects.	Short-term, localized disturbance to soft bottom benthic communities (slight decrease compared to No Action). Localized disturbance, injury, and mortality to plankton (substantial decrease compared to No Action because HE bombs would no longer be used). No long-term population or community-level effects.
MEM	Long-term, minor, and localized accumulation of expended material in soft bottom benthic communities. Slight increase compared to No Action. No long-term changes in community structure or function.	Long-term, minor, and localized accumulation of expended material in soft bottom benthic communities. Slight increase compared to No Action. No long-term changes in community structure or function.
Conclusion	No significant impact to marine communities.	No significant harm to marine communities.

3.7 MARINE MAMMALS

3.7.1 Introduction and Methods

3.7.1.1 Regulatory Framework

Marine Mammal Protection Act

The Marine Mammal Protection Act (MMPA) of 1972 established, with limited exceptions, a moratorium on the "taking" of marine mammals in waters or on lands under U.S. jurisdiction. The Act further regulates "takes" of marine mammals in the global commons (*i.e.*, the high seas) by vessels or persons under U.S. jurisdiction. The term "take," as defined in Section (16 U.S.C. 1362) of the MMPA, means "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal." "Harassment" was further defined in the 1994 amendments to the MMPA, which provided two levels of "harassment," Level A (potential injury) and Level B (potential disturbance).

The National Defense Authorization Act (NDAA) of fiscal year (FY) 2004 (Public Law [PL] 108-136) amended the definition of harassment as applied to military readiness activities or scientific research activities conducted by or on behalf of the federal government, consistent with Section 104(c)(3) [16 U.S.C. 1374 (c)(3)]. The FY 04 NDAA adopted the definition of "military readiness activity" as set forth in the FY 03 NDAA (PL 107-314). Military training activities within the JAX Range Complex constitute military readiness activities as that term is defined in PL 107-314 because training activities constitute "training and operations of the Armed Forces that relate to combat" and constitute "adequate and realistic testing of military equipment, vehicles, weapons, and sensors for proper operation and suitability for combat use." For military readiness activities, the relevant definition of harassment is any act that:

- Injures or has the significant potential to injure a marine mammal or marine mammal stock in the wild ("Level A harassment").
- Disturbs or is likely to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns including, but not limited to, migration, surfacing, nursing, breeding, feeding, or sheltering to a point where such behavioral patterns are abandoned or significantly altered ("Level B harassment") [16 U.S.C. 1362 (18)(B)(i)(ii)].

Section 101(a)(5) of the MMPA directs the Secretary of the Department of Commerce to allow, upon request, the incidental (but not intentional) taking of marine mammals by U.S. citizens who engage in a specified activity (exclusive of commercial fishing), if certain findings are made and regulations are issued. Authorization will be granted by the Secretary for the incidental take of marine mammals if the taking will have a negligible impact on the species or stock and will not have an unmitigable adverse impact on the availability of such species or stock for taking for subsistence uses.

Several species of marine mammals may occur in the Study Area. Accordingly, the Navy has completed an analysis to determine if the action would result in incidental harassment of individual marine mammals (Level A or B harassment, as defined by MMPA) or if the action would have more than a negligible impact on marine mammal populations. The Navy has initiated the MMPA compliance process with the NMFS.

Endangered Species Act

The ESA of 1973 established protection over and conservation of threatened and endangered species and the ecosystems upon which they depend. An "endangered" species is a species in danger of extinction in all or a significant portion of its range, while a "threatened" species is one that is likely to become endangered within the foreseeable future in all or in a significant portion of its range. The U.S. Fish and Wildlife Service (USFWS) and the National NMFS jointly administer the ESA and are also responsible for the listing of species (*i.e.*, the labeling of a species as either threatened or endangered). The USFWS has primary management responsibility for management of terrestrial and freshwater species (including the West Indian manatee), while the NMFS has primary responsibility for marine species (including listed whales) and anadromous fish species (species that migrate from saltwater to freshwater to spawn). The ESA allows the designation of geographic areas as critical habitat for threatened or endangered species.

The ESA requires federal agencies to conserve listed species and consult with the USFWS and/or NMFS to ensure that proposed actions that may affect listed species or critical habitat are consistent with the requirements of the ESA. The ESA specifically requires agencies not to "take" or "jeopardize" the continued existence of any endangered or threatened species, or to destroy or adversely modify habitat critical to any endangered or threatened species. Under Section 9 of the ESA, "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect. Harm is further defined by USFWS to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. Harass is defined by USFWS as actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns that include, but are not limited to, breeding, feeding or sheltering (50 CFR §17.3). Under Section 7 of the ESA, "jeopardize" means to engage in any action that would be expected to reduce appreciably the likelihood of the survival and recovery of a listed species by reducing its reproduction, numbers, or distribution.

Seven marine mammal species listed as endangered under the ESA could potentially occur in the JAX Study Area. Critical habitat for listed species has been designated under the ESA in the Study Area for the North Atlantic right whale and the West Indian manatee:

- The calving ground of the North Atlantic right whale, located seaward of southern Georgia and northern Florida, is found in the JAX Study Area.
- Lake George, located in the inland portion of the Study Area, was designated as manatee critical habitat in 1976.

For purposes of ESA compliance, the Navy analyzed effects of the action to make a determination of effect for listed species (*e.g.*, no effect or may affect) and critical habitat. The definitions used in making the determination of effect under Section 7 of the ESA are based on the USFWS and NMFS *Endangered Species Consultation Handbook* (USFWS and NMFS, 1998). "No effect" is the appropriate conclusion when a listed species will not be affected, either because the species will not be present or because the project does not have any elements with the potential to affect the species. "No effect" does not include a small effect or an effect that is unlikely to occur: if effects are insignificant (in size), discountable (extremely unlikely), or wholly beneficial a "may affect" determination is appropriate. Insignificant effects relate to the magnitude or extent of the impact (*i.e.*, they must be small and would not rise to the level of a take of a species). Discountable effects are those extremely unlikely to occur and based on best

judgment, a person would not: (1) be able to meaningfully measure, detect, or evaluate insignificant effects; or (2) expect discountable effects to occur.

The Navy has completed the ESA Section 7 informal consultation process with USFWS for the preferred alternative for the West Indian manatee. The Navy has initiated the ESA Section 7 consultation process with NMFS to determine if the action would adversely affect ESA-listed whales or jeopardize the continued existence of a listed species. Copies of correspondence with NMFS and USFWS are provided in Appendix C of this FEIS/OEIS.

National Environmental Policy Act and Executive Order 12114

In addition to addressing MMPA and ESA requirements, potential effects were analyzed in accordance with the National Environmental Policy Act (NEPA) to determine if the action would result in significant impacts to marine mammals in territorial waters and in accordance with Executive Order (EO) 12114 to determine if the action would result in significant harm to marine mammals in non-territorial waters.

For purposes of NEPA and EO 12114, the Navy considered context and intensity to determine the significance of effects. Context refers to the affected environment in which the action would occur and intensity refers to the severity of impacts. The Navy considered several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality. The duration of effects (*e.g.*, short-term, long-term, temporary, permanent); degree of controversy; degree of highly uncertain effects or unique or unknown risks; precedent-setting effects; cumulative impacts; adverse effect on ESA-listed species or designated critical habitat; and whether the action threatens a violation of law or requirements imposed for the protection of the environment were also considered. The potential for adverse effects to be observed at the population, stock, or species level was a primary factor considered by the Navy in determining the significance of effects to marine mammals. While the factors outlined above for MMPA and ESA were considered in making NEPA and EO 12114 significance conclusions, it should be recognized that the terminology used to characterize effects varies under these Acts. For example, Level A or B harassment of an individual marine mammal under MMPA or take of an individual marine mammal under ESA do not necessarily equate to a significant impact under NEPA. Rather, the Navy considered context, intensity, and population-level effects in making its significance conclusions for marine mammals.

3.7.1.2 Assessment Methods and Data Used

General Approach to Analysis

Each alternative analyzed in this FEIS/OEIS includes several warfare areas (*e.g.*, Mine Warfare, Anti-air Warfare, *etc*.) and most warfare areas include multiple types of training operations (*e.g.*, Mine Neutralization, MISSILEX (A-S), *etc*.). Likewise, several activities (*e.g.*, vessel movements, aircraft overflights, weapons firing, *etc*.) are accomplished under each operation, and those activities typically are not unique to that operation. For example, many of the operations involve Navy vessel movements and aircraft overflights. Accordingly, the analysis for marine mammals is organized by specific activity and/or stressors associated with that activity, rather than warfare area or operations.

The following general steps were used to analyze the potential environmental consequences of the alternatives to marine mammals:

- Identify those aspects of the proposed action likely to act as stressors to biological resources by having a direct or indirect effect on the physical, chemical, and biotic environment. As part

of this step, the spatial extent of these stressors, including changes in that spatial extent over time, were identified. The results of this step identified those aspects of the proposed action that required detailed analysis in this FEIS/OEIS.
- Identify resources that may occur in the Study Area.
- Identify those biological resources likely to co-occur with the stressors in space and time, and the nature of that co-occurrence (exposure analysis).
- Determine whether and how biological resources are likely to respond given their exposure and available scientific knowledge of their responses (response analysis).
- Determine the risks those responses pose to biological resources and the significance of those risks.

Study Area

The Study Area for marine mammals is described in Section 1.5 and is shown in Figure 1.5-1. The Study Area is analogous to the "action area". For purposes of this marine mammal analysis under Section 7 of the ESA, the action area does not include the Rodman Range..

Data Sources

A comprehensive and systematic review of relevant literature and data was conducted to complete this analysis for marine mammals. Of the available scientific literature (both published and unpublished), the following types of documents were utilized in the assessment: journals, books, periodicals, bulletins, Department of Defense operations reports, theses, dissertations, endangered species recovery plans, species management plans, stock assessment reports, Environmental Impact Statements, Range Complex Management Plans, and other technical reports published by government agencies, private businesses, or consulting firms. The scientific literature was also consulted during the search for geographic location data (geographic coordinates) on the occurrence of marine resources within the Study Area.

Information was collected from the following sources to summarize the occurrence patterns of and to evaluate the impacts to protected species in the Study Area and vicinity:

- Academic and educational/research institutions: College of William and Mary, Duke University, Los Angeles County Museum, New England Aquarium, Old Dominion University, Rutgers University, Texas A&M University, University of Rhode Island, and Virginia Institute of Marine Science;
- University on-line databases: Ingenta, Web of Science; Aquatic Sciences and Fisheries Abstracts, Science Direct, Synergy, BIOSIS previews;
- The Internet, including various databases and related websites: NOAA-Coastal Services Center, NMFS, Ocean Biogeographic Information System, USGS, Mid-Atlantic Fishery Management Council, South Atlantic Fishery Management Council, New England Fishery Management Council, Atlantic States Marine Fisheries Commission, Gulf of Mexico Fishery Management Council, WhaleNet, Blackwell-Science, FishBase, FFWCC-Fish and Wildlife Research Institute, Food and Agriculture Organization, Federal Register, Marine Turtle Newsletter, Proceedings of the Annual Sea Turtle Symposium, Caribbean Conservation Corporation, National Marine Mammal Laboratory Library, and Seaturtle.org;
- Federal and state agencies: the Navy, South Atlantic Fishery Management Council, Gulf of Mexico Fishery Management Council, Atlantic States Marine Fisheries Commission, Mid-Atlantic Fishery Management Council, New England Fishery Management Council, NMFS Highly Migratory Species Division, NMFS Southeast Fisheries Science Center, NMFS

Southwest Fisheries Science Center, NMFS Southeast Regional Office, NMFS Northeast Fisheries Science Center, NMFS Northeast Regional Office, NMFS Office of Habitat Protection, NMFS Office of Protected Resources, NOAA: Marine Managed Areas Inventory, USFWS Ecological Services Field Offices, U.S. Environmental Protection Agency, USGS: Sirenia Project, Bureau of Land Management, Minerals Management Service, FFWCC, Florida Marine Research Institute, Georgia Department of Natural Resources; and

- Marine resource experts and specialists.

Marine Resource Assessments

The information contained in this Chapter relies heavily on the data gathered in the Marine Resource Assessments (MRA). The Navy MRA Program was implemented by the Commander, Fleet Forces Command, to initiate collection of data and information concerning the protected and commercial marine resources found in the Navy's OPAREAs. Specifically, the goal of the MRA program is to describe and document the marine resources present in each of the Navy's OPAREAs. The final version MRA for the JAX and Charleston OPAREAs was completed in 2008 (DoN, 2008a).

The MRA data were used to provide a regional context for each species. The MRA represents a compilation and synthesis of available scientific literature (*e.g.*, journals, periodicals, theses, dissertations, project reports, and other technical reports published by government agencies, private businesses, or consulting firms), and NMFS reports, including stock assessment reports, recovery plans, and survey reports.

Navy OPAREA Density Estimates Report

The Navy OPAREA density estimates (NODE) used in previous Navy environmental documents were recently updated to provide a compilation of the most recent data and information on the occurrence, distribution, and density of marine mammals. The updated NODEs presented in this FEIS/OEIS are derived from the *Navy OPAREA Density Estimates (NODE) for the Southeast OPAREAs* report (DoN, 2007a).

Density estimates for cetaceans were either modeled using available line-transect survey data or derived using available data in order of preference: 1) through spatial models using line-transect survey data provided by NMFS; 2) using abundance estimates from Mullin and Fulling (2003); 3) or based on the cetacean abundance estimates found in the most current NOAA stock assessment report (SAR) (Waring *et al*., 2007).

For the model-based approach, density estimates were calculated for each species within areas containing survey effort. A relationship between these density estimates and the associated environmental parameters such as depth, slope, distance from the shelf break, sea surface temperature (SST), and chlorophyll *a* concentration was formulated using generalized additive models. This relationship was then used to generate a two-dimensional density surface for the region by predicting densities in areas where no survey data exist.

The analyses for cetaceans were based on sighting data collected through shipboard surveys conducted by NMFS-Northeast Fisheries Science Center (NEFSC) and Southeast Fisheries Science Center (NMFS-SEFSC) between 1998 and 2005. Species-specific density estimates derived through spatial modeling were compared with abundance estimates found in the most current NOAA SAR to ensure consistency. All spatial models and density estimates were reviewed by and coordinated with NMFS Science Center technical staff and scientists with the

University of St. Andrews, Scotland, Centre for Environmental and Ecological Modeling. For a more detailed description of the methods, assumptions, and limitations of the density estimates provided in this EIS/OEIS, please refer to the NODE Report for the Southeast (DoN, 2007a). The report is available at:

http://www.jacksonvillerangecomplexeis.com/documents/DON_2007i_SE_NODE_Final_Report.pdf.

The following shows how density estimates were modeled or derived for species analyzed in this EIS/OEIS:

Model-Derived Density Estimates - Line Transect Survey Data

- Fin whale (*Balaenoptera physalus*)
- Sperm whale (*Physeter macrocephalus*)
- Beaked Whales (Family Ziphiidae)
- Bottlenose dolphin (*Tursiops truncatus*)
- Atlantic spotted dolphin (*Stenella frontalis*)
- Striped dolphin (*Stenella coeruleoalba*)
- Common dolphin (*Delphinus delphis*)
- Risso's dolphin (*Grampus griseus*)
- Pilot Whales (*Globicephala* spp.)

SAR or Literature-Derived Density Estimates

- North Atlantic Right Whale (*Eubalaena glacialis*)[1]
- Humpback whale (*Megaptera novaeangliae*)[1]
- Minke whale (*Balaenoptera acutorostrata*)[2]
- *Kogia* spp.[2]
- Rough-toothed dolphin (*Steno bredanensis*)[2]
- Pantropical spotted dolphin (*Stenella attenuata*)[2]
- Clymene dolphin (*Stenella clymene*)[2]

[1] *Abundance estimates were geographically and seasonally partitioned*
[2] *Abundance estimates were uniformly distributed geographically and seasonally*

Table 3.7-1 shows the density estimates by species for training areas where explosive ordnance use may occur in the Jacksonville Range Complex.

TABLE 3.7-1
SEASONAL DENSITY ESTIMATES FOR MARINE MAMMALS IN THE JAX RANGE COMPLEX WHERE EXPLOSIVE ORDNANCE MAY OCCUR

Species and Training Area	Density (animals/km^2)			
	Winter (Dec-Feb)	**Spring** (Mar-May)	**Summer** (June-Aug)	**Fall** (Sept-Nov)
Threatened or Endangered Marine Mammal Species				
Blue Whale	Insufficient data to estimate density.			
Fin Whale				
BB & CC	0.00000	0.00000	0.00000	0.00000
31J	0.00000	0.00000	0.00000	0.00000
MLTR	0.00000	0.00000	0.00000	0.00000

TABLE 3.7-1 (Continued)
SEASONAL DENSITY ESTIMATES FOR MARINE MAMMALS IN THE JAX RANGE COMPLEX WHERE EXPLOSIVE ORDNANCE MAY OCCUR

Species and Training Area	Density (animals/km^2)			
	Winter (Dec-Feb)	**Spring** (Mar-May)	**Summer** (June-Aug)	**Fall** (Sept-Nov)
CHAS UNDET North	0.00000	0.00000	0.00000	0.00000
CHAS UNDET South	0.00000	0.00000	0.00000	0.00000
Humpback Whale				
BB & CC	0.00058	0.00116	0.00000	0.00116
31J	0.00058	0.00116	0.00000	0.00116
MLTR	0.00058	0.00116	0.00000	0.00116
CHAS UNDET North	0.00058	0.00116	0.00000	0.00116
CHAS UNDET South	0.00058	0.00116	0.00000	0.00116
North Atlantic Right Whale				
BB & CC	0.00073	0.00032	0.00000	0.00000
31J	0.00000	0.00000	0.00000	0.00000
MLTR	0.00124	0.00055	0.00000	0.00000
CHAS UNDET North	0.00124	0.00055	0.00000	0.00000
CHAS UNDET South	0.00124	0.00055	0.00000	0.00000
Sei Whale	Insufficient data to estimate density.			
Sperm Whale				
BB & CC	0.00000	0.00000	0.00000	0.00000
31J	0.00000	0.00000	0.00000	0.00000
MLTR	0.00000	0.00000	0.00000	0.00000
CHAS UNDET North	0.00000	0.00000	0.00000	0.00000
CHAS UNDET South	0.00000	0.00000	0.00000	0.00000
West Indian Manatee	Insufficient data to estimate density.			
Non-Threatened or Endangered Marine Mammal Species				
Atlantic Spotted Dolphin				
BB & CC	0.37798	0.37798	0.37798	0.37798
31J	0.00015	0.00015	0.00015	0.00015
MLTR	0.43118	0.43118	0.43118	0.43118
CHAS UNDET North	0.14929	0.14929	0.14929	0.14929
CHAS UNDET South	0.12478	0.12478	0.12478	0.12478
Beaked Whales				
BB & CC	0.00005	0.00005	0.00063	0.00005
31J	0.00082	0.00082	0.00002	0.00082
MLTR	<0.00001	<0.00001	<0.00001	<0.00001

TABLE 3.7-1 (Continued)
SEASONAL DENSITY ESTIMATES FOR MARINE MAMMALS IN THE JAX RANGE COMPLEX WHERE EXPLOSIVE ORDNANCE MAY OCCUR

Species and Training Area	Density (animals/km^2)			
	Winter (Dec-Feb)	**Spring** (Mar-May)	**Summer** (June-Aug)	**Fall** (Sept-Nov)
CHAS UNDET North	0.00000	0.00000	0.00000	0.00000
CHAS UNDET South	0.00000	0.00000	0.00000	0.00000
Bottlenose Dolphin				
BB & CC	0.19732	0.19732	0.11951	0.19732
31J	0.54678	0.54678	0.65242	0.54678
MLTR	0.03915	0.03915	0.02011	0.03915
CHAS UNDET North	0.18773	0.18773	0.18812	0.18773
CHAS UNDET South	0.16551	0.16551	0.13997	0.16551
Bryde's Whale	Insufficient data to estimate density.			
Clymene Dolphin				
BB & CC	0.01063	0.01063	0.01063	0.01063
31J	0.01063	0.01063	0.01063	0.01063
MLTR	0.01063	0.01063	0.01063	0.01063
CHAS UNDET North	0.01063	0.01063	0.01063	0.01063
CHAS UNDET South	0.01063	0.01063	0.01063	0.01063
Common Dolphin				
BB & CC	0.00000	0.00000	0.00000	0.00000
31J	0.00000	0.00000	0.00000	0.00000
MLTR	0.00000	0.00000	0.00000	0.00000
CHAS UNDET North	0.00000	0.00000	0.00000	0.00000
CHAS UNDET South	0.00000	0.00000	0.00000	0.00000
False Killer whale	Insufficient data to estimate density.			
Fraser's Dolphin	Insufficient data to estimate density.			
Killer Whale	Insufficient data to estimate density.			
Melon-headed Whale	Insufficient data to estimate density.			
Minke Whale				
BB & CC	0.00004	0.00004	0.00004	0.00004
31J	0.00004	0.00004	0.00004	0.00004
MLTR	0.00004	0.00004	0.00004	0.00004
CHAS UNDET North	0.00004	0.00004	0.00004	0.00004
CHAS UNDET South	0.00004	0.00004	0.00004	0.00004
Pantropical Spotted Dolphin				
BB & CC	0.02225	0.02225	0.02225	0.02225
31J	0.02225	0.02225	0.02225	0.02225
MLTR	0.02225	0.02225	0.02225	0.02225
CHAS UNDET North	0.02225	0.02225	0.02225	0.02225
CHAS UNDET South	0.02225	0.02225	0.02225	0.02225

TABLE 3.7-1 (Continued)
SEASONAL DENSITY ESTIMATES FOR MARINE MAMMALS IN THE JAX RANGE COMPLEX WHERE EXPLOSIVE ORDNANCE MAY OCCUR

Species and Training Area	Density (animals/km^2)			
	Winter (Dec-Feb)	**Spring** (Mar-May)	**Summer** (June-Aug)	**Fall** (Sept-Nov)
Pilot Whales				
BB & CC	0.01111	0.01111	0.01053	0.01111
31J	0.04741	0.04741	0.04006	0.04741
MLTR	0.00002	0.00002	0.00002	0.00002
CHAS UNDET North	0.00014	0.00014	0.00001	0.00014
CHAS UNDET South	0.00007	0.00007	0.00001	0.00007
Pygmy and Dwarf Sperm Whales				
BB & CC	0.00101	0.00101	0.00101	0.00101
31J	0.00101	0.00101	0.00101	0.00101
MLTR	0.00101	0.00101	0.00101	0.00101
CHAS UNDET North	0.00101	0.00101	0.00101	0.00101
CHAS UNDET South	0.00101	0.00101	0.00101	0.00101
Pygmy Killer Whale	Insufficient data to estimate density.			
Risso's Dolphin				
BB & CC	0.05654	0.05654	0.05654	0.05654
31J	0.01478	0.01478	0.01478	0.01478
MLTR	0.00012	0.00012	0.00012	0.00012
CHAS UNDET North	0.00000	0.00000	0.00000	0.00000
CHAS UNDET South	0.00000	0.00000	0.00000	0.00000
Rough-toothed Dolphin				
BB & CC	0.00048	0.00048	0.00048	0.00048
31J	0.00048	0.00048	0.00048	0.00048
MLTR	0.00048	0.00048	0.00048	0.00048
CHAS UNDET North	0.00048	0.00048	0.00048	0.00048
CHAS UNDET South	0.00048	0.00048	0.00048	0.00048
Spinner Dolphin	Insufficient data to estimate density.			
Striped Dolphin				
BB & CC	0.00000	0.00000	0.00000	0.00000
31J	0.00000	0.00000	0.00000	0.00000
MLTR	0.00000	0.00000	0.00000	0.00000
CHAS UNDET North	0.00000	0.00000	0.00000	0.00000
CHAS UNDET South	0.00000	0.00000	0.00000	0.00000

Source: (DoN, 2007a)

Species for Which Density Estimates Are Not Available

Density estimates could not be calculated for all species due to the limited available data. Occurrence of these species without density estimated (with the exception of the West Indian

manatee) in the Jacksonville Range Complex is considered uncommon. Density estimates were not available for the follwing species.

- Blue whale (*Balaenoptera musculus*)
- Sei whale (*Balaenoptera borealis*)
- Bryde's whale (*Balaenoptera brydei/edeni*)
- Killer whale (*Orcinus orca*)
- Pygmy killer whale (*Feresa attenuata*)
- False killer whale (*Pseudorca crassidens*)
- Melon-headed Whale (*Peponocephala electra*)
- Spinner dolphin (*Stenella longirostris*)
- Fraser's dolphin (*Lagenodelphis hosei*)
- West Indian manatee (*Trichechus manatus*)

3.7.1.3 Warfare Areas and Associated Environmental Stressors

The Navy used a screening process to identify aspects of the proposed action that could act as stressors to marine mammals. Navy subject matter experts de-constructed the warfare areas and operations included in the proposed action to identify specific activities that could act as stressors. Public and agency scoping comments, previous environmental analyses, previous agency consultations, laws, regulations, Executive Orders, and resource-specific information were also evaluated. This process was used to focus the information presented and analyzed in the affected environment and environmental consequences sections of this FEIS/OEIS. As shown in Table 3.7-2, potential stressors to marine mammals include vessel movements (disturbance or collisions), aircraft overflights (disturbance), towed MIW devices (strikes), mine warfare deployment/recovery (habitat alteration), NEPM (disturbance and strikes), UNDETs and HE ordnance, and MEM (ordnance-related material, targets, chaff, self-protection flares, and marine markers). The potential effects of these stressors on marine mammals are analyzed in detail in Section 3.7.3.

As discussed in the EIS, Section 3.3 – Water Resources and Section 3.4 – Air Quality, some water and air pollutants would be released into the environment as a result of the proposed action. The analyses presented in Sections 3.3 and 3.4 indicate that any increases in water or air pollutant concentrations resulting from Navy training in the Study Area would be negligible and localized, and impacts to water and air quality would be less than significant. Based on the analyses presented in Sections 3.3 and 3.4, water and air quality changes would have no effect or negligible effects on marine mammals. Accordingly, the effects of water and air quality changes on marine mammals are not addressed further in this FEIS/OEIS.

3.7.2 Affected Environment

3.7.2.1 Regional Overview

Most of the resource information presented for the Study Area is compiled in the Final Marine Resources Assessment (MRA) for the JAX and Charleston OPAREAs (DoN, 2008a). Table 3.7-3 provides a list of marine mammal species that have confirmed or potential occurrence in the JAX Study Area. These include 29 cetacean species and one sirenian species.

TABLE 3.7-2
SUMMARY OF POTENTIAL STRESSORS TO MARINE MAMMALS IN THE JAX STUDY AREA

Warfare Area and Operation	Training Areas	Vessel Movements (Disturbance)	Vessel Movements (Collisions)	Aircraft Overflights (Disturbance)	Towed Mine Warfare Devices	Mine Warfare Deployment/Recovery	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Material
Mine Warfare (MIW)									
Mine Laying	Lake George Range			✓		✓	✓		✓
Mine Countermeasures Exercise (MCM)	Carrier Operating Areas			✓	✓	✓	✓		
Mine Neutralization	Charleston OPAREA (North and South UNDET Boxes)	✓	✓		✓	✓		✓	✓
Surface Warfare (SUW)									
MISSILEX (A-S)	JAX OPAREA (MLTR))			✓			✓	✓	✓
GUNEX (A-S)	W-132, W-133, W-134, W-157, W-158			✓			✓		✓
GUNEX (S-S) Boat	Charleston OPAREA (Area 11J)	✓	✓				✓		✓
GUNEX (S-S) Ship	JAX OPAREA (AA, BB, and CC)	✓	✓				✓		✓
BOMBEX (A-S) (at sea)	HE, W-158 (31J); NEPM, W157A/B and W-158 A/B			✓			✓	✓	✓
Laser Targeting	W-132, W-133, W-134, W-157, W-158			✓					
GUNEX (S-S) (FAC/FIAC)	Amber Strait: Charleston OPAREA (Boxes Q-9&10, R-9&10)	✓	✓						
VBSS/MIO-Ship	JAX and Charleston OPAREAs	✓	✓						
VBSS/MIO-Helicopter	W-157A (Area 4X) and W-159A (Area 5X)			✓					

TABLE 3.7-2 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO MARINE MAMMALS IN THE JAX STUDY AREA

Warfare Area and Operation	Training Areas	Vessel Movements (Disturbance)	Vessel Movements (Collisions)	Aircraft Overflights (Disturbance)	Towed Mine Warfare Devices	Mine Warfare Deployment/Recovery	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Material
Air Warfare (AW)									
ACM	W-157A (Areas 3X & 4X)			✓					✓
Air Intercept Control	JAX and Charleston OPAREAs	✓	✓	✓					
ACM Chaff Exercise	W-157A (Areas 3X & 4X)	✓	✓	✓					✓
ACM Flare Exercise	W-157A (Areas 3X & 4X)								
MISSILEX (A-A)	W-132, W-133, W-134, W-157, W-158			✓			✓	✓1	✓
MISSILEX (S-A)	JAX and Charleston OPAREAs								✓
Detect-to-Engage	W-132, W-133, W-134, W-157, W-158	✓	✓	✓					
GUNEX (S-A)	JAX OPAREA (AA, BB, and CC)	✓	✓	✓			✓		✓
GUNEX (A-A)	W-157A/W-133 (Area 2X)								✓
Amphibious Warfare (AmW)									
FIREX (Surface-to-Surface) with IMPASS	JAX OPAREA (BB and CC)	✓	✓				✓	✓	✓
Strike Warfare (STW)									
BOMBEX (Air-to-Ground)	Rodman Range								
CSAR and Convoy Operations	Rodman Range								
Electronic Combat (EC)									
EC Operations - Aircraft	W-132, W-133, W-134, W-157, W-158			✓					
EC Operations - Surface Ships	JAX and Charleston OPAREAs	✓	✓						
Chaff Exercise	JAX and Charleston OPAREAs	✓	✓	✓					✓
Flare Exercise- Helicopter	Lake George Range			✓					✓

TABLE 3.7-2 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO MARINE MAMMALS IN THE JAX STUDY AREA

Warfare Area and Operation	Training Areas	Vessel Movements (Disturbance)	Vessel Movements (Collisions)	Aircraft Overflights (Disturbance)	Towed Mine Warfare Devices	Mine Warfare Deployment/Recovery	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Material
Other Training									
SESEF Utilization	5-15 nm east of Mayport	✓	✓						
Precision Anchoring	NS Mayport	✓							
Small Arms with anti-swimmer grenades (MK3A2)	Charleston OPAREA (Area 10L, 12l)	✓	✓					✓	✓

[1] Missile explodes in air, no explosive sound in the water.

The affected environment is the OPAREAs. Refer to Section 1.4.1, Table 2.1-1, and Table 2.1-2 for additional detail regarding components of the JAX Range Complex.

TABLE 3.7-3
MARINE MAMMAL SPECIES FOUND IN THE JAX STUDY AREA

Family and Scientific Name	Common Name	Federal Status
Order Cetacea Suborder Mysticeti (baleen whales) Family Balaenidae (right whales)		
Eubalaena glacialis	North Atlantic right whale	ENDANGERED
Family Balaenopteridae (rorquals)		
Megaptera novaeangliae	Humpback whale	ENDANGERED
Balaenoptera acutorostrata	Minke whale	
Balaenoptera brydei	Bryde's whale	
Balaenoptera boreali	Sei whale	ENDANGERED
Balaenoptera physalus	Fin whale	ENDANGERED
Balaenoptera musculus	Blue whale	ENDANGERED
Suborder Odontoceti (toothed whales) Family Physeteridae (sperm whale)		
Physeter macrocephalus	Sperm whale	ENDANGERED

TABLE 3.7-3 (Continued)
MARINE MAMMAL SPECIES FOUND IN THE JAX STUDY AREA

Family and Scientific Name	Common Name	Federal Status
Family Kogiidae (pygmy sperm whales)		
Kogia breviceps	Pygmy sperm whale	
Kogia sima	Dwarf sperm whale	
Family Ziphiidae (beaked whales)		
Ziphius cavirostris	Cuvier's beaked whale	
Mesoplodon mirus	True's beaked whale	
Mesoplodon europaeus	Gervais' beaked whale	
Mesoplodon densirostris	Blainville's beaked whale	
Family Delphinidae (dolphins)		
Steno bredanensis	Rough-toothed dolphin	
Tursiops truncatus	Bottlenose dolphin	
Stenella attenuata	Pantropical spotted dolphin	
Stenella frontalis	Atlantic spotted dolphin	
Stenella longirostris	Spinner dolphin	
Stenella clymene	Clymene dolphin	
Stenella coeruleoalba	Striped dolphin	
Delphinus spp.	Common dolphin	
Lagenodelphis hosei	Fraser's dolphin	
Grampus griseus	Risso's dolphin	
Peponocephala electra	Melon-headed whale	
Feresa attenuata	Pygmy killer whale	
Pseudorca crassidens	False killer whale	
Orcinus orca	Killer whale	
Globicephala macrorhynchus	Short-finned pilot whale	
Order Sirenia Family Trichechidae (manatees)		
Trichechus manatus	West Indian manatee	ENDANGERED

**Source: DoN, 2008a*

Marine mammals are found in the JAX Study Area, with large numbers of sightings occurring on the continental shelf, particularly along the coast, and near the continental shelf break. Many toothed whale species, such as the pilot whale and Risso's dolphin, frequent waters near the shelf

break, where concentrations of their preferred prey (squid) occur. The bottlenose dolphin, Atlantic spotted dolphin, humpback whale, and North Atlantic right whale are the most likely species to be sighted on the shelf. Some baleen whales, such as the humpback whale and the North Atlantic right whale, migrate through the nearshore waters of the JAX Study Area. Critical habitat for the North Atlantic right whale occurs in the JAX Study Area (for more information, see the right whale discussion). Due to the highly endangered status of this species, dedicated aerial surveys were conducted during fall and winter (November through March) to obtain information on the occurrence of this species on its winter calving ground in the coastal waters of Georgia and northern Florida. As a result, there were concentrated survey efforts in a confined region when North Atlantic right whale mothers with their calves occur in the JAX Study Area. Other than these dedicated aerial survey efforts, there is comparatively little effort conducted in other portions of the Study Area, particularly deep waters seaward of the continental shelf break. There is not as much information on the occurrence of offshore cetacean species.

Marine mammal distribution within the Study Area and in the world is affected by demographic, evolutionary, ecological, habitat-related, and anthropogenic factors (Bjørge, 2002; Bowen *et al*., 2002; Forcada, 2002; Stevick *et al*., 2002). Movement of individuals is generally associated with feeding or breeding activity (Stevick *et al*., 2002). Some baleen whale species, such as the humpback whale, make extensive annual migrations to low-latitude mating and calving grounds in the winter and to high-latitude feeding grounds in the summer (Corkeron and Connor, 1999). Migrations undoubtedly occur during these seasons due to the presence of highly productive waters and associated cetacean prey species at high latitudes and of warm water temperatures at low latitudes (Corkeron and Connor, 1999; Stern, 2002). However, not all baleen whales migrate. Cetacean movements can also reflect more localized distribution and abundance of prey (Gaskin, 1982; Payne *et al*., 1986; Kenney *et al*., 1996). Cetacean movements can also be linked to indirect indicators of prey, such as temperature variations, sea-surface chlorophyll a concentrations, and features such as bottom depth (Fiedler, 2002). Oceanographic features, such as eddies associated with the Gulf Stream, are important factors determining cetacean distribution since their prey are attracted to the increased primary productivity associated with some of these features (Biggs *et al*., 2000; Wormuth *et al*., 2000; Davis *et al*., 2002). The warm Gulf Stream moves rapidly through the Florida Straits and extends northeast along the continental shelf. This current is the single most-influential oceanographic feature of the region and affects water temperature, salinity, and nutrient availability. These factors, in turn, are important in regulating primary productivity associated with phytoplankton growth in the region and the subsequent secondary productivity of zooplankton and other animal life that provide prey for marine mammals.

3.7.2.2 Endangered Species Act-Listed Marine Mammals

As identified in Table 3.7-3, seven marine mammal species listed as endangered under the ESA may be affected by the proposed activities that occur within in the JAX Study Area. These mammals include five baleen whale species (blue, fin, humpback, North Atlantic right, and sei), one toothed whale species (sperm whale), and one manatee species (West Indian manatee). Status, habitat, and distribution of each species are provided below.

Blue Whale

Blue whales are the largest living animals. Adult blue whales in the northern hemisphere reach lengths of 22.9 to 28 m (Jefferson *et al*., 1993). Blue whales feed primarily on euphausiids (krill)

(Kenney *et al*., 1985; Nemoto and Kawamura, 1977). Like other rorquals, blue whales feed by "gulping" (Pivorunas, 1979).

Status and Management

The endangered blue whale was severely depleted by commercial whaling in the twentieth century (NMFS 1998a). At least two discrete populations are found in the North Atlantic. One ranges from West Greenland to New England and is centered in eastern Canadian waters; the other is centered in Icelandic waters and extends south to northwest Africa (Sears *et al*. 2005). There are no current estimates of abundance for the North Atlantic blue whale (Waring *et al*. 2008). However, the 308 photo-identified individuals from the Gulf of St. Lawrence area are considered to be a minimum population estimate for the western North Atlantic stock (Sears *et al*. 1987; Waring et al. 2008). The blue whale is under the jurisdiction of the NMFS. The recovery plan for the blue whale was issued in 1998 (NMFS 1998a).

Habitat

Blue whales inhabit both coastal and oceanic waters in temperate and tropical areas (Yochem and Leatherwood, 1985). Blue whales in the Atlantic are primarily found in deeper, offshore waters and are rare in shallower, shelf waters (Wenzel *et al*., 1988). However, in the Gulf of St. Lawrence, blue whales show strong preferences for the nearshore regions where strong tidal and current mixing leads to high productivity and rich prey resources (Sears *et al*., 1990). Important foraging areas for this species include the edges of continental shelves and upwelling regions (Reilly and Thayer, 1990; Schoenherr, 1991). Based on acoustic and tagging data from the North Pacific, relatively cold, productive waters and fronts attract feeding blue whales (Moore *et al*., 2002). Clark and Gagnon (2004) determined that vocalizing blue whales show strong preferences, even during summer months, for shelf breaks, seamounts, or other areas where food resources are known to occur.

Acoustics and Hearing

Blue whale vocalizations are typically long, patterned low-frequency sounds with durations up to 36 sec (Thomson and Richardson, 1995) repeated every 1 to 2 min (Mellinger and Clark, 2003). Their frequency range is 12 to 400 Hz, with dominant energy in the infrasonic range at 12 to 25 Hz (Ketten, 1998; Mellinger and Clark, 2003). The short-duration sounds are transient, frequency-modulated calls having a higher frequency range and shorter duration than song notes and often sweeping down in frequency (Di Iorio *et al*., 2005; Rankin *et al*., 2005). These short-duration sounds are less than 5 sec in duration (Di Iorio *et al*., 2005; Rankin *et al.*, 2005) and are high-intensity, broadband (858±148 Hz) pulses (Di Iorio *et al*., 2005). Source levels of blue whale vocalizations are up to 188 dB (Ketten, 1998; Moore, 1999; McDonald *et al.*, 2001). While no data on hearing availability are available for this species, Ketten (1997) hypothesized that mysticetes have acute infrasonic hearing.

Distribution

Blue whales are distributed from the ice edge to the tropics and subtropics in both hemispheres (Jefferson *et al*., 1993). Stranding and sighting data suggest blue whale occurrence in the Atlantic extends south to Florida and the Gulf of Mexico; however, the southern limit of this species' range is unknown (Yochem and Leatherwood, 1985). Blue whales now rarely occur in the U.S. Atlantic Exclusive Economic Zone (EEZ) and the Gulf of Maine from August to October, which may represent the limits of their feeding range (CETAP, 1982; Wenzel *et al*., 1988). Sightings in the Gulf

of Maine and U.S. EEZ were made during multiple studies in late summer and early fall (August and October) (CETAP, 1982; Wenzel *et al*., 1988). Researchers using the Navy integrated undersea surveillance system resources detected blue whales in the open Atlantic south to at least the Bahamas (Clark, 1995), suggesting that all North Atlantic blue whales may comprise a single stock (NMFS, 1998b).

Calving area is unknown and occurs primarily during the winter (Yochem and Leatherwood 1985; Jefferson *et al*. 2008). Breeding grounds are thought to be located in tropical/subtropical waters; however, exact locations are unknown (Jefferson *et al*. 2008).

Blue Whale Occurrence

The majority of western North Atlantic blue whale observations the spring, summer, and fall take place around Newfoundland, the Gulf of St. Lawrence, and Nova Scotia (CETAP 1982; Sears *et al*. 1987; Wenzel *et al*. 1988; Sears *et al*. 1990). The southern extent of its feeding range may be somewhere near 40° N latitude and records suggest occurrence of this species south to Florida and in the Gulf of Mexico. The information above suggests the blue whale is less likely to be present during summer months, but may occur any time of the year.

Blue Whale Density

There was insufficient data available to estimate a density for the JAX Study Area, nor is there an abundance estimate in the NOAA stock assessment report (DoN, 2007a).

Fin Whale

The fin whale is the second-largest whale species, with adults reaching 24 m in length (Jefferson *et al*., 1993). Fin whales feed by "gulping" a wide variety of small, schooling prey (especially herring, capelin, and sand lance) including squid and crustaceans (krill and copepods) (Kenney *et al*., 1985; NMFS, 2006d).

Status and Management

The NOAA SAR estimates that there are 2,269 individual fin whales in the U.S. Atlantic waters (Waring *et al*. 2008); this is probably an underestimate, however, as survey coverage of known and potential fin whale habitat was incomplete. The fin whale is listed as endangered under the ESA and is managed under jurisdiction of the NMFS. The draft recovery plan for the fin whale was released in June 2006 (NMFS 2006a). NMFS recently initiated a 5-yr review for the fin whale under the ESA (NMFS 2007a).

Habitat

The fin whale is found in continental shelf, slope, and oceanic waters. Off the U.S. east coast, the fin whale appears to be scarce in slope and Gulf Stream waters (CETAP, 1982; Waring *et al*., 1992). Waring *et al*. (1992) reported sighting fin whales along the edge of a warm core eddy and a remnant near Wilmington Canyon, along the northern wall of the Gulf Stream. Globally, this species tends to be aggregated in locations where populations of prey are most plentiful, irrespective of water depth, although those locations may shift seasonally or annually (Payne *et al*., 1986; 1990; Kenney *et al*., 1997; Notarbartolo-di-Sciara *et al*., 2003). Clark and Gagnon (2004) determined that vocalizing fin whales show strong preferences, even during summer months, for shelf breaks, seamounts, or other areas where food resources are known to occur.

Acoustics and Hearing

Fin and blue whales produce calls with the lowest frequency and some of the highest source levels of all cetaceans. Infrasonic, pattern sounds have been documented for fin whales (Watkins *et al.*, 1987; Clark and Fristrup, 1997; McDonald and Fox, 1999). Fin whales produce a variety of sounds with a frequency range up to 750 Hz. The long, patterned 15 to 30 Hz vocal sequence is most typically recorded; only males are known to produce these (Croll *et al.*, 2002). The most typical fin whale sound is a 20 Hz infrasonic pulse (actually an FM sweep from about 23 to 18 Hz) with durations of about 1 sec and can reach source levels of 184 to 186 dB (Watkins *et al*., 1987; Thomson and Richardson, 1995; Charif *et al.*, 2002). While no data on hearing availability are available for this species, Ketten (1997) hypothesized that mysticetes have acute infrasonic hearing.

Distribution

Fin whales are broadly distributed in the world's oceans, including temperate, tropical, and polar regions (Jefferson *et al*., 2008). The overall range of fin whales in the North Atlantic extends from the Gulf of Mexico/Caribbean and Mediterranean north to Greenland, Iceland, and Norway (Gambell, 1985; NMFS, 1998a). In the western North Atlantic, the fin whale is the most commonly sighted large whale in continental shelf waters from the mid-Atlantic coast of the U.S. to eastern Canada (CETAP, 1982; Hain *et al*., 1992).

Relatively consistent sighting locations for fin whales off the U.S. Atlantic coast include the banks on the Nova Scotian Shelf, Georges Bank, Jeffreys Ledge, Cashes Ledge, Stellwagen Bank, Grand Manan Bank, Newfoundland Grand Banks, the Great South Channel, the Gulf of St. Lawrence, off Long Island and Block Island, Rhode Island, and along the shelf break of the northeastern U.S. (CETAP 1982; Hain *et al*. 1992; Waring *et al*. 2004). Hain *et al*. (1992) reported that the single most important habitat identified in their study was a region of the western Gulf of Maine, to Jeffreys Ledge, Cape Ann, Stellwagen Bank, and to the Great South Channel, in approximately 50 m of water. This was an area of high prey (sand lance) density during the 1970s and early 1980s (Kenney and Winn 1986). Secondary areas of important fin whale habitat included the mid- to outer shelf from the northeast area of Georges Bank through the mid-Atlantic Bight.

Based on passive acoustic detection using Navy Sound Surveillance System hydrophones in the western North Atlantic (Clark, 1995), fin whales are believed to move southward in the fall and northward in spring. The location and extent of the wintering grounds are poorly known (Aguilar, 2002). Fin whales have been seen feeding as far south as the coast of Virginia (Hain *et al*., 1992).

Fin whales are not completely absent from northeastern U.S. continental shelf waters in winter, indicating that not all members of the population conduct seasonal migrations. Perhaps a fifth to a quarter of the spring/summer peak population remains in this area year-round (CETAP, 1982; Hain *et al*., 1992).

Peak calving is in October through January (Hain *et al*. 1992); however, location of breeding grounds is unknown.

Fin Whale Occurrence

Fin whales are the most commonly sighted large whale in the JAX Study Area during the winter in the U.S. Atlantic continental shelf waters. As much as a quarter of the spring/summer peak population stay in continental shelf waters year-round (CETAP, 1982). During the spring, summer, and fall, fin whales occur along the Atlantic coasts of the United States and Canada, with smaller numbers of animals remaining through the winter. Sightings are almost exclusively limited to continental shelf waters inshore of the 6000 foot isobath, from the Gulf of Maine south to Cape Hatteras (CETAP, 1982; Agler *et al*. 1993). The greatest abundance and widest occupation of fin whales in the northeast United States is shown to occur in the spring (Hain *et al*., 1985).

Fin Whale Density

The density estimates for training areas where explosions and/or ordnance use may occur in the JAX Study Area are provided in Table 3.7-1. Methods and results are detailed in the NODE Report (DoN, 2007a). The Navy does not consider estimates of zero density to mean that this species does not occur in the area, only that they generally occur in low numbers or infrequently based on the best available data. It may be reasonable to assume that a number of the sightings were recorded as unidentified rorquals might be of fin whales.

Humpback Whale

Adult humpback whales are 11 to 16 m long. The body is black or dark gray, with very long (about one-third of the body length) flippers that are usually at least partially white (Jefferson et al., 1993; Clapham and Mead, 1999). Humpback whales feed on a wide variety of invertebrates and small schooling fish, including euphausiids (krill), herring, mackerel, sand lance, sardines, anchovies, and capelin (Clapham and Mead, 1999).

Status and Management

An estimated 11,570 humpback whales occur in the entire North Atlantic (Stevick *et al*. 2003a). Humpback whales in the western North Atlantic are thought to belong to five different stocks based on feeding locations (Katona and Beard 1990; Waring *et al*. 2008): Gulf of Maine, Gulf of St. Lawrence, Newfoundland/Labrador, western Greenland, and Iceland. There appears to be very little exchange between these separate feeding stocks (Katona and Beard 1990). The best estimate of abundance for the Gulf of Maine Stock is 847 individuals (Waring *et al*. 2008) based on a 2006 aerial survey. The humpback whale is listed as endangered under the ESA and management of the species is under the jurisdiction of the NMFS. The recovery plan for the humpback whale was issued in 1991 (NMFS 1991).

Habitat

Although humpback whales typically travel over deep, oceanic waters during migration, their feeding and breeding habitats are mostly in shallow, coastal waters over continental shelves (Clapham and Mead, 1999). Shallow banks or ledges with high sea-floor relief characterize feeding grounds (Payne *et al*., 1990; Hamazaki, 2002). The habitat requirements of wintering humpbacks appear to be determined by the conditions necessary for calving. Optimal calving conditions are warm water (24 to 28 °C) and relatively shallow, low-relief ocean bottom in protected areas (*i.e.*, behind reefs) (Sanders *et al*., 2005). Females with calves occur in

significantly shallower waters than other groups of humpback whales, and breeding adults use deeper, more offshore waters (Smultea, 1994; Ersts and Rosenbaum, 2003).

Acoustics and Hearing

Humpback whales produce sounds from 20 Hz to over 10 kHz, with dominant frequencies below 3 kHz (Silber, 1986). Houser *et al*. (2001) produced the first humpback whale audiogram (using a mathematical model). The predicted audiogram indicates sensitivity to frequencies from 700 Hz to 10 kHz, with maximum relative sensitivity between 2 and 6 kHz. Au *et al*. (2006) noted that if the popular notion that animals generally hear the totality of the sounds they produce is applied to humpback whales, this suggests that its upper frequency limit of hearing is as high as 24 kHz.

Distribution

Humpback whales are globally distributed in all major oceans and most seas. They are generally found during the summer on high-latitude feeding grounds and during the winter in the tropics and subtropics around islands, over shallow banks, and along continental coasts, where calving occurs. Most humpback whale sightings are in nearshore and continental shelf waters; however, humpback whales frequently travel through deep water during migration (Clapham and Mattila, 1990; Calambokidis *et al*., 2001).

In the North Atlantic Ocean, humpbacks are found from spring through fall on feeding grounds located from south of New England to northern Norway (NMFS, 1991). During the winter, most of the North Atlantic population of humpback whales is believed to migrate south to calving grounds in the West Indies region (Whitehead and Moore, 1982; Smith *et al*., 1999; Stevick *et al*., 2003b).

There has been an increasing occurrence of humpbacks, which appear to be primarily juveniles, during the winter along the U.S. Atlantic coast from Florida north to Virginia (Clapham *et al*., 1993; Swingle *et al*., 1993; Wiley *et al*., 1995; Laerm *et al*., 1997). It has been proposed that the mid-Atlantic region primarily represents a supplemental winter feeding ground, which is also an area of mixing of humpback whales from different feeding stocks (Barco *et al*., 2002).

Humpback Whale Occurrence

Based on sightings (*e.g*., Winn *et al.*, 1979), strandings (*e.g*., Winn *et al.*, 1979; Schmidly, 1981), and life history parameters, the humpback whale may occur in the JAX Study Area during fall, winter, and spring. This reflects humpback whale migration patterns to calving grounds in the Caribbean during the fall and to the feeding grounds much farther north during the spring. Humpback whales are not expected in the JAX Study Area during summer, since they should occur farther north on their feeding grounds. Over one hundred aerial surveys are conducted in the JAX Study Area every winter, but humpback whales are rarely sighted (Kenney, 2001).

Humpback Whale Density

The density estimates for training areas where explosions and/or ordnance use may occur in the JAX Study Area are provided in Table 3.7-1. Methods and results are detailed in the NODE Report (DoN, 2007a). Density estimates for the OPAREAs reflect the migration patterns of the humpback whale with higher density predicted during spring and fall migration, lower densities during the winter when animals should be largely in calving grounds farther south, and zero density during the summer season when humpbacks should be on feeding grounds to the north.

North Atlantic Right Whale

Adults are robust and may reach 18 m in length (Jefferson *et al.,* 1993). North Atlantic right whales feed on zooplankton, particularly large calanoid copepods such as Calanus (Kenney, *et al.,* 1985; Beardsley *et al.,* 1996; Baumgartner *et al.,* 2007).

Status and Management

The North Atlantic right whale is one of the world's most endangered large whale species (Clapham *et al*. 1999; Perry et al. 1999; IWC 2001).

According to the North Atlantic right whale report card released annually by the North Atlantic Right Whale Consortium, approximately 393 individuals are thought to occur in the western North Atlantic (NARWC 2007). The most recent NOAA SAR states that in a review of the photo-id recapture database for June 2006, 313 individually recognized whales were known to be alive during 2001 (Waring *et al*. 2008). This is considered the minimum population size. The North Atlantic right whale is under the jurisdiction of the NMFS. The recovery plan for the North Atlantic right whale was published in 2005 (NMFS 2005a).

This species is presently declining in number (Caswell et al. 1999; Kraus *et al*. 2005). This species showed a decline in survival during the 1990's (Best *et al*., 2001; Waring *et al*., 2008). In recent years, there has been in increase in the number of catalogued individuals (Waring et al., 2008); however, Kraus *et al*. (2005) noted that the recent increases in birth rate were insufficient to counter the observed spike in human-caused mortality that has recently occurred.

In an effort to reduce ship collisions with critically endangered North Atlantic right whales, the Early Warning System (EWS) (Right Whale Sighting Advisory System) was instigated in 1994 for the calving region along the southeastern U.S. coast. This system was extended in 1996, known as the Northeast U.S. Right Whale Sighting Advisory System, to the feeding areas off New England (MMC 2003; NMFS-NEFSC, 2008). In 2007, the International Maritime Organization implemented a 12 degree shift in shipping lanes that service Boston, Massachussetts to provide a reduction in ship strike risk to right whales and all baleen whale species occurring in the area (Federal Register Vol. 73, No. 198, October 2008).

In 1999, a Mandatory Ship Reporting System was implemented by the U.S. Coast Guard (USCG 1999; USCG 2001). This reporting system requires specified vessels (Navy ships are exempt) to report their location while in the nursery and feeding areas of the right whale (Ward-Geiger et al. 2005). At the same time, ships receive information on locations of North Atlantic right whale sightings in order to avoid whale collisions. Reporting takes place in the southeastern U.S. from 15 November through 15 April. In the northeastern U.S., the reporting system is year-round and the geographical boundaries include the waters of Cape Cod Bay, Massachusetts Bay, and the Great South Channel east and southeast of Massachusetts.

In October 2008, NMFS published the final rule to implement speed restrictions to reduce the threat of ship collisions with NARW. The final rule includes a speed restriction of 10 knots or less during certain times of the year along the U.S. east coast and modification of key shipping routes into Boston. These restrictions only apply to vessels greater than 20 m in length and are not mandatory for any Federal agency (NOAA, 2008). However, the Navy is consulting with NMFS regarding potential impacts from vessel collisions.

Habitat

North Atlantic right whales on the winter calving grounds are most often found in very shallow, nearshore waters in cooler sea surface temperatures inshore of a mid-shelf front (Kraus *et al*., 1993; Ward, 1999). High whale densities can extend more northerly than the current defined boundary of the calving critical habitat in response to interannual variability in regional sea surface temperature distribution (Garrison *et al*., 2005; Glass *et al*., 2005). Warm Gulf Stream waters appear to represent a thermal limit (both southward and eastward) for right whales (Keller *et al*., 2006).

The feeding areas are characterized by bottom topography, water column structure, currents, and tides that combine to physically concentrate zooplankton into extremely dense patches (Wishner *et al*., 1988; Murison and Gaskin, 1989; Macaulay *et al*., 1995; Beardsley *et al*., 1996; Baumgartner *et al*., 2003).

Acoustics and Hearing

Most of the sounds produced by right whales range in frequency from 0.02 to 15 kHz (dominant frequency range from 0.02 to less than 2 kHz; durations typically range from 0.01 to multiple seconds) with some sounds having multiple harmonics (Parks and Tyack, 2005). Recent morphometric analyses of northern right whale inner ears estimates a hearing range of approximately 0.01 to 22 kHz based on established marine mammal models (Parks *et al*., 2004; Parks and Tyack, 2005; Parks *et al*., 2007). In addition, Parks *et al*. (2007) estimated the functional hearing range for right whales to be 15 Hz to 18 kHz. Nowacek *et al*. (2004) observed that exposure to short tones and down sweeps, ranging in frequency from 0.5 to 4.5 kHz, induced an alteration in behavior (received levels of 133 to 148 dB), but exposure to sounds produced by vessels (dominant frequency range of 0.05 to 0.5 kHz) did not produce any behavioral response (received levels of 132 to 142 dB).

North Atlantic Right Whale Critical Habitat

One calving and two feeding areas in U.S. waters are designated as critical habitat for the North Atlantic right whale (NMFS, 1994; NMFS, 2005b) (Figure 3.7-1). The coastal waters off Georgia and northern Florida are the only known calving ground for the North Atlantic right whale. Designated critical habitat, which encompasses the core of the calving ground, is essential to the conservation of this species. Revision of the critical habitat boundary is currently being considered by NMFS, since there are many additional sightings outside the bounds of the current critical habitat.

Distribution

Right whales occur in sub-polar to temperate waters. The North Atlantic right whale was historically widely distributed, ranging from latitudes of 60° N to 20° N, prior to serious declines in abundance due to intensive whaling (NMFS, 2006c; Reeves *et al*., 2007). North Atlantic right whales are found primarily in continental shelf waters between Florida and Nova Scotia. Most sightings are concentrated within five high-use areas: coastal waters of the southeastern United States (Georgia and Florida), Cape Cod and Massachusetts bays, the Great South Channel, the Bay of Fundy, and the Nova Scotian Shelf (Winn *et al*., 1986; NMFS, 2005a). Of these, one calving and two feeding areas in U.S. waters were designated for North Atlantic right whales under the ESA (NMFS, 1994; NMFS, 2005b) (Figure 3.7-1). The critical habitat designated waters off Georgia and northern Florida are known calving ground for western North Atlantic right whales, with use concentrated in the winter (as early as November and through March)

(Winn *et al*., 1986). According to NMFS, some calving also takes place off southern North Carolina. The feeding grounds of Cape Cod Bay, which have individuals in February through April (Winn *et al*., 1986; Hamilton and Mayo, 1990), and the Great South Channel east of Cape Cod, with use in April through June (Winn *et al*., 1986; Kenney *et al*., 1995), have also been designated as critical habitat for the North Atlantic right whale (Figure 3.7-1).

Most North Atlantic right whale sightings follow a well-defined seasonal migratory pattern through several consistently utilized habitats (Winn *et al*., 1986). It should be noted, however, that some individuals may be sighted in these habitats outside the typical time of year and that migration routes are poorly known (there may be a regular offshore component).

During the spring through early summer, North Atlantic right whales are found on feeding grounds off the northeastern United States and Canada. During the winter (as early as November and through March), North Atlantic right whales may be found in coastal waters off North Carolina, Georgia, and northern Florida (Winn *et al*., 1986).

The JAX Study Area lies within the Southeast U.S. Coast Ground (coastal waters between North Carolina and northern Florida) that was a shore-based whaling ground for right whales during winter and early spring (January through March) in the late 1800s (Reeves and Mitchell, 1986). An examination of sighting records from all sources between 1950 and 1992 found that wintering right whales were observed widely along the coast from Cape Hatteras, North Carolina, to Miami, Florida (Kraus *et al.*, 1993). Sightings off the Carolinas were single sightings that appeared to be of transients (Kraus *et al.*, 1993). These observations are consistent with the hypothesis that coastal waters of the Carolinas are part of a migratory corridor for the right whale (Winn *et al.*, 1986). Recent observations of right whales near the Outer Banks of North Carolina are reported less frequently than would be expected judging by those whaling operations, but this could be due to relatively low sighting effort (Reeves, 2001). Until better information is available on the width of the right whale's migratory corridor, it was recommended that management considerations are needed for the coastal areas along the mid-Atlantic migratory corridor within 65 km of shore (Knowlton, 1997).

North Atlantic Right Whale Occurrence

Right whales migrate to the coastal waters of the southeastern United States to calve in the JAX Study Area during the winter months (November through April). There are a large number of sightings during the fall and winter in coastal waters of southern South Carolina through northeastern Florida, when right whales are most frequently observed in this area (DoN, 2008a). The substantial number of sightings reflects the volume of aerial and shore-based surveys being conducted in this area. As noted by Gaskin (1982), right whales might be seen anywhere off the U.S. Atlantic coast in the year.

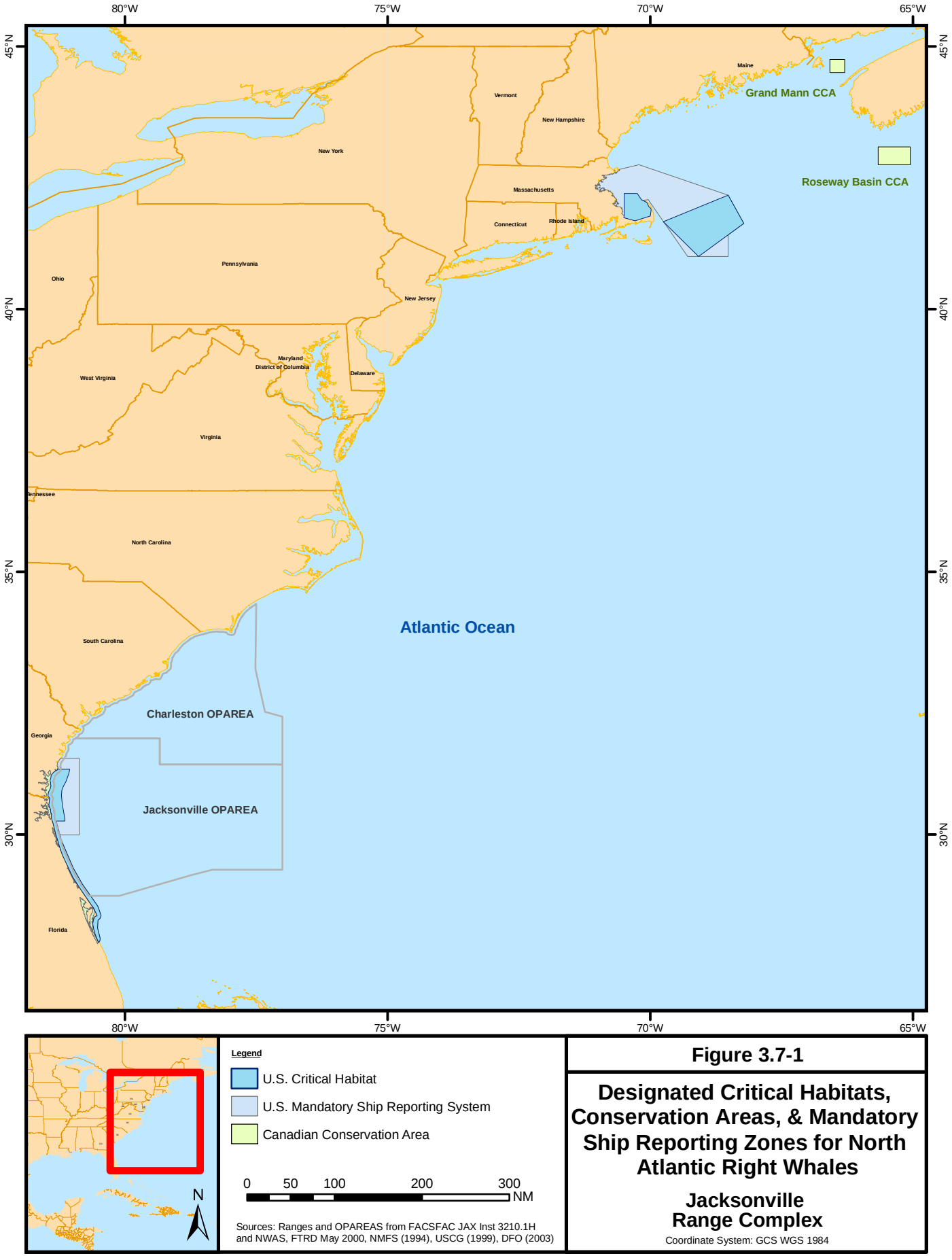


Figure 3.7-1

Designated Critical Habitats, Conservation Areas, & Mandatory Ship Reporting Zones for North Atlantic Right Whales

Jacksonville Range Complex

Coordinate System: GCS WGS 1984

During the summer, right whales should occur farther north on their feeding grounds; however, there are some sightings in the JAX Study Area during this season. As noted by Kraus *et al.* (1993), opportunistic sightings of right whales have been reported off the southeastern United States as early as September and as late as June in some years. Recently, a mother and calf pair was sighted in July 2007 off northeastern Florida (NMFS, 2007a).

Right whale sightings in very deep offshore waters of the western North Atlantic are infrequent. There is limited evidence, however, suggesting there may be an offshore component to their distributional and migratory cycle. This evidence includes a rare occurrence at Bermuda; off-shelf excursions by satellite-tracked individuals (Mate *et al.*, 1997); disappearance of right whales from most coastal habitats in winter; genetic and sighting data, indicating there are additional summer grounds; and right whale individuals sighted past the continental shelf break off Florida. In general, the North Atlantic right whale may occur year-round from the shore to the continental shelf break in the JAX Study Area, with a peak concentration during November through April.

North Atlantic Right Whale Density

The density estimates for training areas where explosions and/or ordnance use may occur in the JAX Study Area are provided in Table 3.7-5. Methods and results are detailed in the NODE Report (DoN, 2007a). Density estimates presented in the following table are not necessarily indicative of the occurrence patterns of right whales in the Study Area. Due to the small population size of North Atlantic right whales, low numbers may produce a low density estimate; however, right whales may occur in the OPAREAs at any given time.

Sei Whale

Adult Sei whales are up to 18 m long and are mostly dark gray in color with a lighter belly, often with mottling on the back (Jefferson *et al*., 1993). In the North Atlantic Ocean, the major prey species are copepods and krill (Kenney *et al*., 1985).

Status and Management

The International Whaling Commission (IWC) recognizes three sei whale stocks in the North Atlantic: Nova Scotia, Iceland-Denmark Strait, and Northeast Atlantic (Perry *et al*. 1999). The Nova Scotia Stock occurs in U.S. Atlantic waters (Waring et al. 2008). The best abundance estimate for sei whales in the western North Atlantic is 207; however this is considered conservative due to uncertainties in population movements and structure (Waring *et al*. 2008). The sei whale is under the jurisdiction of the NMFS. A draft recovery plan for fin and sei whales was released in 1998 (NMFS 1998b). It has since been determined that the two species should have separate recovery plans. The independent recovery plan for the sei whale has not yet been issued; however, the species is listed as endangered under the ESA.

Habitat

Sei whales are most often found in deep, oceanic waters of the cool temperate zone. Sei whales appear to prefer regions of steep bathymetric relief, such as the continental shelf break, canyons, or basins situated between banks and ledges (Kenney and Winn, 1987; Schilling *et al*., 1992; Gregr and Trites, 2001; Best and Lockyer, 2002). These areas are often the location of persistent hydrographic features, which may be important factors in concentrating prey, especially copepods. On the feeding grounds, the distribution is largely associated with oceanic frontal systems (Horwood, 1987). Characteristics of preferred breeding grounds are unknown. Horwood

(1987) noted that Sei whales prefer oceanic waters and are rarely found in marginal seas; historical whaling catches were usually from deep water, and land station catches were usually taken from along or just off the edges of the continental shelf.

Acoustics and Hearing

Sei whale vocalizations have been recorded only on a few occasions. During winter months off Hawaii, Rankin and Barlow (2007a) recorded downsweep calls exhibiting two distinct frequency ranges that were attributed to sei whales: the frequency ranges were from 100 to 44 Hz and from 39 to 21 Hz with the former range usually shorter in duration. Baumgartner *et al*. (2008) documented a down sweep call attributed to sei whales in the Great South Channel of the northwest Atlantic which are similar to the frequency-modulated (100 Hz to 44 Hz) calls recorded by Ranken and Barlow (2007a) from sei whales in the Pacific Ocean. Recordings from the North Atlantic consisted of paired sequences (0.5 to 0.8 sec, separated by 0.4 to 1.0 sec) of 10 to 20 short (4 milliseconds [msec]) frequency-modulated (FM) sweeps between 1.5 and 3.5 kHz; source level was not known (Thomson and Richardson, 1995). While no data on hearing availability are available for this species, Ketten (1997) hypothesized that mysticetes have acute infrasonic hearing.

Distribution

Sei whales have a worldwide distribution but are found primarily in cold temperate to subpolar latitudes rather than in the tropics or near the poles (Horwood, 1987). Sei whales spend the summer months feeding in the subpolar higher latitudes and return to the lower latitudes to calve in the winter. For the most part, the location of winter breeding areas remains a mystery (Rice, 1998; Perry *et al*., 1999).

In the western North Atlantic Ocean, Sei whales occur primarily from Georges Bank north to Davis Strait (northeast Canada, between Greenland and Baffin Island) (Perry *et al*., 1999). Sei whales are not known to be common in most U.S. Atlantic waters (NMFS, 1998a). Peak abundance in U.S. waters occurs from winter through spring (mid-March through mid-June), primarily around the edges of Georges Bank (CETAP, 1982; Stimpert *et al*., 2003). The distribution of the Nova Scotia stock might extend along the U.S. coast at least to North Carolina (NMFS, 1998a). The hypothesis is that the Nova Scotia stock moves from spring feeding grounds on or near Georges Bank, to the Scotian Shelf in June and July, eastward to perhaps Newfoundland and the Grand Banks in late summer, then back to the Scotian Shelf in fall, and offshore and south in winter (Mitchell and Chapman, 1977).

Sei Whale Occurrence

Sei whales are found predominantly in deep water (NMFS, 1998a). Sei whales are not likely to occur in the JAX Study Area during the summer, since they should be on feeding grounds around the eastern Scotian Shelf or Grand Banks (Mitchell, 1975a; Mitchell and Chapman, 1977). The winter range of some rorquals (and often extrapolated to the Sei whale) is thought to be in deep, offshore waters particularly at lower latitudes (Kellogg, 1929; Gaskin, 1982). During fall, winter, and spring, rare occurrences of sei whales may occur in deeper waters of the JAX Study Area.

Sei Whale Density

There was insufficient data available to estimate a density for the JAX Study Area, nor is there an abundance estimate in the NOAA stock assessment report (DoN, 2007a). Lack of sighting data

for density estimates is not indicative of the absence of Sei whales as they are difficult to distinguish from other rorquals at sea.

Sperm Whale

The sperm whale is the largest toothed whale species. Adult females can reach 12 m in length, while adult males measure as much as 18 m in length (Jefferson *et al*., 1993). Sperm whales prey on large mesopelagic squids and other cephalopods, as well as demersal fish and benthic invertebrates (Fiscus and Rice, 1974; Rice, 1989; Clarke, 1996).

Status and Management

Sperm whales are classified as endangered under the ESA (NMFS 2006d), although they are globally not in any immediate danger of extinction. The current combined best estimate of sperm whale abundance from Florida to the Bay of Fundy in the western North Atlantic Ocean is 4,804 individuals (Waring et al. 2008). Stock structure for sperm whales in the North Atlantic is unknown (Dufault et al. 1999). The sperm whale is under the jurisdiction of the NMFS. The draft recovery plan for the sperm whale was released in June 2006 for public comment (NMFS 2006d). In January 2007, NMFS initiated a 5-yr review for the sperm whale under the ESA (NMFS 2007a).

Habitat

Sperm whale distribution can be variable but is generally associated with waters over the continental shelf edge, continental slope, and offshore waters (CETAP, 1982; Hain *et al*., 1985; Smith *et al*., 1996; Waring *et al*., 2001; Davis *et al*., 2002). Rice (1989) noted a strong offshore preference by sperm whales.

In some areas, sperm whale densities were correlated with high secondary productivity and steep underwater topography (Jaquet and Whitehead, 1996). Data from the Gulf of Mexico suggest that sperm whales adjust their movements to stay in or near cold-core rings (Davis et al., 2000; 2002), which demonstrate that sperm whales can shift their movements in response to prey density.

Off the eastern United States, sperm whales are found in regions of pronounced horizontal temperature gradients, such as along the edges of the Gulf Stream and within warm-core rings (Waring *et al*., 1993; Jaquet and Whitehead 1996; Griffin, 1999). Fritts *et al*. (1983) reported sighting sperm whales associated with the Gulf Stream. Waring *et al*. (2003) conducted a deepwater survey south of Georges Bank in 2002 and examined fine-scale habitat use by sperm whales. Sperm whales were located in waters characterized by sea-surface temperatures of 23.2º to 24.9º C and bottom depths of 325 to 2,300 m (Waring *et al*., 2003).

Acoustics and Hearing

Sperm whales typically produce short-duration (less than 30 ms), repetitive broadband clicks used for communication and echolocation. These clicks range in frequency from 0.1 to 30 kHz, with dominant frequencies between the 2 to 4 kHz and 10 to 16 kHz ranges (Thomson and Richardson, 1995). It has been shown that sperm whales may produce clicks during 81 percent of their dive period, specifically 64 percent of the time during their descent phases (Watwood *et al*., 2006). The anatomy of the sperm whale's inner and middle ear indicates an ability to best hear high-frequency to ultrasonic frequency sounds. They may also possess better low-frequency hearing than other odontocetes, although not as low as many baleen whales (Ketten, 1992). The auditory

brainstem response (ABR) technique used on a stranded neonatal sperm whale indicated it could hear sounds from 2.5 to 60 kHz with best sensitivity to frequencies between 5 and 20 kHz (Ridgway and Carder, 2001).

Distribution

Sperm whales are found from tropical to polar waters in all oceans of the world between approximately 70º N and 70º S (Rice, 1998). Females are normally restricted to areas with SSTs greater than approximately 15°C, whereas males, and especially the largest males, can be found in waters as far poleward as the pack ice with temperatures close to 0° (Rice, 1989). The thermal limits on female distribution correspond approximately to the 40° parallels (50° in the North Pacific) (Whitehead, 2003).

Sperm whales are the most-frequently sighted whale seaward of the continental shelf off the eastern United States (CETAP, 1982; Kenney and Winn, 1987; Waring *et al.*, 1993). In Atlantic EEZ waters, sperm whales appear to have a distinctly seasonal distribution (CETAP, 1982; Scott and Sadove, 1997). Although concentrations shift depending on the season, sperm whales generally occur in Atlantic EEZ waters year-round.

Mating may occur December through August, with the peak breeding season falling in the spring (NMFS, 2006b); however, location of specific breeding grounds is unknown.

Sperm Whale Occurrence

Sperm whales are typically distributed in the vicinity of the continental shelf break and over the continental slope and may occur at any time of year. Few sightings occur south of Cape Hatteras, but this is likely a result of the lack of survey effort. Strandings are scattered from North Carolina to Florida (Leatherwood *et al*. 1976b; Schmidly 1981). There are a number of historical stranding and whaling records of sperm whales within and adjacent to the JAX Study Area (Moore, 1953; Caldwell *et al.*, 1971; Winn *et al.*, 1979; Schmidly, 1981). In the 1800s, sperm whales were frequently taken by whaling boats off Charleston, South Carolina, on the Charleston Grounds during January (Townsend, 1935). Many historical records of captures by whalers exist – a few captures occurred near shore off Charleston, South Carolina, but many occurred seaward of the 656-foot isobath to far offshore (Townsend, 1935).

Sperm Whale Density

The density estimates for training areas where explosions and/or ordnance use may occur in the JAX Study Area are provided in Table 3.7-6. Methods and results are detailed in the NODE Report (DoN 2007a). Density estimates presented below are for shallow, near-shore training areas that are not representative of sperm whale preferred habitat. The Navy does not consider estimates of zero density to mean that this species does not occur in the area only that they generally occur in low numbers or infrequently based on the best available data.

West Indian Manatee

The West Indian manatee (*Trichechus manatus*) is a rotund, slow-moving animal, which reaches a maximum length of 3.9 m (Jefferson, *et al.,* 1993). They have an unusually low metabolic rate and a high thermal conductance that leads to energetic stress in winter (Bossart *et al.,* 2002). Manatees are herbivores that feed on a wide variety of submerged, floating, and emergent vegetation, but they also ingest invertebrates (USFWS, 2001; Courbis and Worthy, 2003; Reich

and Worthy, 2006). This section refers to the manatee in the OPAREAs, for more information on the manatee in Lake George, see Section 3.11.

Status and Management

Manatees are classified as endangered under the ESA, and managed under the jurisdiction of the US Fish and Wildlife Service. In the most recent revision of the manatee recovery plan, it was concluded that, based on movement patterns, manatees around Florida should be divided into four relatively discrete management units or subpopulations, each representing a significant portion of the species' range (USFWS, 2001). Manatees found along the Atlantic U.S. coast make up two subpopulations: the Atlantic Region and the Upper St. Johns River Region (USFWS, 2001). Manatees from the western coast of Florida make up the other two subpopulations: the Northwest Region and the Southwest Region (USFWS, 2001).

Manatee numbers are assessed by aerial surveys during the winter months when manatees are concentrated in warm-water refuges. Aerial surveys conducted in February 2007 produced a preliminary abundance estimate of 2,812 individuals (FMRI, 2007). Along Florida's Gulf Coast, observers counted 1,400 manatees, while observers on the Atlantic coast counted 1,412.

In 1976, critical habitat was designated for the West Indian manatee in Florida (USFWS, 1976). There are two types of manatee protection areas in the State of Florida: manatee sanctuaries and manatee refuges (USFWS, 2001; USFWS, 2002; USFWS, 2002). Manatee sanctuaries are areas where all waterborne activities are prohibited while manatee refuges are areas where activities are permitted but certain waterborne activities may be regulated (USFWS, 2001; USFWS, 2002; USFWS, 2002).

Habitat

Sightings of manatees are restricted to warm freshwater, estuarine, and extremely nearshore coastal waters. Manatees occur in very shallow waters of 7 to 13 feet, generally close to shore (approximately less than 1 km) (Beck *et al.,* 2004). Shallow seagrass beds close to deep channels are preferred feeding areas in coastal and riverine habitats (Lefebvre*, et al.,* 2000; USFWS, 2001). West Indian manatees are frequently located in secluded canals, creeks, embayments, and lagoons near the mouths of coastal rivers and sloughs. These areas serve as locations of feeding, resting, mating, and calving (USFWS, 2001). Estuarine and brackish waters with access to natural and artificial freshwater sources, are typical West Indian manatee habitat (USFWS, 2001). When ambient water temperatures drop below about 20° C in fall and winter, migration to natural or anthropogenic warm-water sources takes place (Irvine, 1983). Effluents from sewage treatment plants are important sources of freshwater for West Indian manatees in the Caribbean Sea (Rathbun*, et al.,* 1985). Manatees are also observed drinking fresh water that flows out of the mouths of rivers (Lefebvre *et al.,* 2001) and out of offered hoses at harbors (Fertl *et al.,* 2005).

Manatee Critical Habitat

Critical habitat for the West Indian manatee was designated under 41 FR 41914 in 1976 with an augmentation and correction in 1977 (USFWS, 1976). The habitat extends in the state of Florida and encompasses the St. Johns River, including Lake George (Figure 3.7-2).

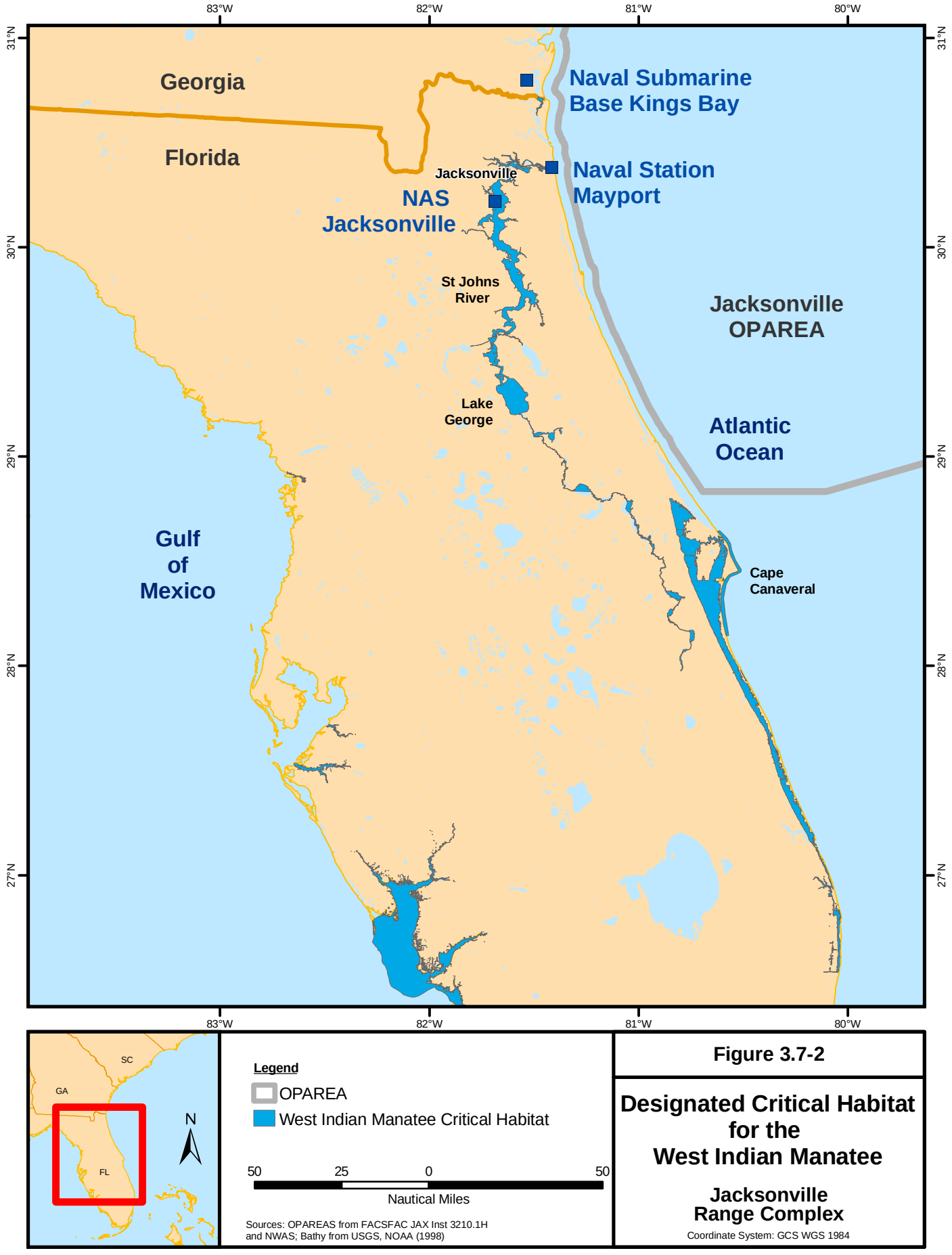


Figure 3.7-2

Designated Critical Habitat for the West Indian Manatee

Jacksonville Range Complex

Coordinate System: GCS WGS 1984

The designated area included the West Indian manatee's entire known range at that time (including waterways in about one-third to one-half of Florida) (Laist, 2002). This critical habitat designation has been infrequently used or referenced since it is broad in description, treats all waterways the same, and does not highlight any particular areas (Laist, 2002).

Acoustics and Hearing

West Indian manatees produce a variety of squeak-like sounds that have a typical frequency range of 0.6 to 12 kHz (dominant frequency range from 2 to 5 kHz), and last 0.25 to 0.5 s (Steel and Morris, 1982; Thomson and Richardson, 1995; Niezrecki *et al*., 2003). Recently, vocalizations below 0.1 kHz have also been recorded (Frisch and Frisch, 2003; Frisch, 2006). Overall, West Indian manatee vocalizations are considered relatively stereotypic, with little variation between isolated populations examined (*i.e*., Florida and Belize; Nowacek *et al.*, 2003). However, vocalizations have been newly shown to possess nonlinear dynamic characteristics (e.g., subharmonics or abrupt, unpredictable transitions between frequencies), which could aid in individual recognition and mother-calf communication (Mann *et al*., 2006). Average source levels for vocalizations have been calculated to range from 90 to 138 dB re: 1 µPa (average: 100 to 112 dB re 1 µPa) (Nowacek *et al*., 2003; Phillips *et al*., 2004). Behavioral data on two animals indicate an underwater hearing range of approximately 0.4 to 46 kHz, with best sensitivity between 16 and 18 kHz (Gerstein *et al.*, 1999), while earlier electrophysiological studies indicated best sensitivity from 1 to 1.5 kHz (Bullock *et al*., 1982).

Distribution

Manatees occur in warm, subtropical, and tropical waters of the western North Atlantic Ocean, from the southeastern United States to Central America, northern South America, and the West Indies (Lefebvre *et al.,* 2001). Manatees occur along both the Atlantic and Gulf coasts of Florida. Manatees are sometimes reported in the Florida Keys; these sightings are typically in the upper Florida Keys, with some reports as far south as Key West (Moore, 1951a, 1951b; Beck, 2006a). During winter months, the manatee population confines itself to inshore and inner shelf waters of the southern half of peninsular Florida and to springs and warm water outfalls (*e.g*., power plant cooling water outfalls) as far north as the Florida/Georgia border along the U.S. east coast. As water temperatures rise in spring, West Indian manatees disperse from winter aggregation areas. Manatees are frequently reported in coastal rivers of Georgia and South Carolina during warmer months (Lefebvre *et al.,* 2001).

Historically, manatees were likely restricted to southernmost Florida during winter and expanded their distribution northward during summer. However, industrial development has made warm-water refuges available (*e.g.*, power plant effluent plumes), and the introduction of several exotic aquatic plant species has expanded the available food supply. These factors have enabled an expansion of West Indian manatee winter range (USFWS, 2001; Laist and Reynolds III, 2005).

Several patterns of seasonal movement are known along the Atlantic coast ranging from year-round residence to long-distance migration (Deutsch *et al.,* 2003). Individuals may be highly consistent in seasonal movement patterns and show strong fidelity to warm and winter ranges, both within and across years (Deutsch *et al.,* 2003).

Perhaps the most famous long distance movements of any West Indian manatee were exhibited by the animal known as "Chessie," who gained fame in the summer of 1995 by swimming to Rhode Island, returning to Florida for the winter, and traveling north again to Virginia where he

was seen in 1996. In early September 2001, "Chessie" was once again sighted in Virginia. More recently, in August 2006, a West Indian manatee was sighted in waters off Rhode Island, Delaware, New Jersey, Massachusetts, and in the Hudson River (Beck, 2006b; Anonymous, 2006, Kenney, 2007)

Manatee Occurrence From Shore Out to the OPAREA

The manatee occurs in nearshore waters and shoreward of the JAX Study Area. It is highly unlikely that manatees would occur within the OPAREAs, which begin 3 nm offshore.

Lake George Manatee Occurrence

Manatees may occur in Lake George during any time of year. A natural warm-water spring on the west shore of the Lake George is used by manatees as a warm water refuge in cold weather (Volusia County Government, 2001). Manatees are most likely to be encountered in the nearshore areas where the aquatic vegetation and fresh water sources occur. See Section 3.11 for more information on the manatee in Lake George.

Manatee Density

Density estimates are not available for manatees in either the JAX and Charleston OPAREAs or Lake George. Although no density estimates could be calculated, the Navy analyzed all endangered species and concluded may affect under the ESA for any potentially impacting stressors outlined in Table 3.7-2.

3.7.2.3 Non-Endangered Species Act-Listed Marine Mammals

Twenty-three non-threatened/non-endangered marine mammal species identified in Table 3.7-2 may be affected by the proposed activities in the JAX Study Area. Affected species include those identified as a regular or rare occurrence within the Study Area. Within the JAX Study Area these species include two baleen whale species and 25 toothed whale species.

Atlantic Spotted Dolphin

The best estimate of Atlantic spotted dolphin abundance in the western North Atlantic is 50,978 individuals (Waring *et al*. 2008). Recent genetic evidence suggests that there are at least two populations in the western North Atlantic (Adams and Rosel 2006), as well as possible continental shelf and offshore segregations. Atlantic populations are divided along a latitudinal boundary corresponding roughly to Cape Hatteras (Adams and Rosel 2006). The Atlantic spotted dolphin is under the jurisdiction of NMFS.

Status

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Habitat

Atlantic spotted dolphins occupy both continental shelf and offshore habitats. The large, heavily spotted coastal form typically occurs over the continental shelf inshore of or near the 185-m

isobath, 8 to 20 km from shore (Perrin *et al*., 1994b; Davis *et al*., 1998; Perrin, 2002b). There are also frequent sightings beyond the continental shelf break in the Caribbean Sea, Gulf of Mexico, and off the U.S. Atlantic Coast (Mills and Rademacher, 1996; Roden and Mullin, 2000; Fulling *et al*., 2003; Mullin and Fulling, 2003; Mullin *et al*., 2004). Atlantic spotted dolphins are found commonly in inshore waters south of Chesapeake Bay as well as over continental shelf break and slope waters north of this region (Payne *et al*., 1984; Mullin and Fulling, 2003). Sightings have also been made along the northern wall of the Gulf Stream and its associated warm-core ring features (Waring *et al*., 1992).

Acoustics and Hearing

A variety of sounds including whistles, echolocation clicks, squawks, barks, growls, and chirps have been recorded for the Atlantic spotted dolphin (Thomson and Richardson, 1995). Whistles have dominant frequencies below 20 kHz (range: 7.1 to 14.5 kHz) but multiple harmonics extend above 100 kHz, while burst pulses consist of frequencies above 20 kHz (dominant frequency of approximately 40 kHz) (Lammers *et al.*, 2003). Other sounds, such as squawks, barks, growls, and chirps, typically range in frequency from 0.1 to 8 kHz (Thomson and Richardson, 1995). Recently recorded echolocation clicks have two dominant frequency ranges at 40 to 50 kHz and 110 to 130 kHz, depending on source level (*i.e.*, lower source levels typically correspond to lower frequencies and higher frequencies to higher source levels) (Au and Herzing, 2003). Echolocation click source levels as high as 210 dB re 1 µPa-m peak-to-peak have been recorded (Au and Herzing, 2003). Spotted dolphins in The Bahamas were frequently recorded during agonistic/aggressive interactions with bottlenose dolphins (and their own species) to produce squawks (0.2 to 12 kHz broad band burst pulses; males and females), screams (5.8 to 9.4 kHz whistles; males only), barks (0.2 to 20 kHz burst pulses; males only), and synchronized squawks (0.1-15 kHz burst pulses; males only in a coordinated group) (Herzing, 1996). There has been no data collected on Atlantic spotted dolphin hearing ability. However, odontocetes are generally adapted to hear high-frequencies (Ketten, 1997).

Distribution

Atlantic spotted dolphins are distributed in warm-temperate and tropical Atlantic waters from approximately 45º N to 35º S; in the western North Atlantic, this translates to waters from New England to Venezuela, including the Gulf of Mexico and the Caribbean Sea (Perrin *et al*., 1987).

Peak calving periods in The Bahamas are early spring and late fall (Herzing, 1997); however, in the western Atlantic breeding times and locations are largely unknown.

Atlantic spotted dolphin occurrence

The Atlantic spotted dolphin can be found in both shelf and offshore waters of the JAX Study Area (Perrin *et al*., 1994a). Atlantic spotted dolphins may occur in both continental shelf and offshore waters of the OPAREAs year-round. The Gulf Stream and its associated warm-core ring features likely influence occurrence of this species in this region.

Atlantic spotted dolphin density

The density estimates for training areas where explosions and/or ordnance use may occur in the JAX Study Area are provided in Table 3.7-1. Methods and results are detailed in the NODE Report (DoN, 2007a). Density estimates below predict a higher density of animals in shelf and nearshore waters; however, Atlantic spotted dolphins may occur in both shelf and deep waters in

the area. This disparity is likely reflective of the intensive right whale survey effort in waters over the continental shelf and lack of effort in waters farther offshore.

Beaked Whales

Based on available data, the following five beaked whale species may be affected by the proposed activities in the JAX Study Area: Cuvier's beaked whales and four members of the genus Mesoplodon (True's, Gervais', Blainville's, and Sowerby's beaked whales).

Cuvier's beaked whales are relatively robust compared to other beaked whale species. Male and female Cuvier's beaked whales may reach 7.5 and 7.0 m in length, respectively (Jefferson *et al*., 1993). Mesoplodon species have maximum reported adult lengths of 6.2 m (Mead, 1989). Stomach content analyses of captured and stranded individuals suggest beaked whales are deep divers that feed by suction on mesopelagic fish, squids, and deepwater benthic invertebrates (Heyning, 1989; Heyning and Mead, 1996; Santos *et al*., 2001; MacLeod *et al*., 2003). Stomach contents of Cuvier's beaked whales rarely contain fish, while stomach contents of Mesoplodon species frequently do (MacLeod *et al*., 2003).

Status and Management

The best estimate of Mesoplodon spp. and Cuvier's beaked whale abundance combined in the western North Atlantic is 3,513 individuals (Waring *et al*. 2008). A recent study of global phylogeogaphic structure of Cuvier's beaked whales suggested that some regions show a high level of differentiation (Dalebout *et al*. 2005); however, Dalebout et al., (2005) could not discern finer-scale population differences within the North Atlantic. Beaked whales are under the jurisdiction of NMFS.

Habitat

World-wide, beaked whales normally inhabit continental slope and deep oceanic waters (>200 m) (Waring *et al*., 2001; Cañadas *et al*., 2002; Pitman, 2002; MacLeod *et al*., 2004; Ferguson *et al*., 2006; MacLeod and Mitchell, 2006). Beaked whales are only occasionally reported in waters over the continental shelf (Pitman, 2002). Distribution of *Mesoplodon* spp. in the North Atlantic may relate to water temperature (MacLeod, 2000a). The Blainville's and Gervais' beaked whales occur in warmer southern waters, in contrast to Sowerby's and True's beaked whales that are more northern (MacLeod, 2000b). Beaked whale abundance off the eastern United States may be highest in association with the Gulf Stream and the warm-core rings it develops (Waring *et al*., 1992). In summer, the continental shelf break off the northeastern United States is primary habitat (Waring *et al*., 2001).

Acoustics and Hearing

Sounds recorded from beaked whales are divided into two categories: whistles and pulsed sounds (clicks); whistles likely serve a communicative function and pulsed sounds are important in foraging and/or navigation (Johnson *et al.*, 2004; Madsen *et al.*, 2005b; MacLeod and D'Amico, 2006; Tyack *et al.*, 2006). Whistle frequencies are about 2 to 12 kHz, while pulsed sounds range in frequency from 300 Hz to 135 kHz; however, as noted by MacLeod and D'Amico (2006), higher frequencies may not be recorded due to equipment limitations. Whistles recorded from free-ranging Cuvier's beaked whales off Greece ranged in frequency from 8 to 12 kHz, with an upsweep of about 1 sec (Manghi *et al.*, 1999), while pulsed sounds had a narrow peak frequency of 13 to 17 kHz, lasting 15 to 44 sec in duration (Frantzis *et al.*, 2002). Short whistles and chirps

from a stranded subadult Blainville's beaked whale ranged in frequency from slightly less than 1 to almost 6 kHz (Caldwell and Caldwell, 1971a).

Recent studies incorporating DTAGs (miniature sound and orientation recording tag) attached to Blainville's beaked whales in the Canary Islands and Cuvier's beaked whales in the Ligurian Sea recorded high-frequency echolocation clicks (duration: 175 µs for Blainville's and 200 to 250 µs for Cuvier's) with dominant frequency ranges from about 20 to over 40 kHz (limit of recording system was 48 kHz) and only at depths greater than 200 m (656 ft) (Johnson *et al.*, 2004; Madsen *et al.*, 2005; Zimmer *et al.*, 2005; Tyack *et al.*, 2006). The source level of the Blainville's beaked whales' clicks were estimated to range from 200 to 220 dB re 1 µPa-m peak-to-peak (Johnson *et al.*, 2004), while they were 214 dB re 1 µPa-m peak-to-peak for the Cuvier's beaked whale (Zimmer *et al.*, 2005). Mid-frequency sounds including a frequency-modulated pure tone, and three FM and AM pulsed sounds (between 6 and 16 kHz) were attributed to three cow/calf pairs of Blainville's beaked whales during shipboard visual/acoustic surveys near the Hawaiian islands (Rankin and Barlow, 2007b).

From anatomical examination of their ears, it is presumed that beaked whales are predominantly adapted to best hear ultrasonic frequencies (MacLeod, 1999; Ketten, 2000). Beaked whales have well-developed semi-circular canals (typically for vestibular function but may function differently in beaked whales) compared to other cetacean species, and they may be more sensitive than other cetaceans to low-frequency sounds (MacLeod, 1999; Ketten, 2000). Ketten (2000) remarked on how beaked whale ears (computerized tomography (CT) scans of Cuvier's, Blainville's, Sowerby's, and Gervais' beaked whale heads) have anomalously well-developed vestibular elements and heavily reinforced (large bore, strutted) Eustachian tubes and noted that they may impart special resonances and acoustic sensitivities. The only direct measure of beaked whale hearing is from a stranded juvenile Gervais' beaked whale using auditory evoked potential techniques (Cook *et al.*, 2006). The hearing range was 5 to 80 kHz, with greatest sensitivity at 40 and 80 kHz (Cook *et al.*, 2006).

Distribution

Cuvier's beaked whales are the most widely distributed of the beaked whales and are present in most regions of all major oceans (Heyning, 1989; MacLeod *et al*., 2006). This species occupies almost all temperate, subtropical, and tropical waters, as well as subpolar and even polar waters in some areas (MacLeod *et al*., 2006). Blainville's beaked whales are thought to have a continuous distribution in tropical, subtropical, and warm-temperate waters of the world's oceans; they occasionally occur in cold-temperate areas (MacLeod *et al*., 2006). The Gervais' beaked whale is restricted to warm-temperate and tropical Atlantic waters with records in the Caribbean Sea (MacLeod *et al*., 2006). The Sowerby's beaked whale is endemic to the North Atlantic; this is considered to be more of a temperate species (MacLeod *et al*., 2006). In the western North Atlantic, confirmed strandings of True's beaked whales are recorded from Nova Scotia to Florida and also in Bermuda (MacLeod *et al*., 2006). There is also a sighting made southeast of Hatteras Inlet, North Carolina (Tove, 1995).

The continental shelf margins from Cape Hatteras to southern Nova Scotia were recently identified as known "key areas" for beaked whales in a global review by MacLeod and Mitchell (2006).

Beaked whale life histories are poorly known, reproductive biology is generally undescribed, and the locations of specific breeding grounds are unknown.

Beaked whale occurrence

Beaked whales may occur seaward of the continental shelf break in the JAX Study Area year-round. Beaked whale sightings in the western North Atlantic Ocean appear to be concentrated in waters between the 200 m isobath and those just beyond the 2,000 m isobath (DoN, 2008a, b, c); however, this may be an artifact of survey effort and occurrence may extend into deeper waters as well.

Beaked whale density

The density estimates for training areas where explosions and/or ordnance use may occur in the JAX Study Area are provided in Table 3.7-1. Because beaked whales are difficult to identify to species at sea, all sightings of beaked whales, including Cuvier's beaked whales and *Mesoplodon* spp. are included in the density estimates. Methods and results are detailed in the NODE Reports (DoN, 2007a). As indicated by the estimates below, beaked whales are not anticipated in nearshore waters. Density is likely not uniform across the area, but rather concentrated in deeper water regions based on species habitat preferences.

Bottlenose Dolphin

Bottlenose dolphins are large and robust with striking regional variations in body size; adult body lengths range from 1.9 to 3.8 m (Jefferson *et al*., 1993). Bottlenose dolphins are opportunistic feeders that utilize numerous feeding strategies to prey upon a variety of fish, cephalopod, and shrimp (Shane, 1990; Wells and Scott, 1999).

Status and Management

Two forms of bottlenose dolphins are recognized in the western North Atlantic Ocean: nearshore (coastal) and offshore (Waring *et al*. 2008). The best estimate for the western North Atlantic coastal stock of bottlenose dolphins is 15,620 (Waring *et al*., 2008). Currently, a single western North Atlantic offshore stock is recognized seaward of 34 km from the U.S. coastline (Waring *et al*. 2008). The best population estimate for this stock is 81,588 individuals (Waring *et al*., 2008).

Habitat

Coastal bottlenose dolphins occur in coastal embayments and estuaries as well as in waters over the continental shelf; individuals may exhibit either resident or migratory patterns in coastal areas (Kenney, 1990). Read *et al*. (2003) found the dolphins occurring in North Carolina bays, sounds, and estuaries to contribute substantially to the coastal bottlenose dolphin population in the area. Bays, sounds, and estuaries are high-use habitats for bottlenose dolphins due to their importance as nursery and feeding areas (Read *et al*., 2003).

Coastal bottlenose dolphins show a temperature-limited distribution, occurring in significantly warmer waters than the offshore stock, and having a distinct northern boundary (Kenney, 1990). A study of the Chesapeake Bay/Virginia coast area showed a much greater probability of sightings with SSTs of 16° to 28°C (Armstrong *et al*., 2005). SST may significantly influence seasonal movements of migrating coastal dolphins along the western Atlantic coast (Barco *et al*., 1999); these seasonal movements are likely also influenced by movements of prey resources.

The nearshore waters of the Outer Banks serve as winter habitat for coastal bottlenose dolphins (Read *et al*., 2003). Cape Hatteras represents important habitat for bottlenose dolphins,

particularly in winter, as evidenced from concentrations of bottlenose dolphins during recent aerial surveys (Torres *et al*., 2005).

In the western North Atlantic, the greatest concentrations of the offshore stock are along the continental shelf break (Kenney, 1990). Evidence suggests a distinct spatial separation of the coastal and offshore stocks during the summer; however, the morphotypes overlap in the winter (Garrison *et al*., 2003; Torres *et al*., 2003). During CETAP surveys, offshore bottlenose dolphins generally were distributed between the 200 and 2,000-m isobaths in waters with a mean bottom depth of 846 m from Cape Hatteras to the eastern end of Georges Bank. Geography and temperature also influence the distribution of offshore bottlenose dolphins (Kenney, 1990).

Acoustics and Hearing

Sounds emitted by bottlenose dolphins have been classified into two broad categories: pulsed sounds (including clicks and burst-pulses) and narrow-band continuous sounds (whistles), which usually are frequency modulated. Clicks and whistles have a dominant frequency range of 110 to 130 kHz and a source level of 218 to 228 dB re 1 µPa-m peak-to-peak (Au, 1993) and 3.4 to 14.5 kHz and 125 to 173 dB re 1 µPa-m, respectively (Ketten, 1998). Whistles are primarily associated with communication and can serve to identify specific individuals (*i.e.*, signature whistles) (Caldwell and Caldwell, 1965; Janik *et al.*, 2006). Up to 52 percent of whistles produced by bottlenose dolphin groups with mother-calf pairs can be classified as signature whistles (Cook *et al.*, 2004). Sound production is also influenced by group type (single or multiple individuals), habitat, and behavior (Nowacek, 2005). Bray calls (low-frequency vocalizations; majority of energy below 4 kHz), for example, are used when capturing fishes, specifically sea trout (*Salmo trutta*) and Atlantic salmon (*Salmo salar*), in some regions (*i.e.*, Moray Firth, Scotland) (Janik, 2000). Additionally, whistle production has been observed to increase while feeding (Acevedo-Gutiérrez and Stienessen, 2004; Cook *et al.*, 2004). Furthermore, both whistles and clicks have been demonstrated to vary geographically in terms of overall vocal activity, group size, and specific context (*e.g.*, feeding, milling, traveling, and socializing) (Jones and Sayigh, 2002; Zaretsky *et al.*, 2005; Baron, 2006). For example, preliminary research indicates that characteristics of whistles from populations in the northern Gulf of Mexico significantly differ (*i.e.*, in frequency and duration) from those in the western north Atlantic (Zaretsky *et al.*, 2005; Baron, 2006).

Bottlenose dolphins can typically hear within a broad frequency range of 0.04 to 160 kHz (Au, 1993; Turl, 1993). Electrophysiological experiments suggest that the bottlenose dolphin brain has a dual analysis system: one specialized for ultrasonic clicks and another for lower-frequency sounds, such as whistles (Ridgway, 2000). Scientists have reported a range of highest sensitivity between 25 and 70 kHz, with peaks in sensitivity at 25 and 50 kHz (Nachtigall *et al.*, 2000). Recent research on the same individuals indicates that auditory thresholds obtained by electrophysiological methods correlate well with those obtained in behavior studies, except at the some lower (10 kHz) and higher (80 and 100 kHz) frequencies (Finneran and Houser, 2006).

Temporary threshold shifts in hearing have been experimentally induced in captive bottlenose dolphins using a variety of noises (*i.e.*, broad-band, pulses) (Ridgway *et al.*, 1997; Schlundt *et al.*, 2000; Nachtigall *et al.*, 2003; Finneran *et al.*, 2005; Mooney *et al.*, 2005; Mooney, 2006). For example, TTS has been induced with exposure to a 3 kHz, one-second pulse with sound exposure level (SEL) of 195 dB re 1 µPa2-s (Finneran *et al.*, 2005), one-second pulses from 3 to 20 kHz at 192 to 201 dB re 1µPa-m (Schlundt *et al.*, 2000), and octave band noise (4 to 11 kHz) for 50

minutes at 179 dB re 1 µPa-m (Nachtigall *et al.*, 2003). Preliminary research indicates that TTS and recovery after noise exposure are frequency dependent and that an inverse relationship exists between exposure time and sound pressure level associated with exposure (Mooney *et al.*, 2005; Mooney, 2006). Observed changes in behavior were induced with an exposure to a 75 kHz one-second pulse at 178 dB re 1 µPa-m (Ridgway *et al.*, 1997; Schlundt *et al.*, 2000). Finneran *et al.* (2005) concluded that a SEL of 195 dB re 1 µPa2 s is a reasonable threshold for the onset of TTS in bottlenose dolphins exposed to mid-frequency tones.

Distribution

In the western North Atlantic, bottlenose dolphins occur as far north as Nova Scotia but are most common in coastal waters from New England to Florida, the Gulf of Mexico, the Caribbean, and southward to Venezuela and Brazil (Würsig *et al*., 2000). Bottlenose dolphins occur seasonally in estuaries and coastal embayments as far north as Delaware Bay (Kenney, 1990) and in waters over the outer continental shelf and inner slope, as far north as Georges Bank (CETAP, 1982; Kenney, 1990).

In North Carolina, there is significant overlap between distributions of coastal and offshore dolphins during the summer. North of Cape Lookout, there is a separation of the offshore and coastal ecotypes by bottom depth; the coastal form occurs in nearshore waters (<20 m deep) while the offshore form is in deeper waters (>40 m deep) (Garrison and Hoggard, 2003); however, south of Cape Lookout to northern Florida, there is significant spatial overlap between the two stocks. In this region, coastal dolphins may be found in waters as deep as 31 m and 75 km from shore while offshore dolphins may occur in waters as shallow as 13 m (Garrison *et al*., 2003b). Additional aerial surveys and genetic sampling are required to better understand the distribution of the stocks in the year.

Populations exhibit seasonal migrations regulated by temperature and prey availability (Torres *et al*., 2005), traveling as far north as New Jersey in summer and as far south as central Florida in winter (Urian *et al*., 1999).

Coastal bottlenose dolphins along the western Atlantic coast may exhibit either resident or migratory patterns (Waring *et al*. 2007). Photo-identification studies support evidence of year-round resident bottlenose dolphin populations in Beaufort and Wilmington, North Carolina (Koster *et al*., 2000; Waring *et al*., 2007); these are the northernmost documented sites of year-round residency for bottlenose dolphins in the western North Atlantic (Koster *et al*., 2000). Migratory dolphins may enter these areas seasonally as well, as evidenced by a bottlenose dolphin tagged in 2001 in Virginia Beach who overwintered in waters between Cape Hatteras and Cape Lookout (NMFS-SEFSC, 2001).

Bottlenose dolphins are flexible in their timing of reproduction. Seasons of birth for bottlenose dolphin populations are likely responses to seasonal patterns of availability of local resources (Urian *et al*. 1996). There are no specific breeding locations for this species.

Bottlenose dolphin occurrence

Bottlenose dolphins are abundant in continental shelf and inner slope waters in the western North Atlantic (CETAP 1982; Kenney 1990; Waring *et al*., 2007). The greatest concentrations of offshore animals are along the continental shelf break and between the 200 and 2,000 m isobaths (Kenney 1990; Waring *et al*. 2007). However, tagging data suggest that the range of offshore bottlenose dolphins may actually extend farther offshore into much deeper waters (Kenney 1990;

Wells *et al*. 1999). Sightings in the JAX Study Area extend seaward into deep (>1,000 m) offshore waters (DoN 2007a). Bottlenose dolphins may occur in the OPAREAs year-round.

Bottlenose dolphin density

The density estimates for training areas where explosions and/or ordnance use may occur in the JAX Study Area are provided in Table 3.7-1. Methods and results are detailed in the NODE Reports (DoN, 2007a). Density estimates indicate the likelihood of bottlenose dolphins occurring in the Study Area; however, given the intensive survey effort in continental shelf waters, the density estimates do not necessarily represent a lower concentration of animals in offshore waters.

Bryde's Whale

Bryde's whales usually have three prominent ridges on the rostrum (other rorquals generally have only one) (Jefferson *et al*., 1993). Adults can be up to 15.5 m long (Jefferson *et al*., 1993). Bryde's whales can be easily confused with sei whales. Bryde's whales are lunge-feeders, feeding on schooling fish and krill (Nemoto and Kawamura, 1977; Siciliano *et al*., 2004; Anderson, 2005).

Status and Management

No abundance information is currently available for Bryde's whales in the western North Atlantic (Waring *et al*. 2008). Bryde's whales are under the jurisdiction of NMFS.

Habitat

Bryde's whales are found both offshore and near the coasts in many regions. The Bryde's whale appears to have a preference for water temperatures between approximately 15° and 20°C (Yoshida and Kato, 1999). Bryde's whales are more restricted to tropical and subtropical waters than other rorquals.

Acoustics and Hearing

Bryde's whales produce low frequency tonal and swept calls similar to those of other rorquals (Oleson *et al*., 2003). Calls vary regionally, yet all but one of the call types have a fundamental frequency below 60 Hz. They last from one-quarter of a second to several seconds and are produced in extended sequences. Heimlich *et al*. (2005) recently described five tone types. These include two types of alternating tonal "phrases," a wideband "burst" followed by a tone that occurred in either lower (19 to 30 Hz) or higher (42 Hz) frequencies depending on the area, and an "harmonic tone phrase" with a fundamental frequency of 26 Hz. No vocalization exceeded 80 Hz. While no data on hearing ability for this species are available, Ketten (1997) hypothesized that mysticetes have acute infrasonic hearing.

Distribution

Bryde's whales are found in subtropical and tropical waters and generally do not range north of 40° in the northern hemisphere or south of 40° in the southern hemisphere (Jefferson *et al*., 1993).

The Bryde's whale does not have a well-defined breeding season in most areas and locations of specific breeding areas are unknown.

Bryde's whale occurrence

There is a general lack of knowledge of this species, particularly in the North Atlantic. There are no confirmed sightings for this species in the JAX Study Area, but there are strandings recorded

in the year (DoN, 2008a). It would be reasonable to assume that some of the sightings that were recorded as unidentified rorquals (this group includes the Bryde's whale, humpback whale, fin whale, blue whale, minke whale, and sei whale, all of which can be difficult to distinguish from one another during some sighting conditions) might be of Bryde's whales. Bryde's whales may occur from the shore seaward in the year.

Bryde's whale density

There was insufficient data available to estimate a density for the JAX Study Area, nor is there an abundance estimate in the NOAA stock assessment report (DoN, 2007a). Lack of sighting data for density estimates is not indicative of the absence of Bryde's whales as they are difficult to distinguish from other rorquals at sea.

Clymene Dolphin

Due to similarity in appearance, Clymene dolphins are easily confused with spinner and short-beaked common dolphins (Fertl *et al*., 2003). The Clymene dolphin, however, is smaller and more robust, with a much shorter and stockier beak. The Clymene dolphin can reach at least 2 m in length and weights of at least 85 kg (Jefferson *et al*., 1993). Clymene dolphins feed on small pelagic fish and squid (Perrin *et al*., 1981; Perrin and Mead, 1994; Fertl *et al*., 1997).

Status and Management

The population in the western North Atlantic is currently considered a separate stock for management purposes although there is not enough information to distinguish this stock from the Gulf of Mexico stock(s) (Waring *et al*. 2008). The best estimate of abundance for the western North Atlantic stock of Clymene dolphins is 6,086 individuals (Waring *et al*. 2008). The Clymene dolphin is under NMFS jurisdiction.

Habitat

Clymene dolphins are a tropical to subtropical species, primarily sighted in deep waters well beyond the edge of the continental shelf (Fertl *et al*., 2003). Biogeographically, the Clymene dolphin is found in the warmer waters of the North Atlantic and is often associated with the North Equatorial Current, the Gulf Stream, and the Canary Current (Fertl *et al*., 2003). In the western North Atlantic, Clymene dolphins were identified primarily in offshore waters east of Cape Hatteras over the continental slope and are likely to be strongly influenced by oceanographic features of the Gulf Stream (Mullin and Fulling, 2003).

Acoustics and Hearing

The only data available for this species is a description of their whistles. Clymene dolphin whistle structure is similar to that of other stenellids, but it is generally higher in frequency (range of 6.3 to 19.2 kHz) (Mullin *et al*., 1994a). There is no empirical data on the hearing ability of Clymene dolphins; however, the most sensitive hearing range for odontocetes generally includes high frequencies (Ketten, 1997).

Distribution

In the western Atlantic Ocean, Clymene dolphins are distributed from New Jersey to Brazil, including the Gulf of Mexico and Caribbean Sea (Fertl *et al*., 2003; Moreno *et al*., 2005).

Seasonality and location of Clymene dolphin breeding is unknown.

Clymene dolphin occurrence

Clymene dolphins have been found stranded along the Atlantic coast of Florida adjacent to the JAX Study Area and farther south in the year (Caldwell and Caldwell 1975b; Perrin *et al*. 1981; Fertl *et al*., 2001). Based on confirmed sightings and the preference of this species for deep waters, Clymene dolphins may occur in waters seaward of the shelf break in the JAX Study Area year-round.

Clymene dolphin density

The density estimates for training areas where explosions and/or ordnance use may occur in the JAX Study Area are provided in Table 3.7-1. Methods and results are detailed in the NODE Reports (DoN, 2007a). Although density appears uniform for this species in the Study Area, Clymene dolphins are generally found associated with Gulf Stream oceanographic features and deep water habitat. The discrepancy between anticipated occurrence and density estimates may reflect the intensive inshore survey effort in contrast to the lower level of effort in offshore areas.

Common Dolphin

There are two types of common dolphin, only the short-beaked common dolphin is expected to occur in the JAX Study Area. The short-beaked common dolphin is a moderately robust dolphin, with a moderate-length beak, and a tall, slightly falcate dorsal fin. Length ranges up to about 2.3 m (females) and 2.6 m (males); however, there is substantial geographic variation (Jefferson *et al*., 1993). Common dolphins feed on a wide variety of epipelagic and mesopelagic schooling fish and squids, such as the long-finned squid, Atlantic mackerel, herring, whiting, pilchard, and anchovy (Waring *et al*., 1990; Overholtz and Waring, 1991).

Status and Management

The best estimate of abundance for the Western North Atlantic *Delphinus* spp. stock is 120,743 individuals (Waring *et al*. 2008). There is no information available for western North Atlantic common dolphin stock structure (Waring *et al*. 2008). The common dolphin is under the jurisdiction of NMFS.

Habitat

Common dolphins occupy a variety of habitats, including shallow continental shelf waters, waters along the continental shelf break, and continental slope and oceanic areas. Along the U.S. Atlantic coast, common dolphins typically occur in temperate waters on the continental shelf between the 100 and 200-m isobaths, in association with the Gulf Stream, along the edge of the continental shelf (CETAP, 1982; Selzer and Payne, 1988; Waring and Palka, 2002).

Acoustics and Hearing

Recorded *Delphinus* spp. vocalizations include whistles, chirps, barks, and clicks (Ketten, 1998). Clicks range from 0.2 to 150 kHz with dominant frequencies between 23 and 67 kHz and estimated source levels of 170 dB re 1 µPa. Chirps and barks typically have a frequency range from less than 0.5 to 14 kHz, and whistles range in frequency from 2 to 18 kHz (Fish and Turl, 1976; Thomson and Richardson, 1995; Ketten, 1998; Oswald *et al.*, 2003). Maximum source levels are approximately 180 dB 1 µPa-m (Fish and Turl, 1976). This species' hearing range extends from 10 to 150 kHz; sensitivity is greatest from 60 to 70 kHz (Popov and Klishin, 1998).

Distribution

Common dolphins occur from southern Norway to West Africa in the eastern Atlantic and from Newfoundland to Florida in the western Atlantic (Perrin, 2002a), although this species more commonly occurs in temperate, cooler waters in the northwestern Atlantic (Waring and Palka, 2002). This species is abundant within a broad band paralleling the continental slope from 35ºN to the northeast peak of Georges Bank (Selzer and Payne, 1988). Short-beaked common dolphin sightings are known to occur along the continental shelf break south of 40ºN in spring and north of this latitude in fall. Throughout all seasons common dolphins occur along the shelf edge in a wide band, with occurrence extending onto the shelf (CETAP, 1982). During fall, this species is particularly abundant along the northern edge of Georges Bank (CETAP, 1982). The common dolphin is less abundant south of Cape Hatteras (Waring *et al*., 2007).

Calving peaks differ between stocks, and have been reported in spring and autumn as well summer (Jefferson *et al*. 1993); however, locations of breeding areas are unknown.

Common dolphin occurrence

Common dolphins primarily occur in a broad band along the shelf break from Cape Hatteras to Nova Scotia year-round (CETAP, 1982). This species is less common south of Cape Hatteras (Waring *et al*. 2007). Based on the cool water temperature preferences of this species and available sighting data, common dolphins may occur rarely during the winter, spring, and fall in the JAX Study Area (DoN, 2008a). While there are a number of historical stranding records for common dolphins during the summer, there are no recent confirmed records for this species. Therefore, common dolphins are not expected to occur in the JAX Study Area during the summer. Although the common dolphin is often found along the shelf-edge, there are sighting and by catch records in shallower waters to the north within the Navy Cherry Point and VACAPES OPAREAs, as well as sightings on the continental shelf in the JAX Study Area (DoN 2007a).

Common dolphin density

The density estimates for training areas where explosions and/or ordnance use may occur in the JAX Study Area are provided in Table 3.7-1. Methods and results are detailed in the NODE Reports (DoN, 2007a). Zero density estimates for common dolphins in the JAX Study Area do not necessarily indicate the absence of animals. As noted earlier, sighting and by catch records for this species in the Study Area do exist (DoN, 2008a). The density estimates likely reflect the rarity of the species in this region.

False Killer Whale

The false killer whale has a long slender body, a rounded overhanging forehead, and little or no beak (Jefferson *et al*., 1993). Individuals reach maximum lengths of 6.1 m (Jefferson *et al*., 1993). The flippers have a characteristic hump on the S-shaped leading edge - this is perhaps the best characteristic for distinguishing this species from the other "blackfish" (an informal grouping that is often taken to include pygmy killer, melon-headed, and pilot whales; Jefferson *et al*., 1993). Deepwater cephalopods and fish are their primary prey (Odell and McClune, 1999), but large pelagic species, such as dorado, have been taken. False killer whales are known to attack marine mammals such as other delphinids, (Perryman and Foster, 1980; Stacey and Baird, 1991), sperm whales (Palacios and Mate, 1996), and baleen whales (Hoyt, 1983; Jefferson, 2006).

Status and Management

There are no abundance estimates available for this species in the western North Atlantic (Waring *et al*. 2008). The false killer whale is under the jurisdiction of NMFS.

Habitat

False killer whales are primarily offshore animals, although they do come close to shore, particularly around oceanic islands (Baird, 2002). Inshore movements are occasionally associated with prey movement and the movement of warm ocean currents toward the shore (Stacey *et al*., 1994).

Acoustics and Hearing

Dominant frequencies of false killer whale whistles are from 4 to 9.5 kHz, and those of their echolocation clicks are from either 20 to 60 kHz or 100 to 130 kHz depending on ambient noise and target distance (Thomson and Richardson, 1995). Click source levels typically range from 200 to 228 dB re 1 µPa-m (Ketten, 1998). Recently, false killer whales recorded in the Indian Ocean produced echolocation clicks with dominant frequencies of about 40 kHz and estimated source levels of 201-225 dB re 1 µPa-m peak-to-peak (Madsen *et al.*, 2004b). False killer whales can hear frequencies ranging from approximately 2 to 115 kHz with best hearing sensitivity ranging from 16 to 64 kHz (Thomas *et al.*, 1988). Additional behavioral audiograms of false killer whales support a range of best hearing sensitivity between 16 and 24 kHz, with peak sensitivity at 20 kHz (Yuen *et al.*, 2005). The same study also measured audiograms using the ABR technique, which came to similar results, with a range of best hearing sensitivity between 16 and 22.5 kHz, peaking at 22.5 kHz (Yuen *et al.*, 2005). Behavioral audiograms in this study consistently resulted in lower thresholds than those obtained by ABR.

Distribution

False killer whales are found in tropical and temperate waters, generally between 50°S and 50°N latitude with a few records north of 50°N in the Pacific and the Atlantic (Baird *et al*., 1989; Odell and McClune, 1999).

Seasonality and location of false killer whale breeding are unknown.

False killer whale occurrence

False killer whales occur in offshore, warm waters worldwide (Baird, 2002). The warm waters of the Gulf Stream likely influence occurrence in the JAX Study Area. False killer whales may occur seaward of the shelf break in the Study Area year-round.

False killer whale density

There were not sufficient data available to estimate a density for the Study Area, nor is there an abundance estimate in the NOAA stock assessment report (DoN, 2007a).

Fraser's Dolphin

The Fraser's dolphin reaches a maximum length of 2.7 m and is generally more robust than other small delphinids (Jefferson *et al*., 1993). They feed on mesopelagic fish, squid, and shrimp (Jefferson and Leatherwood, 1994; Perrin *et al*., 1994a).

Status and Management

No abundance estimate of Fraser's dolphins in the western North Atlantic is available (Waring *et al*. 2008). Fraser's dolphins are under the jurisdiction of NMFS.

Habitat

The Fraser's dolphin is an oceanic species, except in places where deepwater approaches a coastline (Dolar, 2002).

Acoustics and Hearing

Fraser's dolphin whistles have been recorded having a frequency range of 7.6 to 13.4 kHz in the Gulf of Mexico (duration less than 0.5 sec) (Leatherwood *et al.*, 1993). There are no empirical hearing data hearing data available for this species.

Distribution

Fraser's dolphins are found in subtropical and tropical waters around the world, typically between 30ºN and 30ºS (Jefferson *et al*., 1993). Few records are available from the Atlantic Ocean (Leatherwood *et al*., 1993; Watkins *et al*., 1994; Bolaños and Villarroel-Marin, 2003).

Location of Fraser's dolphin breeding is unknown, and available data do not support calving seasonality.

Fraser's dolphin occurrence

Although there are no confirmed records of Fraser's dolphins in the JAX Study Area (DoN, 2008a), there is one confirmed sighting farther north in the offshore waters of the VACAPES OPAREA (DoN 2007c). Fraser's dolphins may occur in the JAX Study Area in waters seaward of the continental shelf, and distribution is assumed to be similar year-round.

Fraser's dolphin density

There were not sufficient data available to estimate a density for the JAX Study Area, nor is there an abundance estimate in the NOAA stock assessment report (DoN, 2007a).

Killer Whale

Killer whales are probably the most instantly recognizable of all the cetaceans. The black-and-white color pattern of the killer whale is striking, as is the tall, erect dorsal fin of the adult male (1.0 to 1.8 m high). This is the largest member of the dolphin family. Females may reach lengths of 7.7 m, and males 9.0 m (Dahlheim and Heyning, 1999). Killer whales feed on fish, cephalopods, seabirds, sea turtles, and other marine mammals (Katona *et al*., 1988; Jefferson *et al*., 1991; Jefferson *et al.*, 2008).

Status and Management

There are no estimates of abundance for killer whales in the western North Atlantic (Waring *et al*. 2008). Most cetacean taxonomists agree that multiple killer whale species or subspecies occur worldwide (Krahn *et al*. 2004; Waples and Clapham 2004). However, at this time, further information is not available, particularly for the western North Atlantic. The killer whale is under the jurisdiction of NMFS.

Habitat

Killer whales have the most ubiquitous distribution of any species of marine mammal, and they have been observed in virtually every marine habitat from the tropics to the poles and from shallow, inshore waters (and even rivers) to deep, oceanic regions (Dahlheim and Heyning, 1999). In coastal areas, killer whales often enter shallow bays, estuaries, and river mouths (Leatherwood *et al*., 1976). Based on a review of historical sighting and whaling records, killer whales in the northwestern Atlantic are found most often along the shelf break and farther offshore (Katona *et al*., 1988; Mitchell and Reeves, 1988). Killer whales in the Hatteras-Fundy region probably respond to the migration and seasonal distribution patterns of prey species, such as bluefin tuna, herring, and squids (Katona *et al*., 1988; Gormley, 1990).

Acoustics and Hearing

Killer whales produce a wide variety of clicks and whistles, but most of this species' social sounds are pulsed, with frequencies ranging from 0.5 to 25 kHz (dominant frequency range: 1 to 6 kHz) (Thomson and Richardson, 1995). Echolocation clicks recorded for Canadian killer whales foraging on salmon have source levels ranging from 195 to 224 dB re: 1 µPa-m peak-to-peak, a center frequency ranging from 45 to 80 kHz, and durations of 80 to 120 µs (Au *et al.*, 2004). Echolocation clicks from Norwegian killer whales were considerably lower than the previously mentioned study and ranged from 173 to 202 re: 1 µPa-m peak-to-peak. The clicks had a center frequency ranging from 22 to 49 kHz and durations of 31 to 203 µs (Simon *et al.*, 2007). Source levels associated with social sounds have been calculated to range from 131 to 168 dB re 1 µPa-m and have been demonstrated to vary with vocalization type (*e.g.*, whistles: average source level of 140.2 dB re 1 µPa-m, variable calls: average source level of 146.6 dB re 1 µPa-m, and stereotyped calls: average source level 152.6 dB re 1 µPa-m) (Veirs, 2004). Additionally, killer whales modify their vocalizations depending on social context or ecological function (*i.e.*, short-range vocalizations [less than 10 km [5 nm] range] are typically associated with social and resting behaviors and long-range vocalizations [10 to 16 km [5 to 9 nm) range] are associated with travel and foraging) (Miller, 2006). Likewise, echolocation clicks are adapted to the type of fish prey (Simon *et al.*, 2007).

Acoustic studies of resident killer whales in British Columbia have found that they possess dialects, which are highly stereotyped, repetitive discrete calls that are group-specific and are shared by all group members (Ford, 2002). These dialects likely are used to maintain group identity and cohesion and may serve as indicators of relatedness that help in the avoidance of inbreeding between closely related whales (Ford, 1991 and 2002). Dialects have been documented in northern Norway (Ford, 2002) and southern Alaskan killer whales populations (Yurk *et al.*, 2002) and are likely occur in other regions as well.

Both behavioral and ABR techniques indicate killer whales can hear a frequency range of 1 to 100 kHz and are most sensitive at 20 kHz, which is one of the lowest maximum-sensitivity frequency known among toothed whales (Szymanski *et al.*, 1999).

Distribution

Killer whales are found in all oceans and contiguous seas, from equatorial regions to polar pack ice zones of both hemispheres. In the western North Atlantic, killer whales are known from the polar pack ice, off of Baffin Island, and in Labrador Sound southward to Florida, the Bahamas, and the Gulf of Mexico (Dahlheim and Heyning, 1999), where they have been sighted year-round

(Jefferson and Schiro, 1997; O'Sullivan and Mullin, 1997; Würsig *et al*., 2000). A year-round killer whale population in the western North Atlantic may exist south of around 35°N (Katona *et al*., 1988).

In the Atlantic, calving takes place in late fall to mid-winter (Jefferson *et al*. 2008); however, location of killer whale breeding in the North Atlantic is unknown.

Killer whale occurrence

Killer whale sightings in the JAX Study Area and vicinity have been recorded close to shore (DoN, 2008a). However, just to the north of the Study Area, there are sightings in deep waters seaward of the continental shelf break (DoN, 2008a). Killer whales may occur in the JAX Study Area seaward of the shoreline year-round based on available sighting data and the diverse habitat preferences of this species.

Killer whale density

There were not sufficient data available to estimate a density for the JAX Study Area, nor is there an abundance estimate in the NOAA stock assessment report (DoN, 2007a).

Melon-headed Whale

Melon-headed whales at sea closely resemble pygmy killer whales; both species have a blunt head with little or no beak. Melon-headed whales have pointed (versus rounded) flippers and a more triangular head shape than pygmy killer whales (Jefferson *et al*., 1993). Melon-headed whales reach a maximum length of 2.75 m (Jefferson *et al*., 1993). Melon-headed whales prey on squids, pelagic fish, and occasionally crustaceans. Most fish and squid prey are mesopelagic in waters up to 1,500 m deep, suggesting that feeding takes place deep in the water column (Jefferson and Barros, 1997).

Status and Management

There are no abundance estimates for melon-headed whales in the western North Atlantic (Waring *et al*. 2008). The melon-headed whale is under the jurisdiction of NMFS.

Habitat

Melon-headed whales are most often found in offshore waters. Sightings off Cape Hatteras, North Carolina are reported in waters greater than 2,500 m (Waring *et al*., 2007), and most in the Gulf of Mexico have been sighted well beyond the edge of the continental shelf break (Mullin *et al*., 1994; Davis and Fargion, 1996b; Davis *et al*., 2000) and out over the abyssal plain (Waring *et al*., 2004). Nearshore sightings are generally from areas where deep, oceanic waters approach the coast (Perryman, 2002).

Acoustics and Hearing

The only published acoustic information for melon-headed whales is from the southeastern Caribbean (Watkins *et al.*, 1997). Sounds recorded included whistles and click sequences. Recorded whistles have dominant frequencies between 8 and 12 kHz; higher level whistles were estimated at no more than 155 dB re 1 µPa-m (Watkins *et al.*, 1997). Clicks had dominant frequencies of 20 to 40 kHz; higher-level click bursts were judged to be about 165 dB re 1 µPa-m (Watkins *et al.*, 1997). No empirical data on hearing ability for this species are available.

Distribution

Melon-headed whales occur worldwide in subtropical and tropical waters. There are very few records for melon-headed whales in the North Atlantic (Ross and Leatherwood, 1994; Jefferson and Barros, 1997). Maryland is thought to represent the extreme of the northern distribution for this species in the northwest Atlantic (Perryman *et al*., 1994; Jefferson and Barros, 1997).

Seasonality and location of melon-headed whale breeding are unknown.

Melon-headed whale occurrence

The melon-headed whale is an oceanic species. Strandings have been recorded along the Florida coastline of the JAX Study Area (DoN, 2008a). Based on the low number of confirmed sightings of this species along the U.S. Atlantic coast (north of the Study Area) and the melon-headed whale's propensity for warmer and deeper waters, melon-headed whales may occur seaward of the shelf break in the JAX Study Area.

Melon-headed whale density

There were not sufficient data available to estimate a density for the JAX Study Area, nor is there an abundance estimate in the NOAA stock assessment report (DoN, 2007a).

Minke Whale

Minke whales are small rorquals; adults reach lengths of just over 9 m (Jefferson *et al*., 1993). In the western North Atlantic, minke whales feed primarily on schooling fish, such as sand lance, capelin, herring, and mackerel (Kenney *et al*., 1985), as well as copepods and krill (Horwood, 1990).

Status and Management

There are four recognized populations in the North Atlantic Ocean: Canadian East Coast, West Greenland, Central North Atlantic, and Northeastern North Atlantic (Donovan 1991). Minke whales off the eastern U.S. are considered to be part of the Canadian East Coast stock which inhabits the area from the western half of the Davis Strait to 45º W and south to the Gulf of Mexico (Waring *et al*. 2008). The best estimate of abundance for the Canadian East Coast stock is 3,312 individuals (Waring *et al*. 2008). The minke whale is under the jurisdiction of NMFS.

Habitat

Off eastern North America, minke whales generally remain in waters over the continental shelf, including inshore bays and estuaries (Mitchell and Kozicki, 1975; Murphy, 1995; Mignucci-Giannoni, 1998). However, based on whaling catches and global surveys, there is an offshore component to minke whale distribution (Slijper *et al*., 1964; Horwood, 1990; Mitchell, 1991).

Acoustics and Hearing

Recordings of minke whale sounds indicate the production of both high- and low-frequency sounds (range of 0.06 to 20 kHz) (Beamish and Mitchell, 1973; Winn and Perkins, 1976; Thomson and Richardson, 1995; Mellinger *et al.*, 2000). Minke whale sounds have a dominant frequency range of 0.06 to greater than 12 kHz, depending on sound type (Thomson and Richardson, 1995; Edds-Walton, 2000). "Boings" are produced by minke whales and are suggested to be a breeding display, consisting of a brief pulse at 1.3 kHz followed by an amplitude-modulated call with greatest energy at 1.4 kHz, with slight frequency modulation over

a duration of 2.5 sec (Rankin and Barlow, 2005). While no empirical data on hearing ability for this species are available, Ketten (1997) hypothesized that mysticetes are most adapted to hear low to infrasonic frequencies.

Distribution

Minke whales are distributed in polar, temperate, and tropical waters (Jefferson *et al*., 1993); they are less common in the tropics than in cooler waters. This species is more abundant in New England waters than in the mid-Atlantic (Hamazaki, 2002; Waring *et al*., 2006). The southernmost sighting in recent NMFS shipboard surveys was of one individual offshore of the mouth of Chesapeake Bay, in waters with a bottom depth of 3,475 m (Mullin and Fulling, 2003). Minke whales off the U.S. Atlantic coast apparently migrate offshore and southward in winter (Mitchell, 1991). Minke whales are known to occur during the winter months (November through March) in the western North Atlantic from Bermuda to the West Indies (Winn and Perkins, 1976; Mitchell, 1991; Mellinger *et al*., 2000).

Mating is thought to occur in October to March but has never been observed (Stewart and Leatherwood, 1985); however, location of specific breeding grounds is unknown, although it is thought to be in areas of low latitude (Jefferson *et al*. 2008).

Minke whale occurrence

Minke whales generally occupy the continental shelf and are widely scattered in the mid-Atlantic region (CETAP, 1982). There is a more common occurrence farther north of the OPAREAs. Minke whale sightings have been recorded in the JAX Study Area during the winter (DoN, 2008a). The winter range of some rorquals (and often extrapolated to the minke whale) is thought to be in deep, offshore waters particularly at lower latitudes (Kellogg, 1928; Gaskin, 1982), and minke whale sightings have been reported in deep waters during this time of year (Slijper *et al*., 1964; Mitchell, 1991). Minke whales may occur in the JAX Study Area just inshore of the shelf break and seaward beyond the Study Area boundaries in most of the year. Despite the lack of sightings of minke whales in the Study Area during other times of the year, it is assumed that minke whales have a similar life history as the other rorquals, with seasonal offshore/inshore movements and a population shift north into summer feeding grounds. During the summer, minke whales are expected to occur at higher latitudes on their feeding grounds and are not expected in the JAX Study Area.

Minke whale density

The density estimates for training areas where explosions and/or ordnance use may occur in the JAX Study Area are provided in Table 3.7-1. Methods and results are detailed in the NODE Reports (DoN, 2007a). Density numbers are too low to indicate any seasonal differences in minke whale numbers; however, it is assumed that, as with other rorquals, minke whales engage in seasonal migrations.

Pantropical Spotted Dolphin

The pantropical spotted dolphin is a rather slender dolphin. Adults may reach 2.6 m in length (Jefferson *et al*., 1993). Pantropical spotted dolphins are born spotless and develop spots as they age although the degree of spotting varies geographically (Perrin and Hohn, 1994). North and offshore of Cape Hatteras, adults may bear only a few small, dark, ventral spots, whereas individuals over the continental shelf become so heavily spotted that they appear nearly white

(Perrin and Hohn, 1994. Pantropical spotted dolphins prey on epipelagic fish, squids, and crustaceans (Perrin and Hohn, 1994; Robertson and Chivers, 1997; Wang *et al*., 2003).

Status and Management

The best estimate of abundance of the western North Atlantic stock of pantropical spotted dolphins is 4,439 individuals (Waring *et al*. 2008). There is no information on stock differentiation for pantropical spotted dolphins in the U.S. Atlantic (Waring *et al*. 2008). The pantropical spotted dolphin is under the jurisdiction of NMFS.

Habitat

Pantropical spotted dolphins tend to associate with bathymetric relief and oceanographic interfaces. Pantropical spotted dolphins may rarely be sighted in shallower waters (*e.g*., Peddemors, 1999; Gannier, 2002; Mignucci-Giannoni *et al*., 2003; Waring *et al*., 2007). Along the northeastern United States, Waring *et al*. (1992) found that *Stenella* spp. were distributed along the Gulf Stream's northern wall. *Stenella* sightings also occurred within the Gulf Stream, which is consistent with the oceanic distribution of this genus and its preference for warm water (Waring *et al*., 1992; Mullin and Fulling, 2003).

Acoustics and Hearing

Pantropical spotted dolphin whistles have a frequency range of 3.1 to 21.4 kHz (Thomson and Richardson, 1995). Clicks typically have two frequency peaks (bimodal) at 40 to 60 kHz and 120 to 140 kHz with estimated source levels up to 220 dB re 1 µPa peak-to-peak (Schotten *et al.*, 2004). No direct measures of hearing ability are available for pantropical spotted dolphins, but ear anatomy has been studied and indicates that this species should be adapted to hear the lower range of ultrasonic frequencies (less than 100 kHz) (Ketten, 1992 and 1997).

Distribution

Pantropical spotted dolphins occur in subtropical and tropical waters worldwide (Perrin and Hohn 1994).

In the eastern tropical Pacific, where this species has been best studied, there are two (possibly three) calving peaks: one in spring, (one possibly in summer), and one in fall (Perrin and Hohn 1994). However, in the western Atlantic, breeding times and locations are unknown.

Pantropical spotted dolphin occurrence

Pantropical spotted dolphins have been sighted along the Florida shelf and slope waters and offshore in Gulf Stream waters southeast of Cape Hatteras (Waring *et al*., 2007). In the Atlantic, this species is considered broadly sympatric with Atlantic spotted dolphins (Perrin and Hohn 1994). The offshore form of the Atlantic spotted dolphin and the pantropical spotted dolphin can be difficult to differentiate at sea. Based on sighting data and known habitat preferences, pantropical spotted dolphins may occur seaward of the shelf break in the JAX Study Area year-round.

Pantropical spotted dolphin density

The density estimates for training areas where explosions and/or ordnance use may occur in the JAX Study Area are provided in Table 3.7-1. Methods and results are detailed in the NODE Reports (DoN, 2007a). Although the density estimates below indicate that pantropical spotted dolphin density is uniform across the Study Area, this does not reflect the known habitat

preferences of the species. Pantropical spotted dolphins are more likely to be found seaward of the shelf break; however, offshore forms of this species are difficult to differentiate from Atlantic spotted dolphins at sea which may result in fewer verified sightings. Additionally, survey effort in offshore waters is much lower than that in nearshore waters.

Pilot Whales

Pilot whales are among the largest dolphins, with long-finned pilot whales potentially reaching 5.7 m (females) and 6.7 m (males) in length. Short-finned pilot whales may reach 5.5 m (females) and 6.1 m (males) in length (Jefferson *et al*., 1993). The flippers of long-finned pilot whales are extremely long, sickle shaped, and slender, with pointed tips, and an angled leading edge that forms an "elbow." Long-finned pilot whale flippers range from 18 to 27 percent of length. Short-finned pilot whales have flippers that are somewhat shorter than long-finned pilot whale at 16 to 22 percent of the total body length (Jefferson *et al*., 1993). Both pilot whale species feed primarily on squids but also take fish (Bernard and Reilly, 1999).

Status and Management

The best estimate of pilot whale abundance (combined short-finned and long-finned) in the western North Atlantic is 31,139 individuals (Waring *et al*. 2008). Pilot whales are under the jurisdiction of NMFS.

Habitat

Pilot whales occur along the continental shelf break, in continental slope waters, and in areas of high-topographic relief (Olson and Reilly, 2002). While typically distributed along the continental shelf break, they are also commonly sighted on the continental shelf and inshore of the 100-m isobath (CETAP, 1982; Payne and Heinemann, 1993). Sightings of pilot whales also frequently occur seaward of the 2,000-m isobath north of Cape Hatteras (CETAP, 1982; Payne and Heinemann, 1993).

Waring, *et al*., (1992) sighted pilot whales principally along the northern wall of the Gulf Stream and along the shelf break at thermal fronts. A few of these sightings were also made in the mid-portion of the Gulf Stream near Cape Hatteras (Abend and Smith, 1999).

Pilot whales occur close to shore at oceanic islands where the shelf is narrow and deeper waters are nearby (Mignucci-Giannoni, 1998; Gannier, 2000; Anderson, 2005). Long-finned pilot whale sightings extend south to near Cape Hatteras (Abend and Smith, 1999) along the continental slope.

Acoustics and Hearing

Pilot whale sound production includes whistles and echolocation clicks. Short-finned pilot whale whistles and clicks have a dominant frequency range of 2 to 14 kHz and 30 to 60 kHz, respectively, at an estimated source level of 180 dB re 1 µPa-m (Fish and Turl, 1976; Ketten, 1998). Rendell and Gordan (1999) recorded vocalizations from a group of approximately 50 long-finned pilot whales in the Ligurian Sea in conjunction with the presence of military sonar signals, which facilitated an examination of this species short-term response to external sound sources. Whistle production was examined in relation to sonar pulses: frequency ranged from 4.1 to 8.7 kHz with a mean duration of .93 s, and showed varying contour patterns spectrographically (Rendell and Gordon, 1999). Preliminary results from these data suggest that certain whistles were associated with sonar signals; however, the functional meaning of how these signals might

be correlated to external sonar is unclear.Long-finned pilot whales have been shown to modify their whistle characteristics in the presence of sonar transmissions in the Ligurian sea (Rendell and Gorden, 1999). There are no hearing data available for either pilot whale species. However, the most sensitive hearing range for odontocetes generally includes high frequencies (Ketten, 1997).

Distribution

Long-finned pilot whales are distributed in subpolar to temperate North Atlantic waters offshore and in some coastal waters. The short-finned pilot whale usually does not range north of 50 N or south of 40 S (Jefferson *et al*., 1993); short-finned pilot whales have stranded as far north as Rhode Island. Strandings of long-finned pilot whales have been recorded as far south as South Carolina (Waring *et al*., 2007). Short-finned pilot whales are common south of Cape Hatteras (Caldwell and Golley, 1965; Irvine *et al*., 1979). Long-finned pilot whales appear to concentrate during winter along the continental shelf break primarily between Cape Hatteras and Georges Bank (Waring *et al*., 1990). The apparent ranges of the two pilot whale species overlap in shelf/shelf-edge and slope waters of the northeastern United States between 35°N and 38° to 39°N (New Jersey to Cape Hatteras, North Carolina) (Payne and Heinemann, 1993). However, incidents of strandings of short-finned pilot whales as far north as Block Island, Rhode Island and Nova Scotia indicate that the area of overlap may be larger than previously thought (Waring *et al*., 2007).

Pilot whales concentrate along the continental shelf break from during late winter and early spring north of Cape Hatteras (CETAP, 1982; Payne and Heinemann, 1993). This corresponds to a general movement northward and onto the continental shelf from continental slope waters (Payne and Heinemann, 1993). Short-finned pilot whales seem to move from offshore to continental shelf break waters and then northward to approximately 39ºN, east of Delaware Bay during summer (Payne and Heinemann, 1993). Sightings coalesce into a patchy continuum and, by December, most short-finned pilot whales occur in the mid-Atlantic slope waters east of Cape Hatteras (Payne and Heinemann, 1993). Although pilot whales appear to be seasonally migratory, sightings indicate common year-round occurrence in some continental shelf areas, such as the southern margin of Georges Bank (CETAP, 1982; Abend and Smith, 1999).

The calving peak for long-finned pilot whales is from July to September in the northern hemisphere (Bernard and Reilly, 1999). Short-finned pilot whale calving peaks in the northern hemisphere are in the fall and winter for the majority of populations (Jefferson *et al*. 2008). Locations of breeding areas are unknown.

Pilot whale occurrence

The JAX Study Area is located well south of the suggested overlap area for the two pilot whale species (Payne and Heinemann 1993). Thus, the sightings of unidentified pilot whales in the Study Area are most likely of the short-finned pilot whale (DoN, 2008a). The majority of pilot whale strandings on beaches adjacent to the JAX Study Area are of the short-finned pilot whale (Moore 1953; Layne 1965; Irvine *et al*. 1979; Winn *et al*. 1979; Schmidly 1981). Schmidly (1981) reported on two possible long-finned pilot whale skulls from localities south of latitude 34ºN (St. Catherine's Island, Georgia, was the southernmost record), but noted that their identification had not been verified. If those two records were proven to be of long-finned pilot whales, they would be the southernmost records for this species in the western North Atlantic. As deepwater species, pilot whales may occur seaward of the shelf break in the Study Area year-round. They may also occur between the shore and shelf break (CETAP, 1982; Kenney, 1990),

which is supported by opportunistic sightings and by catch records inshore of the shelf break to the north of the JAX Study Area (DoN, 2008c).

Pilot whale density

The density estimates for training areas where explosions and/or ordnance use may occur in the JAX Study Area are provided in Table 3.7-1. Methods and results are detailed in the NODE Reports (DoN 2007a). Density is not expected to be uniform across the warning area. Pilot whales will likely be concentrated in waters near and seaward of the shelf break based on habitat preferences; however, they may also occur in shelf waters in smaller numbers.

Pygmy and Dwarf Sperm Whales

Dwarf and pygmy sperm whales are difficult for the inexperienced observer to distinguish from one another at sea, and sightings of either species are often categorized as *Kogia* spp. The difficulty in identifying pygmy and dwarf sperm whales is exacerbated by their avoidance reaction toward ships and change in behavior toward approaching survey aircraft (Würsig *et al*., 1998). *Kogia* spp. feed on cephalopods and, less often, on deep-sea fish and shrimp (Caldwell and Caldwell, 1989; McAlpine *et al*., 1997; Willis and Baird, 1998; Santos *et al*., 2006).*Status and Management*

There is currently no information to differentiate Atlantic stock(s) (Waring *et al*. 2008). The best estimate of abundance for both species combined in the western North Atlantic is 395 individuals (Waring *et al*. 2008). Species-level abundance estimates cannot be calculated due to uncertainty of species identification at sea (Waring *et al*. 2008). Pygmy and dwarf sperm whales are under the jurisdiction of NMFS.

Habitat

Kogia spp. occurs in waters along the continental shelf break and over the continental slope (*e.g*., Baumgartner *et al*., 2001; McAlpine, 2002). Data from the Gulf of Mexico suggest that *Kogia* spp. may associate with frontal regions along the continental shelf break and upper continental slope, where their primary prey of squid may concentrate due to higher epipelagic zooplankton biomass (Baumgartner *et al*., 2001).

Acoustics and Hearing

There is little published information on sounds produced by *Kogia* spp, although they are categorized as non-whistling smaller toothed whales. Recently, free-ranging dwarf sperm whales off La Martinique (Lesser Antilles) were recorded producing clicks at 13 to 33 kHz with durations of 0.3 to 0.5 sec (Jérémie *et al.*, 2006). The only sound recordings for the pygmy sperm whale are from two stranded individuals. A stranded individual being prepared for release in the western North Atlantic emitted clicks of narrow band pulses with a mean duration of 119 µsec, interclick intervals between 40 and 70 msec, centroid frequency of 129 kHz (centroid is the frequency which divides the energy in the click into two equal portions), peak frequency of 130 kHz, and apparent peak-peak source level up to 175 dB re 1 µPa-m (Madsen *et al*., 2005). Another individual found stranded in Monterey Bay produced echolocation clicks ranging from 60 to 200 kHz, with a dominant frequency of 120 to 130 kHz (Ridgway and Carder, 2001). No information on sound production or hearing is available for the dwarf sperm whale.

Distribution

Both *Kogia* species apparently have a worldwide distribution in tropical and temperate waters (Jefferson *et al*., 1993). In the western Atlantic Ocean, stranding records have documented the pygmy sperm whale as far north as the northern Gulf of St. Lawrence, New Brunswick and parts of eastern Canada (Piers, 1923, Measures *et al*., 2004; McAlpine *et al*., 1997; Baird *et al*., 1996) and as far south as Colombia and around to Brazil (in the southern Atlantic) (de Carvalho, 1967; Geise and Borobia 1987; Muñoz-Hincapié *et al*., 1998). Pygmy sperm whales are also found in the Gulf of Mexico (Hysmith, 1976; Gunter *et al*., 1955; Baumgartner *et al*., 2001) and in the Caribbean (MacLeod and Hauser 2002).

The northern range of the dwarf sperm whale is largely unknown; however, multiple stranding records exist on the eastern coast of the United States as far north as North Carolina (Hohn *et al*., 2006) and Virginia (Morgan *et al*., 2002; Potter, 1979). Records of strandings and incidental captures indicate the dwarf sperm whale may range as far south as the Northern Antilles in the northern Atlantic (Muñoz-Hincapié *et al*., 1998); although records continue south along Brazil in the southern Atlantic (Muñoz-Hincapié *et al*., 1998). Dwarf sperm whales occur in the Caribbean (Caldwell *et al*., 1973; Cardona-Maldonado and Mignucci-Giannoni, 1999) and the Gulf of Mexico (Davis *et al*., 2002; Jefferson and Schiro, 1997).

Births have been recorded between December and March for dwarf sperm whales in South Africa (Plön, 2004); however, the breeding season and locations of specific are unknown.

Kogia occurrence

Kogia spp. generally occurs along the continental shelf break and over the continental slope (*e.g*., Baumgartner *et al*. 2001; McAlpine 2002). Few sightings are recorded in the JAX Study Area, likely due to incomplete survey coverage in most of the deep waters of this region (especially during winter and fall) as well as their avoidance reactions toward ships. Strandings are recorded in the JAX Study Area during all seasons and support the likelihood of *Kogia* occurrence in the region year-round (DoN, 2008a). *Kogia* may occur seaward of the shelf break in the Study Area year-round.

Kogia density

The density estimates for training areas where explosions and/or ordnance use may occur in the JAX Study Area are provided in Table 3.7-1. Methods and results are detailed in the NODE Reports (DoN, 2007a). Density is not expected to be uniform across the warning area. *Kogia* spp. will likely be concentrated in waters near and seaward of the shelf break based on habitat preferences. Density estimates may reflect the lower amount of survey effort in offshore waters as well as their documented avoidance reactions to ships.

Pygmy Killer Whale

The pygmy killer whale is often confused with the melon-headed whale and less often with the false killer whale. Flipper shape is the best distinguishing characteristic; pygmy killer whales have rounded flipper tips (Jefferson *et al*., 1993). Pygmy killer whales reach lengths of up to 2.6 m (Jefferson *et al*., 1993). Pygmy killer whales eat predominantly fish and squids, and sometimes take large fish. They are known to occasionally attack other dolphins (Perryman and Foster, 1980; Ross and Leatherwood, 1994).

Status and Management

There are no abundance estimates for pygmy killer whales in the western North Atlantic (Waring *et al*. 2008). Pygmy killer whales are under the jurisdiction of NMFS.

Habitat

Pygmy killer whales generally occupy offshore habitats. In the northern Gulf of Mexico, this species is found primarily in deeper waters off the continental shelf (Davis and Fargion, 1996a; Davis *et al*., 2000) out to waters over the abyssal plain (Jefferson, 2006). Pygmy killer whales were sighted in waters deeper than 1,500 m off Cape Hatteras (Hansen *et al*., 1994).

Acoustics and Hearing

The pygmy killer whale emits short duration, broadband signals similar to a large number of other delphinid species (Madsen *et al.*, 2004b). Clicks produced by pygmy killer whales have centroid frequencies (centroid is the frequency which divides the energy in the click into two equal portions) between 70 and 85 kHz; there are bimodal peak frequencies between 45 and 117 kHz. The estimated source levels are between 197 and 223 dB re 1 µPa-m peak-to-peak (Madsen *et al.*, 2004b). These clicks possess characteristics of echolocation clicks (Madsen *et al.*, 2004b). There are no empirical hearing data available for this species.

Distribution

Pygmy killer whales have a worldwide distribution in tropical and subtropical waters, generally not ranging north of 40ºN or south of 35ºS (Jefferson *et al*., 1993). There are few records of this species in the western North Atlantic (*e.g*., Caldwell and Caldwell, 1971; Ross and Leatherwood, 1994). Most records from outside the tropics are associated with unseasonable intrusions of warm water into higher latitudes (Ross and Leatherwood, 1994).

Seasonality and location of pygmy killer whale breeding are unknown.

Pygmy killer whale occurrence

A sighting of six individuals is confirmed in the JAX Study Area (Hansen *et al*., 1994). There are also a few strandings south of the Study Area (Caldwell and Caldwell, 1975a; Schmidly, 1981). The pygmy killer whale is an oceanic species which may occur seaward of the shelf break year-round in the JAX Study Area.

Pygmy killer whale density

There were not sufficient data available to estimate a density for the JAX Study Area, nor is there an abundance estimate in the NOAA stock assessment report (DoN, 2007a).

Risso's Dolphin

Risso’s dolphins are moderately large, robust animals reaching at least 3.8 m in length (Jefferson *et al*., 1993). Cephalopods are their primary prey (Clarke, 1996).

Status and Management

The best estimate of Risso’s dolphin abundance in the western North Atlantic is 20,479 individuals (Waring *et al*. 2008). Risso’s dolphins are under the jurisdiction of NMFS.

Habitat

Several studies have noted that Risso's dolphins are found offshore, along the continental slope, and over the continental shelf (CETAP, 1982; Green *et al*., 1992; Baumgartner, 1997; Davis *et al*., 1998; Mignucci-Giannoni, 1998; Kruse *et al*., 1999). Baumgartner (1997) hypothesized that the fidelity of Risso's dolphins to the steeper portions of the upper continental slope in the Gulf of Mexico is most likely the result of cephalopod prey distribution in the same area.

Acoustics and Hearing

Risso's dolphin vocalizations include broadband clicks, barks, buzzes, grunts, chirps, whistles, and combined whistle and burst-pulse sounds that range in frequency from 0.4 to 22 kHz and in duration from less than a second to several seconds (Corkeron and Van Parijs, 2001). The combined whistle and burst pulse sound (2 to 22 kHz, mean duration of 8 seconds) appears to be unique to Risso's dolphin (Corkeron and Van Parijs, 2001). Risso's dolphins also produce echolocation clicks (40 to 70 µs duration) with a dominant frequency range of 50 to 65 kHz and estimated source levels up to 222 dB re 1 µPa-m peak-to-peak (Thomson and Richardson, 1995; Philips *et al.*, 2003; Madsen *et al.*, 2004a). Baseline research on the hearing ability of this species was conducted by Nachtigall *et al.* (1995) in a natural setting (included natural background noise) using behavioral methods on one older individual. This individual could hear frequencies ranging from 1.6 to 100 kHz and was most sensitive between 8 and 64 kHz. Recently, the auditory brainstem response technique has been used to measure hearing in a stranded infant (Nachtigall *et al.*, 2005). This individual could hear frequencies ranging from 4 to 150 kHz, with best sensitivity at 90 kHz. This study demonstrated that this species can hear higher frequencies than previously reported.

Distribution

Risso's dolphins are distributed worldwide in cool-temperate to tropical waters from roughly 60ºN to 60ºS, where SSTs are generally greater than 10ºC (Kruse *et al*., 1999). In the western North Atlantic, this species is found from Newfoundland (Jefferson *et al*., 2008) southward to the Gulf of Mexico (Baumgartner, 1997; Jefferson and Schiro, 1997), in the Caribbean, and around the equator (van Bree, 1975; Ward *et al*., 2001).

Risso's dolphins are distributed along the continental shelf break and slope waters from Cape Hatteras north to Georges Bank in spring, summer, and fall (CETAP, 1982; Payne *et al*., 1984). In the winter the range shifts to mid-Atlantic Bight and offshore waters (Payne *et al*., 1984). Risso's dolphins may also occur in the waters from the mid-shelf to over the slope from Georges Bank south to, and including, the mid-Atlantic Bight, primarily in the summer and fall (Payne *et al*., 1984). Only rare occurrences are noted in the Gulf of Maine (Payne *et al*., 1984).

In the North Atlantic, there appears to be a summer calving peak (Jefferson *et al*., 1993); however, locations of breeding areas are unknown.

Risso's dolphin occurrence

Risso's dolphins may occur just inshore of the shelf break and seaward of the shelf break in the JAX Study Area year-round based on sighting data and the preference of this species for deep waters (DoN, 2008a).

Risso's dolphin density

The density estimates for training areas where explosions and/or ordnance use may occur in the JAX Study Area are provided in Table 3.7-1 Methods and results are detailed in the NODE Reports (DoN, 2007a). Density is not expected to be uniform across the warning area. Risso's dolphins will likely be concentrated in waters at and seaward of the shelf break based on habitat preferences. This is not accurately reflected in the density estimates, possibly due to low survey effort in offshore waters.

Rough-toothed Dolphin

The rough-toothed dolphin is relatively robust with a cone-shaped head with no demarcation between the melon and beak (Jefferson *et al*., 1993). Rough-toothed dolphins reach 2.8 m in length (Jefferson *et al*., 1993). They feed on cephalopods and fish, including large fish such as dorado (Miyazaki and Perrin, 1994; Reeves *et al*., 1999; Pitman and Stinchcomb, 2002).

Status and Management

No abundance estimate is available for rough-toothed dolphins in the western North Atlantic (Waring *et al*. 2008). The rough-toothed dolphin is under the jurisdiction of NMFS.

Habitat

The rough-toothed dolphin is regarded as an offshore species that prefers deep waters; however, it can occur in shallower waters as well (*e.g*., Gannier and West, 2005). Tagging data for this species from the Gulf of Mexico and western North Atlantic provide important information on habitat preferences. Three dolphins with satellite-linked transmitters released in 1998 off the Gulf Coast of Florida were tracked off the Florida panhandle in average water depths of 195 m (Wells *et al*., 1999b). Dolphins released in March of 2005 after a mass stranding were tagged with satellite-linked transmitters and released southeast of Fort Pierce moved within the Gulf Stream and parallel to the continental shelf off Florida, Georgia, and South Carolina, in waters with a depth of 400 to 800 m. (Manire and Wells, 2005). They later moved northeast into waters with a depth greater than 4,000 m (Manire and Wells, 2005). Another tagged dolphin from released after the 2005 mass stranding moved north as far as Charleston, South Carolina, before returning to the Miami area, remaining in relatively shallow waters (Wells, 2007). During May 2005, seven more rough-toothed dolphins (stranded in the Florida Keys in March 2005 and rehabilitated) were tagged and released by the Marine Mammal Conservancy in the Florida Keys (Wells, 2007). During an initial period of apparent disorientation in the shallow waters west of Andros Island, they continued to the east, then moved north through Crooked Island Passage, and paralleled the West Indies (Wells, 2007). The last signal placed them northeast of the Lesser Antilles (Wells, 2007). During September 2005, two more individuals (from the same mass stranding) were satellite-tagged and released east of the Florida Keys and proceeded south to a deep trench close to the north coast of Cuba (Wells, 2007).

Acoustics and Hearing

The rough-toothed dolphin produces a variety of sounds, including broadband echolocation clicks and whistles. Echolocation clicks (duration less than 250 microseconds [µsec]) typically have a frequency range of 0.1 to 200 kHz, with a dominant frequency of 25 kHz (Miyazaki and Perrin, 1994; Yu *et al.*, 2003; Chou, 2005). Whistles (duration less than 1 sec) have a wide frequency

range of 0.3 to greater than 24 kHz but dominate in the 2 to 14 kHz range (Miyazaki and Perrin, 1994; Yu *et al.*, 2003).

Auditory evoked potential measurements were performed on six individuals involved in a mass stranding event on Hutchinson Island, Florida in August 2004 (Cook *et al.*, 2005). The rough-toothed dolphin can detect sounds between 5 and 80 kHz and is most likely capable of detecting frequencies much higher than 80 kHz (Cook *et al.*, 2005).

Distribution

Rough-toothed dolphins are found in tropical to warm-temperate waters globally, rarely ranging north of 40°N or south of 35°S (Miyazaki and Perrin, 1994). This species is not a commonly encountered species in the areas where it is known to occur (Jefferson, 2002). Not many records for this species exist from the western North Atlantic, but they indicate that this species occurs from Virginia south to Florida, the Gulf of Mexico, the West Indies, and along the northeastern coast of South America (Leatherwood *et al*., 1976; Jefferson *et al*. 2008).

Seasonality and location of rough-toothed dolphin breeding is unknown.

Rough-toothed dolphin occurrence

Rough-toothed dolphins may occur seaward of the shelf break in the JAX Study Area based on this species' preference for deep waters and confirmed sightings in the Study Area (DoN, 2008a).

Rough-toothed dolphin density

The density estimates for training areas where explosions and/or ordnance use may occur in the JAX Study Area are provided in Table 3.7-1. Methods and results are detailed in the NODE Reports (DoN, 2007a). Although density appears uniform for this species in the Study Area, rough-toothed dolphins are generally found associated with the shelf break and deep water habitat. The discrepancy between anticipated occurrence and density estimates may reflect the intensive inshore survey effort in contrast to the lower level of effort in offshore areas.

Spinner Dolphin

The spinner dolphin generally has a dark eye-to-flipper stripe and dark lips and beak tip (Jefferson *et al*., 1993). This species typically has a three-part color pattern (dark gray cape, light gray sides, and white belly). Adults can reach 2.4 m in length (Jefferson *et al*., 1993). Spinner dolphins feed primarily on small mesopelagic fish, squid, and sergestid shrimp (Perrin and Gilpatrick, 1994).

Status and Management

No abundance estimates are currently available for the western North Atlantic stock of spinner dolphins (Waring *et al*. 2008). Stock structure in the western North Atlantic is unknown (Waring et al. 2008). The spinner dolphin is under the jurisdiction of NMFS.

Habitat

Spinner dolphins occur in both oceanic and coastal environments. Most sightings of this species in tropical waters have been associated with inshore waters, islands, or banks (Perrin and Gilpatrick, 1994).

Spinner dolphin distribution in the Gulf of Mexico and off the northeastern U.S. coast is primarily in offshore waters. Along the northeastern United States and in the Gulf of Mexico, they are

distributed in waters with a depth greater than 2,000 m (CETAP, 1982; Davis *et al*., 1998). Off the eastern U.S. coast, spinner dolphins were sighted within the Gulf Stream, which is consistent with the oceanic distribution and warm-water preference of this genus (Waring *et al*., 1992).

Acoustics and Hearing

Pulses, whistles, and clicks have been recorded from this species. Pulses and whistles have dominant frequency ranges of 5 to 60 kHz and 8 to 12 kHz, respectively (Ketten, 1998). Spinner dolphins consistently produce whistles with frequencies as high as 16.9 to 17.9 kHz with a maximum frequency for the fundamental component at 24.9 kHz (Bazúa-Durán and Au, 2002; Lammers *et al.*, 2003). Clicks have a dominant frequency of 60 kHz (Ketten, 1998). The burst pulses are predominantly ultrasonic, often with little or no energy below 20 kHz (Lammers *et al.*, 2003). Source levels between 195 and 222 dB re 1 µPa-m peak-to-peak have been recorded for spinner dolphin clicks (Schotten *et al.*, 2004).

Distribution

Spinner dolphins are found in subtropical and tropical waters worldwide, with different geographical forms in various ocean basins. The range of this species extends to near 40°N latitude (Jefferson *et al*., 1993). Distribution in the western North Atlantic is thought to extend from North Carolina south to Venezuela (Schmidly, 1981), including the Gulf of Mexico (Davis *et al*., 2002).

Breeding occurs across all season with calving peaks that may range from late spring to fall for different populations (Jefferson *et al*., 2008); however, locations of breeding areas is unknown.

Spinner dolphin occurrence

Spinner dolphins may occur from the vicinity of the continental shelf break to eastward of the JAX Study Area boundary based on the spinner dolphin's known preference for deep, warm waters, and the distribution of the few confirmed records for this species in the Study Area (DoN, 2008a). No seasonal differences in occurrence are anticipated.

Spinner dolphin density

There were not sufficient data available to estimate a density for the JAX Study Area; nor is there an abundance estimate in the NOAA stock assessment report (DoN, 2007a).

Striped Dolphin

The striped dolphin is uniquely marked with black lateral stripes from eye to flipper and eye to anus. There is also a light gray spinal blaze originating above and behind the eye and narrowing below and behind the dorsal fin (Jefferson *et al*., 2008). This species reaches 2.6 m in length. Small, mid-water fish (in particular, myctophids or lanternfish) and squids are the dominant prey (Perrin *et al*., 1994c; Ringelstein *et al*., 2006).

Status and Management

The best estimate of striped dolphin abundance in the western North Atlantic is 94,462 individuals (Waring *et al*. 2008). The striped dolphin is under the jurisdiction of NMFS.

Habitat

Striped dolphins are usually found beyond the continental shelf, typically over the continental slope out to oceanic waters and are often associated with convergence zones and waters

influenced by upwelling (Au and Perryman, 1985). This species also occurs in conjunction with the shelf edge in the northeastern United States (between Cape Hatteras and Georges Bank; Hain *et al*., 1985). Striped dolphins are known to associate with the Gulf Stream's northern wall and warm-core ring features (Waring *et al*., 1992).

Acoustics and Hearing

Striped dolphin whistles range from 6 to greater than 24 kHz, with dominant frequencies ranging from 8 to 12.5 kHz (Thomson and Richardson, 1995). A single striped dolphin's hearing range, determined by using standard psycho-acoustic techniques, was from 0.5 to 160 kHz with best sensitivity at 64 kHz (Kastelein *et al.*, 2003).

Distribution

Striped dolphins are distributed worldwide in cool-temperate to tropical zones. In the western North Atlantic, this species occurs from Nova Scotia southward to the Caribbean Sea, Gulf of Mexico, and Brazil (Baird *et al*., 1993; Jefferson *et al*., 2008). Off the northeastern United States, striped dolphins are distributed along the continental shelf break from Cape Hatteras to the southern margin of Georges Bank, as well as offshore over the continental slope and continental rise in the mid-Atlantic region (CETAP, 1982).

Off Japan, where their biology has been best studied, there are two calving peaks: one in summer and one in winter (Perrin *et al*., 1994c). However, in the western Atlantic, breeding times and locations are unknown.

Striped dolphin occurrence

As noted earlier, the striped dolphin is a deepwater species that is generally distributed north of Cape Hatteras (CETAP, 1982). Based on sparse available data (DoN, 2008a), striped dolphins may sporadically occur near and seaward of the shelf break in the JAX Study Area year-round.

Striped dolphin density

The density estimates for training areas where explosions and/or ordnance use may occur in the JAX Study Area are provided in Table 3.7-1. Methods and results are detailed in the NODE Reports (DoN, 2007a). Zero and low density estimates for striped dolphins in the OPAREAs do not necessarily indicate the absence of animals. As noted earlier, sighting and by catch records for this species in the Study Area do exist (DoN, 2008a). The density estimates likely reflect the rarity of the species in this region.

3.7.3 Environmental Consequences

The following sections provide an in-depth discussion of the biological framework for assessing impacts of sound on marine species. Section 3.7.3.1 focuses on the acoustic characteristics of sound. The discussion in this section is presented primarily as it relates to sonar, but much of the information is also applicable to the acoustic components of explosives. Additional consideration was given to discussing the effects of sound from impulsive sources related to underwater detonations. A thorough analysis of these impacts is provided in section 3.7.3.2.

3.7.3.1 Conceptual Biological Framework for Assessing Marine Mammal Response to Anthropogenic Sound

The regulatory language of the MMPA and ESA requires that all anticipated responses to sound resulting from Navy exercises be considered relative to their potential impact on animal growth, survivability and reproduction. Whether an effect significantly affects a marine mammal must be determined from the best available science regarding marine mammal responses to sound.

A conceptual framework (Figure 3.7-3) has been constructed to assist in ordering and evaluating the potential responses of marine mammals to sound. Although the framework is described in the context of effects of sonar on marine mammals, the same approach could be used for fish, sea turtles, sea birds, etc., that are exposed to other sound sources (e.g., impulsive sounds from explosions); the framework need only be consulted for potential pathways leading to possible effects.

Organization

The framework is a "block diagram" or "flow chart", organized from left to right, and grossly compartmentalized according to the phenomena that occur within each block. These include the physics of sound propagation (physics component), the potential physiological responses associated with sound exposure (physiology component), the behavioral processes that might be affected (behavior component), and the life functions that may be immediately affected by changes in behavior at the time of exposure (life function – proximate). These are extended to longer term life functions (life function – ultimate) and into population and species effects.

Throughout the flow chart, dotted and solid lines are used to connect related events. Solid lines are those items which "will" happen, and dotted lines are those which "might" happen, but which must be considered (including those hypothesized to occur but for which there is no direct evidence). Blue dotted lines indicate instances of "feedback," where the information flows back to a previous block. Some boxes are colored according to how they relate to the definitions of harassment in the MMPA, with red indicating Level A harassment (injury) and yellow indicating Level B harassment (behavioral disturbance).

The following sections describe the flowthrough of the framework, starting with the production of a sound, and flowing through marine mammal exposures, responses to the exposures, and the possible consequences of the exposure. Along with the description of each block, an overview of the state of knowledge is described with regard to marine mammal responses to sound and the consequences of those exposures. Application of the conceptual framework to impact analyses and regulations defined by the MMPA and ESA are discussed in subsequent sections.

Physics Block

Sounds emitted from a source propagate through the environment to create a spatially variable sound field. To determine if an animal is "exposed" to the sound, the received sound level at the animal's location is compared to the background ambient noise. An animal is considered exposed if the predicted received sound level,at the animal's location, is above the ambient level of background noise. If the animal is determined to be exposed, two possible scenarios must be

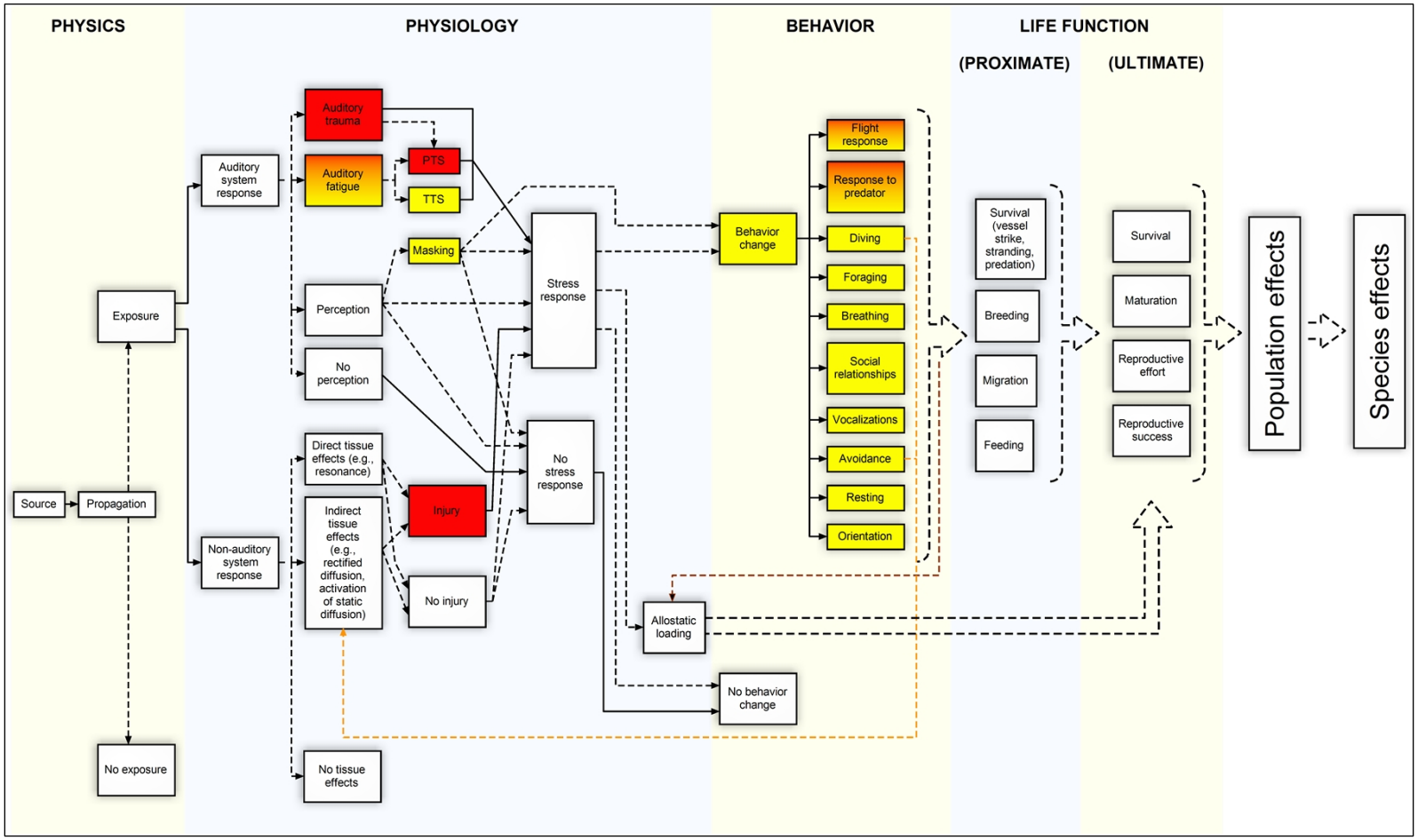


Figure 3.7-3 Conceptual biological framework used to order and evaluate the potential responses of marine mammals to sound.

considered with respect to the animal's physiology, responses of the auditory system and responses of non-auditory system tissues. These are not independent pathways and both must be considered since the same sound could affect both auditory and non-auditory tissues.

Physiology Block

Auditory System Response

The primary physiological effects of sound are on the auditory system (Ward, 1997). The mammalian auditory system consists of the outer ear, middle ear, inner ear, and central nervous system. Sound waves are transmitted through the outer and middle ears to fluids within the inner ear. The inner ear contains delicate electromechanical hair cells that convert the fluid motions into neural impulses that are sent to the brain. The hair cells within the inner ear are the most vulnerable to overstimulation by noise exposure (Yost, 1994).

Potential auditory system effects are assessed by considering the characteristics of the received sound (e.g., amplitude, frequency, duration) and the sensitivity/susceptibility of the exposed animals. Some of these assessments can be numerically based, while others will be necessarily qualitative, due to lack of information, or will need to be extrapolated from other species for which information exists. Potential physiological responses to a sound exposure are discussed here in order of increasing severity, progressing from perception of sound to auditory trauma.

No Perception

The received level is not of sufficient amplitude, frequency, and duration to be perceptible to the animal (i.e., the sound is not audible). By extension, this cannot result in a stress response or a change in behavior.

Perception

Sounds with sufficient amplitude and duration to be detected within the background ambient noise are assumed to be perceived (i.e., sensed) by an animal. This category includes sounds from the threshold of audibility through the normal dynamic range of hearing. To determine whether an animal perceives the sound, the received level, frequency, and duration of the sound are compared to what is known of the species' hearing sensitivity. Within this conceptual framework, a sound capable of auditory masking, auditory fatigue, or trauma is assumed to be perceived by the animal.

Information on hearing sensitivity exists for approximately 25 of the nearly 130 species of marine mammals. Within the cetaceans, these studies have focused primarily on odontocete species (e.g., Szymanski *et al.*, 1999; Kastelein *et al.*, 2002; Nachtigall *et al.*, 2005; Yuen *et al.*, 2005; Houser and Finneran, 2006). Because of size and availability, direct measurements of mysticete whale hearing are nearly non-existent (Ridgway and Carder, 2001). Measurements of hearing sensitivity have been conducted on species representing all of the families within the pinniped families (Phocidae, Otariidae, Odobenidae) (Schusterman *et al.*, 1972; Moore and Schusterman, 1987; Terhune, 1988; Thomas *et al.*, 1990a; Turnbull and Terhune, 1990; Kastelein *et al.*, 2002, 2005; Wolski *et al.*, 2003). Hearing sensitivity measured in these studies can be compared to the amplitude, duration and frequency of a received sound, as well as the ambient environmental noise, to predict whether or not an exposed marine mammal will perceive a sound to which it is exposed.

The features of a perceived sound (e.g., amplitude, frequency, duration, and temporal pattern) are also used to judge whether the sound exposure is capable of producing a stress response. Factors to consider in this decision include the probability of the animal being naïve or experienced with the

sound (i.e., what are the known/unknown consequences to the animal from the exposure). Although preliminary because of the small numbers of samples collected, different types of sounds (impulsive vs. continuous broadband vs. continuous tonal) have been shown to produce variable stress responses in marine mammals. Belugas demonstrated no catecholamine (hormones released in situations of stress) response to the playback of oil drilling sounds (Thomas *et al.*, 1990) but showed an increase in catecholamines following exposure to impulsive sounds produced from a seismic water gun (Romano *et al.*, 2004). A dolphin exposed to the same seismic water gun signals did not demonstrate a catecholamine response, but did demonstrate an elevation in aldosterone, a hormone that has been suggested as being a significant indicator of stress in odontocetes (St. Aubin and Geraci, 1989; St. Aubin *et al.*, 2001). Increases in heart rate were observed in dolphins to which conspecific calls were played, although no increase in heart rate was observed when tank noise was played back (Miksis *et al.*, 2001). Collectively, these results suggest a variable response that depends on the characteristics of the received signal and prior experience with the received signal.

Audible natural and artificial sounds can potentially result in auditory masking, a condition that occurs when a sound interferes with an animal's ability to hear other sounds. Masking occurs when the perception of a sound is interfered with by a second sound and the probability of masking increases as the two sounds increase in similarity. It is important to distinguish auditory fatigue, which persists after the sound exposure, from masking, which occurs during the sound exposure. Critical ratios have been determined for pinnipeds (Southall *et al.*, 2000; Southall *et al.*, 2003) and detections of signals under varying masking conditions have been determined for active echolocation and passive listening tasks in odontocetes (Johnson, 1971; Au and Pawloski, 1989; Erbe, 2000). These studies provide baseline information from which the probability of masking can be estimated. The potential impact to a marine mammal depends on the type of signal that is being masked, important cues from conspecifics, signals produced by predators, or interference with echolocation are likely to have a greater impact on a marine mammal when they are masked than will a sound of little biological consequence.

Unlike auditory fatigue, which always results in a localized stress response because the sensory tissues are being stimulated beyond their normal physiological range, masking may or may not result in a stress response since it depends on the degree and duration of the masking effect and the signal that is being masked. Masking may also result in a unique circumstance where an animal's ability to detect other sounds is compromised without the animal's knowledge. This could conceivably result in sensory impairment and subsequent behavior change; in this case, the change in behavior is the lack of a response that would normally be made if sensory impairment did not occur. For this reason, masking also may lead directly to behavior change without first causing a stress response.

The most intense underwater sounds that may occur in the JAX Study Area are those produced from exploding ordnance associated with live fire activities. Sonars and other acoustic sources that are in the mid-frequency or higher range are likely within the audible range of most cetaceans, but are very limited in the temporal, frequency, and spatial domains. In particular, the pulse lengths are short, the duty cycle low, the events are geographically and temporally dispersed, event durations are limited, and the tactical sonars transmit within a narrow band of frequencies (typically less than one-third octave). Finally, high levels of sound are confined to a volume around the source and are constrained by attenuation at mid- and high-frequencies, as well as by limited beam widths and

pulse lengths. For these reasons, the likelihood of sonar operations causing masking effects is considered negligible in this FEIS/OEIS.

Auditory Fatigue

The most familiar effect of exposure to high intensity sound is hearing loss, meaning an increase in the hearing threshold. This phenomenon is called a noise-induced threshold shift (NITS), or simply a threshold shift (TS) (Miller, 1974). A TS may be either permanent, in which case it is called a permanent threshold shift (PTS), or temporary, in which case it is called a temporary threshold shift (TTS). The distinction between PTS and TTS is based on whether there is a complete recovery of a TS following a sound exposure. If the TS eventually returns to zero (the threshold returns to the preexposure value), the TS is a TTS. If the TS does not return to zero but leaves some finite amount of TS, then that remaining TS is a PTS. Figure 3.7-4 (Two Hypothetical Threshold Shifts) shows one hypothetical TS that completely recovers, a TTS, and one that does not completely recover, leaving some PTS.

Although both auditory trauma and fatigue may result in hearing loss, the mechanisms responsible for auditory fatigue differ from auditory trauma and would primarily consist of metabolic fatigue and exhaustion of the hair cells and cochlear tissues. Note that the term "auditory fatigue" is often used to mean "TTS"; however, in this FEIS/OEIS we use a more general meaning to differentiate fatigue mechanisms (e.g., metabolic exhaustion and distortion of tissues) from trauma mechanisms (e.g., physical destruction of cochlear tissues occurring at the time of exposure). Auditory fatigue may result in PTS or TTS but is always assumed to result in a stress response. The actual amount of threshold shift depends on the amplitude, duration, frequency, and temporal pattern of the sound exposure.

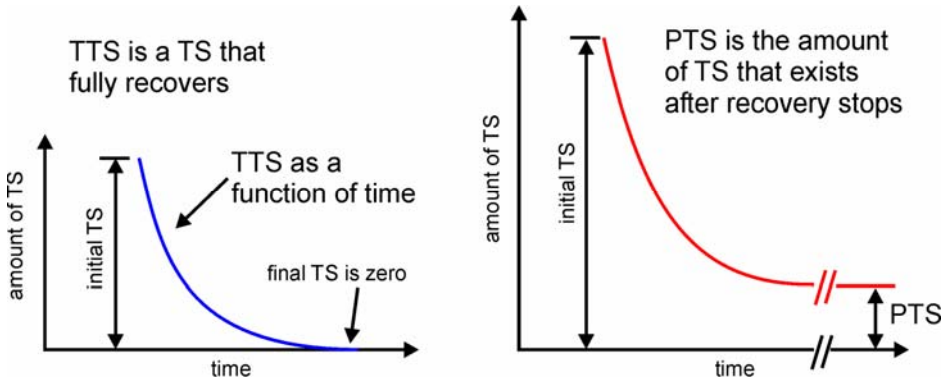


Figure 3.7 4. Two Hypothetical Thresold Shifts

There are no PTS data for cetaceans; however, a number of investigators have measured TTS in cetaceans (Schlundt *et al.*, 2000, 2006; Finneran *et al.*, 2000, 2002, 2005, 2007; Nachtigall *et al.*, 2003, 2004). In these studies hearing thresholds were measured in trained dolphins and belugas before and after exposure to intense sounds. Some of the more important data obtained from these studies are onset-TTS levels – exposure levels sufficient to cause a just-measurable amount of TTS, often defined as 6 dB of TTS (for example, Schlundt *et al.*, 2000). The existing cetacean TTS data show the following for the species studied in this FEIS/OEIS and non-impulsive, mid-frequency sounds of interest:

- The growth and recovery of TTS are analogous to those in land mammals. This means that, as in land mammals, cetacean TSs depend on the amplitude, duration, frequency content, and temporal pattern of the sound exposure. Threshold shifts will generally increase with the amplitude and duration of sound exposure. For continuous sounds, exposures of equal energy will lead to approximately equal effects (Ward, 1997). For intermittent sounds, less TS will occur than from a continuous exposure with the same energy (some recovery will occur during the quiet period between exposures) (Kryter *et al.*, 1965; Ward, 1997).
- Sound pressure level (SPL) by itself is not a good predictor of onset-TTS, since the amount of TTS depends on both SPL and duration.
- Exposure energy flux density level (EL) is correlated with the amount of TTS and is a good predictor for onset-TTS from single, continuous exposures with variable durations. This agrees with human TTS data presented by Ward *et al.* (1958, 1959).

The most relevant TTS data for analyzing the effects of mid-frequency sonars are from Schlundt *et al.* (2000, 2006) and Finneran *et al.* (2005). These studies point to an energy flux density level of 195 dB re 1 µPa2-s as the most appropriate predictor for onset-TTS in dolphins and belugas from a single, continuous exposure in the mid-frequency range. This finding is supported by the recommendations of a panel of scientific experts formed to study the effects of sound on marine mammals (Southall *et al.*, 2007).

Research by Kastak *et al.* (1999; 2005) provided estimates of the average SEL (EFD level) for onset-TTS for a harbor seal, sea lion, and Northern Elephant seal. Although the duration for exposure sessions duration is well beyond those typically used with tactical sonars, the frequency ranges are similar (2.5 kHz to 3.5 kHz). This data provides good estimates for the onset of TTS in pinnipeds since the researchers tested different combinations of SPL and exposure duration, and plotted the growth of TTS with an increasing energy exposure level. Of the three pinniped groups studied by Kastak *et al.*, harbor seals are the most representative of other pinnipeds likely to be present in the Study Area. The onset-TTS number, provided by Kastak *et al.* for harbor seals, is 183 dB re 1 µPa2-s.

In contrast to TTS data, PTS data do not exist and are unlikely to be obtained for marine mammals. Differences in auditory structures and the way that sound propagates and interacts with tissues prevent terrestrial mammal PTS thresholds from being directly applied to marine mammals; however, the inner ears of marine mammals are analogous to those of terrestrial mammals. Experiments with marine mammals have revealed similarities between marine and terrestrial mammals with respect to features such as TTS, age-related hearing loss, ototoxic drug-induced hearing loss, masking, and frequency selectivity. Therefore, in the absence of marine mammal PTS data, onset-PTS exposure levels may be estimated from marine mammal TTS data and PTS/TTS relationships observed in terrestrial mammals. This involves:

- Estimating the largest amount of TTS that may be induced without PTS. Exposures causing a TS greater than this value are assumed to cause PTS.
- Estimating the additional exposure, above the onset-TTS exposure, necessary to reach the maximum allowable amount of TTS (assumed here to indicate PTS). This requires estimating the growth rate of TTS – how much additional TTS is produced by an increase in exposure level.

A variety of terrestrial mammal data sources indicate that TSs up to 40 to 50 dB may be induced without PTS, and that 40 dB is a reasonable upper limit for TS to prevent PTS (Ward *et al.*, 1958,

1959, 1960; Miller *et al.*, 1963; Kryter *et al.*, 1966). A conservative assumption is that continuous-type exposures producing TSs of 40 dB or more always result in some amount of PTS.

The TTS growth rate as a function of exposure EL is nonlinear; the growth rate at small amounts of TTS is less than the growth rate at larger amounts of TTS. In other words, the curve relating TTS and EL is not a straight line but a curve that becomes steeper as EL and TTS increase. This means that the relatively small amounts of TTS produced in marine mammal studies limit the applicability of these data to estimate the TTS growth rate — since the amounts of TTS are generally small the TTS growth rate estimates would likely be too low. Fortunately, data exist for the growth of TTS in terrestrial mammals at higher amounts of TTS. Data from Ward *et al.* (1958, 1959) reveal a linear relationship between TTS and exposure EL with growth rates of 1.5 to 1.6 dB TTS per dB increase in EL. Since there is a 34 dB TS difference between onset-TTS (6 dB) and onset-PTS (40 dB), the additional exposure above onset-TTS that is required to reach PTS would be 34 dB divided by 1.6 dB, or approximately 20 dB. Therefore, exposures with ELs 20 dB above those producing TTS may be assumed to produce a PTS. For an onset-TTS exposure with EL = 195 dB re 1 μPa2-s, the estimate for onset-PTS for cetaceans would be 215 dB re 1 μPa2-s. The estimate for onset-PTS threshold for harbor seals would be 203 dB re 1 μPa2-s. This extrapolation process and the resulting TTS prediction is identical to that recently proposed by a panel of scientific experts formed to study the effects of sound on marine mammals (Southall *et al.*, 2007). The method predicts larger (worse) effects than have actually been observed in tests on a bottlenose dolphin [Schlundt *et al.* (2006) reported a TTS of 23 dB (no PTS) in a bottlenose dolphin exposed to a 3 kHz tone with an EL = 217 dB re 1 μPa2-s].

Auditory Trauma

Auditory trauma represents direct mechanical injury to hearing related structures, including tympanic membrane rupture, disarticulation of the middle ear ossicles, and trauma to the inner ear structures such as the organ of Corti and the associated hair cells. The potential for trauma is related to the frequency, duration, onset time and received sound pressure as well as the sensitivity of the animal to the sound frequencies. Because of these interactions, the potential for auditory trauma will vary among species. Auditory trauma is always injurious, but could be temporary and not result in permanent hearing loss. Auditory trauma is always assumed to result in a stress response.

Relatively little is known about auditory system trauma in marine mammals resulting from known sound exposure. A single study spatially and temporally correlated the occurrence of auditory system trauma in humpback whales with the detonation of a 5,000 kg (11,023 lb) explosive (Ketten *et al.*, 1993). The exact magnitude of the exposure in this study cannot be determined and it is possible that the trauma was caused by the shock wave produced by the explosion. There are no known occurrences of direct auditory trauma in marine mammals exposed to tactical sonars.

Non-Auditory System Response

Potential impacts to tissues other than those related to the auditory system are assessed by considering the characteristics of the sound (e.g., amplitude, frequency, duration) and the known or estimated response characteristics of non-auditory tissues. Some of these assessments can be numerically based (e.g., exposure required for rectified diffusion). Others will be necessarily qualitative, due to lack of information on the mechanical properties of the tissues and their function. Each of the potential responses may or may not result in a stress response. Further information on non-auditory system responses (such as direct and in-direct tissue effects) as it

relates to the impulsive characteristics of sound will be discussed in section 3.7.3.2 under Potential Impacts from Exposure to Underwater Detonations.

Direct Tissue Effects

Direct tissue responses to sound stimulation may range from tissue trauma (injury) to mechanical vibration with no resulting injury. Any tissue injury would produce a stress response whereas non-injurious stimulation may or may not.

Resonance is a phenomenon that exists when an object is vibrated at a frequency near its natural frequency of vibration, or the particular frequency at which the object vibrates most readily. The size and geometry of an air cavity determine the frequency at which the cavity will resonate. Displacement of the cavity boundaries during resonance has been suggested as a cause of injury. Large displacements have the potential to tear tissues that surround the air space (e.g., lung tissue).

Understanding resonant frequencies and the susceptibility of marine mammal air cavities to resonance is important in determining whether certain sonars have the potential to affect different cavities in different species. In 2002, NMFS convened a panel of government and private scientists to address this issue (NOAA, 2002). They modeled and evaluated the likelihood that Navy mid-frequency sonars caused resonance effects in beaked whales that eventually led to their stranding (DoC and DON, 2001). The conclusions of that group were that resonance in air-filled structures was not likely to have caused the Bahamas stranding (NOAA, 2002). The frequencies at which resonance was predicted to occur were below the frequencies utilized by the sonar systems employed. Furthermore, air cavity vibrations, even at resonant frequencies, were not considered to be of sufficient amplitude to cause tissue damage, even under the worst-case scenario in which air volumes would be undamped by surrounding tissues and the amplitude of the resonant response would be maximal. These same conclusions would apply to other actions involving mid-frequency tactical sonar.

Indirect Tissue Effects

Based upon the amplitude, frequency, and duration of the sound, it must be assessed whether exposure is sufficient to indirectly affect tissues. For example, one suggested (indirect) cause of injury to marine mammals is rectified diffusion (Crum and Mao, 1996), the process of increasing the size of a bubble by exposing it to a sound field. Under this hypothesis, one of three things could happen: (1) bubbles grow to the extent that tissue hemorrhage (injury) occurs; (2) bubbles develop to the extent that a complement immune response is triggered or the nervous tissue is subjected to enough localized pressure that pain or dysfunction occurs (a stress response without injury); or (3) the bubbles are cleared by the lung without negative consequence to the animal. The probability of rectified diffusion, or any other indirect tissue effect, will necessarily be based upon what is known about the specific process involved.

Rectified diffusion is facilitated if the environment in which the ensonified bubbles exist is supersaturated with gas. Repetitive diving by marine mammals can cause the blood and some tissues to accumulate gas to a greater degree than is supported by the surrounding environmental pressure (Ridgway and Howard, 1979). The dive patterns of some marine mammals (for example, beaked whales) are theoretically predicted to induce greater supersaturation (Houser *et al.*, 2001). If rectified diffusion were possible in marine mammals exposed to high-level sound, conditions of tissue supersaturation could theoretically speed the rate and increase the size of bubble growth.

Subsequent effects due to tissue trauma and emboli would presumably mirror those observed in humans suffering from decompression sickness (DCS).

It is unlikely that the short duration of sonar pings would be long enough to drive bubble growth to any substantial size, if such a phenomenon occurs. However, an alternative but related hypothesis has also been suggested: stable microbubbles could be destabilized by high-level sound exposures such that bubble growth then occurs through static diffusion of gas out of the tissues. In such a scenario, the marine mammal would need to be in a gas-supersaturated state for a long enough period of time for bubbles to become of a problematic size.

Recent research with ex vivo supersaturated tissues suggested that sound exposures of approximately 215 dB re 1 µPa would be required before microbubbles became destabilized and grew (Crum *et al.* 2005). Assuming spherical spreading loss and a nominal sonar source level of 235 dB re 1 µPa, a whale would need to be within 10 m (33 ft) of the sonar dome to be exposed to such sound levels. Furthermore, tissues were supersaturated by exposing them to pressures of 400 to 700 kPa for periods of hours and then releasing them to ambient pressures. Assuming the equilibration of gases with the tissues occurred when the tissues were exposed to the high pressures, levels of supersaturation in the tissues could have been as high as 400 to 700 percent. These levels of tissue supersaturation are substantially higher than model predictions for marine mammals (Houser *et al.*, 2001b). It is improbable that this mechanism is responsible for stranding events or traumas associated with beaked whale strandings. Both the degree of supersaturation and exposure levels observed to cause microbubble destabilization are unlikely to occur, either alone or in concert.

Yet another hypothesis has speculated that rapid ascent to the surface following exposure to a startling sound might produce tissue gas saturation sufficient for the evolution of nitrogen bubbles (Jepson *et al.*, 2003; Fernandez *et al.*, 2005). This is accounted for in the conceptual framework via a feedback path from the behavioral changes of "diving" and "avoidance" to the "indirect tissue response" block. In this scenario, the rate of ascent would need to be sufficiently rapid to compromise behavioral or physiological protections against nitrogen bubble formation. Recent modeling suggests that unrealistically rapid rates of ascent from normal dive behaviors are unlikely to result in supersaturation to the extent that bubble formation would be expected in beaked whales (Zimmer *et al.*, 2007). Recently, Tyack *et al.* (2006) suggested that emboli observed in animals exposed to mid-frequency range sonar (Jepson *et al.*, 2003; Fernandez *et al.*, 2005) could stem instead from a behavioral response that involves repeated dives shallower than the depth of lung collapse. Given that nitrogen gas accumulation is a passive process (i.e. nitrogen is metabolically inert), a bottlenose dolphin was trained to repetitively dive a profile predicted to elevate nitrogen saturation to the point that nitrogen bubble formation was predicted to occur. However, inspection of the vascular system of the dolphin via ultrasound did not demonstrate the formation of even asymptomatic nitrogen gas bubbles (Houser *et al.*, 2007).

There is considerable disagreement among scientists as to the likelihood of this phenomenon (Piantadosi and Thalmann, 2004; Evans and Miller, 2003). Although it has been argued that traumas from recent beaked whale strandings are consistent with gas emboli and bubble-induced tissue separations (Jepson *et al.*, 2003; Fernandez *et al.*, 2005), nitrogen bubble formation as the cause of the traumas has not been verified. The presence of bubbles postmortem, particularly after decompression, is not necessarily indicative of bubble pathology. Prior experimental work has demonstrated the post-mortem presence of bubbles following decompression in laboratory animals can occur as a result of invasive investigative procedures (Stock *et al.*, 1980).

Additionally, the fat embolic syndrome identified by Fernández *et al.* (2005) is the first of its kind. The pathogenesis of fat emboli formation is as yet undetermined and remains largely unstudied, and it would therefore be inappropriate to causally link it to nitrogen bubble formation. Because evidence of nitrogen bubble formation following a rapid ascent by beaked whales is arguable and requires further investigation, this FEIS/OEIS makes no assumptions about it being the causative mechanism in beaked whale strandings associated with sonar operations. No similar findings to those found in beaked whales stranding coincident with sonar activity have been reported in other stranded animals following known exposure to sonar operations. By extension, no marine mammals addressed in this FEIS/OEIS are given differential treatment due to the possibility for acoustically mediated bubble growth.

No Tissue Effects

The received sound is insufficient to cause either direct (mechanical) or indirect effects to tissues. No stress response occurs.

The Stress Response

The acoustic source is considered a potential stressor if, by its action on the animal, via auditory or nonauditory means, it may produce a stress response in the animal. The term "stress" has taken on an ambiguous meaning in the scientific literature, but with respect to Figure 3.7-3 and the later discussions of allostasis and allostatic loading, the stress response will refer to an increase in energetic expenditure that results from exposure to the stressor and which is predominantly characterized by either the stimulation of the sympathetic nervous system (SNS) or the hypothalamic-pituitary-adrenal (HPA) axis (Reeder and Kramer, 2005), or through oxidative stress, as occurs in noise-induced hearing loss (Henderson *et al.*, 2006). The SNS response to a stressor is immediate and acute and is characterized by the release of the catecholamine neurohormones norepinephrine and epinephrine (i.e., adrenaline). These hormones produce elevations in the heart and respiration rate, increase awareness, and increase the availability of glucose and lipids for energy. The HPA response is ultimately defined by increases in the secretion of the glucocorticoid steroid hormones, (e.g. cortisol, aldosterone). The amount of increase in circulating glucocorticoids above baseline may be an indicator of the overall severity of a stress response (Hennessy *et al.*, 1979). Each component of the stress response is variable in time; e.g., adrenalines are released nearly immediately and are used or cleared by the system quickly, whereas cortisol levels may take long periods of time to return to baseline.

The presence and magnitude of a stress response in an animal depends on a number of factors. These include the animal's life history stage (e.g., neonate, juvenile, and adult), the environmental conditions, reproductive or developmental state, and experience with the stressor. Not only will these factors be subject to individual variation, but they will also vary within an individual over time. Prior experience with a stressor may be of particular importance as repeated experience with a stressor may dull the stress response via acclimation (St. Aubin and Dierauf, 2001). In considering potential stress responses of marine mammals to acoustic stressors, each of these should be considered. For example, is the acoustic stressor in an area where animals engage in breeding activity? Are animals in the region resident and likely to have experience with the stressor (i.e., repeated exposures)? Is the region a foraging ground or are the animals passing through as transients? What is the ratio of young (naïve) to old (experienced) animals in the population? It is unlikely that all such questions can be answered from empirical data; however, they should be

addressed in any qualitative assessment of a potential stress response as based on the available literature.

Marine mammals naturally experience stressors within their environment and as part of their life histories. Changing weather and ocean conditions, exposure to diseases and naturally occurring toxins, lack of prey availability, social interactions with conspecifics, and interactions with predators all contribute to the stress a marine mammal experiences. In some cases, naturally occurring stressors can have profound impacts on marine mammals; for example, chronic stress, as observed in stranded animals with long-term debilitating conditions (e.g., disease), has been demonstrated to result in an increased size of the adrenal glands and an increase in the number of epinephrine-producing cells (Clark *et al.*, 2006). Anthropogenic activities have the potential to provide additional stressors above and beyond those that occur naturally. Potential stressors resulting from anthropogenic activities must be considered not only as to their direct impact on the animal but also as to their cumulative impact with environmental stressors already experienced by the animal.

Thus, the issue is not whether cetaceans are "under stress" in a given situation, as they are always under demand for adaptation. The issue is whether the degree and duration of stress experienced is physiologically damaging or not. The effects of stress are expected to vary with the adaptive mechanisms of the subject, and will therefore vary with the species and its environment. Since stress may have a psychological component, which could be influenced by experience, it may be expected to vary among individuals of the same species (Cowan and Curry, 2008).

Studies on the stress response of odontocete cetaceans to acute acoustic stimuli were previously discussed Thomas *et al.*, 1990; Miksis *et al.*, 2001; Romano *et al.*, 2004). Other types of stressors include the presence of vessels, fishery interactions, acts of pursuit and capture, the act of stranding, and pollution. In contrast to the limited amount of work performed on stress responses resulting from sound exposure, a considerably larger body of work exists on stress responses associated with pursuit, capture, handling and stranding. Pursuit, capture and short-term holding of belugas has been observed to result in a decrease in thyroid hormones (St. Aubin and Geraci, 1988) and increases in epinephrine (St. Aubin and Dierauf, 2001). In dolphins, the trend is more complicated with the duration of the handling time potentially contributing to the magnitude of the stress response (St. Aubin *et al.*, 1996; Ortiz and Worthy, 2000; St. Aubin, 2002). Elephant seals demonstrate an acute cortisol response to handling, but do not demonstrate a chronic response; on the contrary, adult females demonstrate a reduction in the adrenocortical response following repetitive chemical immobilization (Engelhard *et al.*, 2002). With respect to anthropogenic sound as a stressor, the current limited body of knowledge will require extrapolation from species for which information exists to those for which no information exists.

The stress response may or may not result in a behavioral change, depending on the characteristics of the exposed animal. However, provided a stress response occurs, we assume that some contribution is made to the animal's allostatic load. Allostasis is the ability of an animal to maintain stability through change by adjusting its physiology in response to both predictable and unpredictable events (McEwen and Wingfield, 2003). The same hormones associated with the stress response vary naturally throughout an animal's life, providing support for particular life history events (e.g., pregnancy) and predictable environmental conditions (e.g., seasonal changes). The allostatic load is the cumulative cost of allostasis incurred by an animal and is generally characterized with respect to an animal's energetic expenditure. Perturbations to an animal that may occur with the presence of a stressor, either biological (e.g., predator) or anthropogenic (e.g.,

construction), can contribute to the allostatic load (Wingfield, 2003). Additional costs are cumulative and additions to the allostatic load over time may contribute to reductions in the probability of achieving ultimate life history functions (e.g., survival, maturation, reproductive effort and success) by producing pathophysiological states. The contribution to the allostatic load from a stressor requires estimating the magnitude and duration of the stress response, as well as any secondary contributions that might result from a change in behavior.

If the acoustic source does not produce tissue effects, is not perceived by the animal, or does not produce a stress response by any other means, Figure 3.7-3 assumes that the exposure does not contribute to the allostatic load. Additionally, without a stress response or auditory masking, it is assumed that there can be no behavioral change. Conversely, any immediate effect of exposure that produces an injury (i.e., red boxes on the flow chart in Figure 3.7-3) is assumed to also produce a stress response and contribute to the allostatic load.

Behavior Block

Acute stress responses may or may not cause a behavioral reaction. However, all changes in behavior are expected to result from an acute stress response. This expectation is conservatively based on the assumption that some sort of physiological trigger must exist for an anthropogenic stimulus to alter a biologically significant behavior that is already being performed. The exception to this rule is the case of masking. The presence of a masking sound may not produce a stress response, but may interfere with the animal's ability to detect and discriminate biologically relevant signals. The inability to detect and discriminate biologically relevant signals hinders the potential for normal behavioral responses to auditory cues and is thus considered a behavioral change.

Numerous behavioral changes can occur as a result of stress response, and Figure 3.7-3 lists only those that might be considered the most common types of response for a marine animal. For each potential behavioral change, the magnitude in the change and the severity of the response needs to be estimated. Certain conditions, such as a flight response might have a probability of resulting in injury. For example, a flight response, if significant enough, could produce a stranding event. Under the MMPA, such an event precipitated by anthropogenic noise would be considered a Level A harassment. Each altered behavior may also have the potential to disrupt biologically significant events (e.g., breeding or nursing) and may need to be qualified as Level B harassment. All behavioral disruptions have the potential to contribute to the allostatic load. This secondary potential is signified by the feedback from the collective behaviors to allostatic loading (physiology block).

The response of a marine mammal to an anthropogenic sound source will depend on the frequency content, duration, temporal pattern and amplitude of the sound as well as the animal's prior experience with the sound and the context in which the sound is encountered (i.e., what the animal is doing at the time of the exposure). The direction of the responses can vary, with some changes resulting in either increases or decreases from baseline (e.g., decreased dive times and increased respiration rate). Responses can also overlap; for example, an increased respiration rate is likely to be coupled to a flight response. Differential responses between and within species are expected since hearing ranges vary across species and the behavioral ecology of individual species is unlikely to completely overlap.

A review of marine mammal responses to anthropogenic sound was first conducted by Richardson and others in 1995. A more recent review (Nowacek *et al.*, 2007) addresses studies conducted since

1995 and focuses on observations where the received sound level of the exposed marine mammal(s) was known or could be estimated. The following sections provide a very brief overview of the state of knowledge of behavioral responses. The overviews focus on studies conducted since 2000 but are not meant to be comprehensive; rather, they provide an idea of the variability in behavioral responses that would be expected given the differential sensitivities of marine mammal species to sound and the wide range of potential acoustic sources to which a marine mammal may be exposed. Estimates of the types of behavioral responses that could occur for a given sound exposure should be determined from the literature that is available for each species, or extrapolated from closely related species when no information exists.

Flight Response – A flight response is a dramatic change in normal movement to a directed and rapid movement away from the perceived location of a sound source. Relatively little information on flight responses of marine mammals to anthropogenic signals exists, although observations of flight responses to the presence of predators have occurred (Connor and Heithaus, 1996). Flight responses have been speculated as being a component of marine mammal strandings associated with sonar activities (Evans and England, 2001).

Response to Predator – Evidence suggests that at least some marine mammals have the ability to acoustically identify potential predators. For example, harbor seals that reside in the coastal waters off British Columbia are frequently targeted by certain groups of killer whales, but not others. The seals discriminate between the calls of threatening and non-threatening killer whales (Deecke *et al.*, 2002), a capability that should increase survivorship while reducing the energy required for attending to and responding to all killer whale calls. The occurrence of masking or hearing impairment provides a means by which marine mammals may be prevented from responding to the acoustic cues produced by their predators. Whether or not this is a possibility depends on the duration of the masking/hearing impairment and the likelihood of encountering a predator during the time that predator cues are impeded.

Diving – Changes in dive behavior can vary widely. They may consist of increased or decreased dive times and surface intervals as well as changes in the rates of ascent and descent during a dive. Variations in dive behavior may reflect interruptions in biologically significant activities (e.g., foraging) or they may be of little biological significance. Variations in dive behavior may also expose an animal to potentially harmful conditions (e.g., increasing the chance of ship-strike) or may serve as an avoidance response that enhances survivorship. The impact of a variation in diving resulting from an acoustic exposure depends on what the animal is doing at the time of the exposure and the type and magnitude of the response.

Nowacek *et al.* (2004) reported disruptions of dive behaviors in foraging North Atlantic right whales when exposed to an alerting stimulus, an action, they noted, that could lead to an increased likelihood of ship strike. However, the whales did not respond to playbacks of either right whale social sounds or vessel noise, highlighting the importance of the sound characteristics in producing a behavioral reaction. Conversely, Indo-Pacific humpback dolphins have been observed to dive for longer periods of time in areas where vessels were present and/or approaching (Ng and Leung, 2003). In both of these studies, the influence of the sound exposure cannot be decoupled from the physical presence of a surface vessel, thus complicating intepretations of the relative contribution of each stimulus to the response. Indeed, the presence of surface vessels, their approach and speed of approach, seemed to be significant factors in the response of the Indo-Pacific humpback dolphins (Ng and Leung, 2003). Low frequency signals of the Acoustic Thermometry of Ocean Climate (ATOC) sound source were not found to affect dive times of humpback whales in

Hawaiian waters (Frankel and Clark, 2000) or to overtly affect elephant seal dives (Costa *et al.*, 2003). They did, however, produce subtle effects that varied in direction and degree among the individual seals, illustrating the equivocal nature of behavioral effects and consequent difficulty in defining and predicting them.

Due to past incidents of beaked whale strandings associated with sonar operations, feedback paths are provided between avoidance and diving and indirect tissue effects. This feedback accounts for the hypothesis that variations in diving behavior and/or avoidance responses can possibly result in nitrogen tissue supersaturation and nitrogen off-gassing, possibly to the point of deleterious vascular bubble formation (Jepson *et al.*, 2003). Although hypothetical, the potential process is being debated within the scientific community.

Foraging - Disruption of feeding behavior can be difficult to correlate with anthropogenic sound exposure, so it is usually inferred by observed displacement from known foraging areas, the appearance of secondary indicators (e.g., bubble nets or sediment plumes), or changes in dive behavior. Noise from seismic surveys was not found to impact the feeding behavior in western gray whales off the coast of Russia (Yazvenko *et al.*, 2007) and sperm whales engaged in foraging dives did not abandon dives when exposed to distant signatures of seismic airguns (Madsen *et al.*, 2006). Balaenopterid whales exposed to moderate low-frequency signals similar to the ATOC sound source demonstrated no variation in foraging activity (Croll *et al.*, 2001), whereas five out of six North Atlantic right whales exposed to an acoustic alarm interrupted their foraging dives (Nowacek *et al.*, 2004). Although the received sound pressure level at the animals was similar in the latter two studies, the frequency, duration, and temporal pattern of signal presentation were different. These factors, as well as differences in species sensitivity, are likely contributing factors to the differential response. A determination of whether foraging disruptions incur fitness consequences will require information on or estimates of the energetic requirements of the individuals and the relationship between prey availability, foraging effort and success, and the life history stage of the animal.

Breathing – Variations in respiration naturally vary with different behaviors and variations in respiration rate as a function of acoustic exposure can be expected to co-occur with other behavioral reactions, such as a flight response or an alteration in diving. However, respiration rates in and of themselves may be representative of annoyance or an acute stress response. Mean exhalation rates of gray whales at rest and while diving were found to be unaffected by seismic surveys conducted adjacent to the whale feeding grounds (Gailey *et al.*, 2007). Studies with captive harbor porpoises showed increased respiration rates upon introduction of acoustic alarms (Kastelein *et al.*, 2001; Kastelein *et al.*, 2006a) and emissions for underwater data transmission (Kastelein *et al.*, 2005). However, exposure of the same acoustic alarm to a striped dolphin under the same conditions did not elicit a response (Kastelein *et al.*, 2006a), again highlighting the importance in understanding species differences in the tolerance of underwater noise when determining the potential for impacts resulting from anthropogenic sound exposure.

Social relationships - Social interactions between mammals can be affected by noise via the disruption of communication signals or by the displacement of individuals. Disruption of social relationships therefore depends on the disruption of other behaviors (e.g., caused avoidance, masking, etc.) and no specific overview is provided here. However, social disruptions must be considered in context of the relationships that are affected. Long-term disruptions of mother/calf pairs or mating displays have the potential to affect the growth and survival or reproductive effort/success of individuals, respectively.

Vocalizations - Vocal changes in response to anthropogenic noise can occur across the repertoire of sound production modes used by marine mammals, such as whistling, echolocation click production, calling, and singing. Changes may result in response to a need to compete with an increase in background noise or may reflect an increased vigilance or startle response. For example, in the presence of low-frequency active sonar, humpback whales have been observed to increase the length of their "songs" (Miller *et al.*, 2000; Fristrup *et al.*, 2003), possibly due to the overlap in frequencies between the whale song and the low-frequency active sonar. A similar compensatory effect for the presence of low frequency vessel noise has been suggested for right whales; right whales have been observed to shift the frequency content of their calls upward while reducing the rate of calling in areas of increased anthropogenic noise (Parks *et al.*, 2007). Killer whales off the northwestern coast of the United States have been observed to increase the duration of primary calls once a threshold in observing vessel density (e.g., whale watching) was reached, which has been suggested as a response to increased masking noise produced by the vessels (Foote *et al.*, 2004). In contrast, both sperm and pilot whales potentially ceased sound production during the Heard Island feasibility test (Bowles *et al.*, 1994), although it cannot be absolutely determined whether the inability to acoustically detect the animals was due to the cessation of sound production or the displacement of animals from the area.

Avoidance - Avoidance is the displacement of an individual from an area as a result of the presence of a sound. It is qualitatively different from the flight response in its magnitude (i.e., directed movement, rate of travel, etc.). Oftentimes avoidance is temporary, and animals return to the area once the noise has ceased. Longer term displacement is possible, however, which can lead to changes in abundance or distribution patterns of the species in the affected region if they do not become acclimated to the presence of the sound (Blackwell *et al.*, 2004; Bejder *et al.*, 2006; Teilmann *et al.*, 2006). Acute avoidance responses have been observed in captive porpoises and pinnipeds exposed to a number of different sound sources (Kastelein *et al.*, 2001; Finneran *et al.*, 2003; Kastelein *et al.*, 2006a; Kastelein *et al.*, 2006b). Short term avoidance of seismic surveys, low frequency emissions, and acoustic deterrants has also been noted in wild populations of odontocetes (Bowles *et al.*, 1994; Goold, 1996; 1998; Stone *et al.*, 2000; Morton and Symonds, 2002) and to some extent in mysticetes (Gailey *et al.*, 2007), while longer term or repetitive/chronic displacement for some dolpin groups and for manatees has been suggested to be due to the presence of chronic vessel noise (Haviland-Howell *et al.*, 2007; Miksis-Olds *et al.*, 2007).

Orientation - A shift in an animal's resting state or an attentional change via an orienting response represent behaviors that would be considered mild disruptions if occurring alone, and thus are placed at the bottom of the framework behavior list. As previously mentioned, the responses may co-occur with other behaviors; for instance, an animal may initially orient toward a sound source, and then move away from it. Thus, any orienting response should be considered in context of other reactions that may occur.

Life Function

Proximate life history functions are the functions that the animal is engaged in at the time of acoustic exposure. The disruption of these functions, and the magnitude of the disruption, is something that must be considered in determining how the ultimate life history functions are affected. Consideration of the magnitude of the effect to each of the proximate life history functions is dependent upon the life stage of the animal. For example, an animal on a breeding

ground which is sexually immature will suffer relatively little consequence to disruption of breeding behavior when compared to an actively displaying adult of prime reproductive age.

The ultimate life functions are those that enable an animal to contribute to the population (or stock, or species, etc.) and which related to the animal's fitness. The impact to ultimate life functions will depend on the nature and magnitude of the perturbation to proximate life history functions. Depending on the severity of the response to the stressor, acute perturbations may have nominal to profound impacts on ultimate life functions. For example, unit-level use of sonar by a vessel transiting through an area that is utilized for foraging, but not for breeding, may disrupt feeding by exposed animals for a brief period of time. Because of the brevity of the perturbation, the impact to ultimate life functions may be negligible. By contrast, weekly training over a period of years may have a more substantial impact because the stressor is chronic. Assessment of the magnitude of the stress response from the chronic perturbation would require an understanding of how and whether animals acclimate to a specific, repeated stressor and whether chronic elevations in the stress response (*e.g.*, cortisol levels) produce fitness deficits.

The proximate life functions are loosely ordered in decreasing severity of impact. Mortality (survival) has an immediate effect, in that no future reproductive success is feasible and there is no further addition to the population resulting from reproduction. Severe injuries may also lead to reduced survivorship (longevity) and prolonged alterations in behavior. The latter may further affect an animal's overall reproductive success and reproductive effort. Disruptions of breeding have an immediate impact on reproductive effort and may impact reproductive success. The magnitude of the effect will depend on the duration of the disruption and the type of behavior change that was provoked. Disruptions to feeding and migration can affect all of the ultimate life functions; however, the impacts to reproductive effort and success are not likely to be as severe or immediate as those incurred by mortality and breeding disruptions.

3.7.3.2 Background Information for Explosive Modeling Analysis

Some of the Navy's training exercises include the underwater detonation of explosives. When an explosive detonates, a physical shock front rapidly compresses the explosive material. As this front passes through the explosive, it triggers a chemical reaction, turning the solid of the explosive into gaseous products and liberating a large amount of energy. An accompanying pressure wave, called a "shock wave" is also produced which then passes into the surrounding medium. Noise associated with the blast is also transmitted into the surrounding medium. The shock wave (impulsive characteristic of sound) and blast noise (acoustic characteristic of sound) are of the most concern to marine animals. Beyond a short distance from the blast (generally 3-10 diameters of the explosive charge), thermal and direct detonation effects from the explosion are significantly reduced or eliminated (Viada et al., 2008). The main sources of impact outside the immediate vicinity of the explosion are the shock wave and expanding gaseous reaction products. Generally, the original shock wave is the primary cause of harm to aquatic life. The expanding gases, if they break into the water column, can set up a pulsating bubble whose recurring pressure waves also may contribute significantly to damage (Viada *et al*., 2008).

The effects of an underwater explosion on marine mammals and sea turtles, are dependent on several factors, including the size, type, and depth of both the animal and the explosive charge; the depth of the water column; and the standoff distance between the explosive charge and the animal, as well as the sound propagation properties of the environment. Impacts to marine species are a result of physiological responses (generally the destruction of tissues at air-fluid interfaces) to both

the type and strength of the acoustic signature and shock wave generated by an underwater explosion. Behavioral impacts are also expected, though the type and severity of these effects are more difficult to define due to limited studies addressing the behavioral effects of explosives on marine mammals and other aquatic species. Potential effects can range from brief acoustic effects (such as behavioral disturbance), tactile perception, physical discomfort, slight injury of the internal organs and the auditory system, to death of the animal (Yelverton *et al*., 1973; O'Keefe and Young, 1984; DoN, 2001). Non-lethal injury includes slight injury to internal organs and the auditory system; however, delayed lethality may be a result of individual or cumulative sublethal injuries (DoN, 2001). Immediate lethal injury would be a result of massive combined trauma to internal organs as a direct result of close proximity to the point of detonation (DoN, 2001). In the following subsections, potential effects due to the exposure to underwater detonations is discussed in more detail.

Potential Impacts from Exposure to Underwater Detonations

Direct Tissue Effects

Direct tissue responses to impulsive sound stimulation may range from tissue trauma (injury) to mechanical vibration or compression with no resulting injury. Any tissue injury would produce a stress response whereas a non-injurious stimulation may or may not.

Generally, blast injury, defined as biophysical and pathophysiological events and clinical syndromes that occur when a living body is exposed to a blast of any origin, comprises two categories: primary blast injury (PBI) and cavitation (Costanzo and Gordon, 1989; Office of the Surgeon General, 1991; Department of the Navy 2001, 2007). Primary blast injury (PBI) occurs when the shock wave strikes and compresses the body, and energy from the blast is transferred directly from the transmitting medium (water) to the body surface. Cavitation occurs when compression waves generated by an underwater explosion propagate to the surface and are reflected back through the water column as rarefraction waves. Subsequent rarefraction waves create a state of tension in the water column, causing cavitation (defined as the formation of partial vacuums in a liquid by high intensity sound waves) within a bounded area called the cavitation region (Viada *et al*., 2008). In addition to these two avenues for impulsive effects, direct tissue damage can occur if the animal is close enough to the explosive source to be struck by the fragments or casing of the actual explosive device. Given current mitigation measures associated with underwater detonations, this scenario is highly unlikely.

Injury resulting from a shock wave takes place at boundaries between tissues of different density. Different velocities are imparted to tissue of different densities, and this can lead to their physical disruption. Blast effects are greatest at gas-liquid interfaces (Landsberg, 2000). Gas-containing organs, particularly the lungs, gastrointestinal tract, and the auditory system are susceptible in marine animals (Goertner, 1982; Hill, 1978; Yelverton *et al*., 1973). The direct effects of cavitation on marine mammals and sea turtles is unknown, though it is assumed that cavitation created by detonation of a small charge could directly annoy or injure (primarily the auditory system and lungs) or increase the severity of PBI injuries in the cavitation region (Department of Navy, 2001; 2007). Non-lethal injuries include minor injuries to the auditory system and certain internal organs.

Because the ears are the most sensitive to pressure, they are the organs most sensitive to injury (Ketten, 2000). Sound related damage associated with the blast noise can be theoretically distinct from injury from the shock wave, particularly farther from the explosion. Sound related trauma can be lethal or sub-lethal. Lethal impacts are those that result in immediate death or serious

debilitation in or near an intense source and are not, technically, pure acoustic trauma (Ketten, 1995). Sub-lethal impacts include hearing loss, which is caused by exposure to perceptible sounds. Severe damage, from the shock wave, to the ears can include rupture of the tympanic membrane (or tympanum in the case of sea turtles), facture of the ossicles, damage to the cochlea, hemorrhage, and cerebrospinal fluid leakage into the middle ear (NMFS, 2008). Moderate injury implies partial hearing loss due to tympanic membrane rupture and blood in the middle ear. Permanent hearing loss also can occur when the hair cells are damaged by one very loud event, as well as prolonged exposure to noise. The level of impact from blasts depends on both an animal's location and, at outer zones, on its sensitivity to the residual noise (Ketten, 1995).

In addition to injuries to the ear, other sensitive organs are also affected by the shock wave from underwater detonations. For example, lung injuries, including laceration and rupture of the alveoli and blood vessels, can lead to hemorrhage, creation of air embolisms, and breathing difficulties. In addition, gas-containing organs including the nasal sacs, larynx, pharynx, trachea, and lungs may be damaged by compression/expansion caused by the oscillations of the blast gas bubble (Reidenberg and Laitman, 2003). The gastrointestinal tract is also susceptible to trauma from underwater explosions. Intestinal walls can bruise or rupture, with subsequent hemorrhage and escape of the gut contents into the body cavity. Less severe gastrointestinal tract injuries include contusions, slight hemorrhaging, and petichia (Yelverton et al., 1973). In underwater blast studies using cadaver marine mammals, Ketten *et al*. (2003) and Reidenberg and Laitman (2003), injury was consistent with what would be expected in live animals and included apparent hemorrhages at the blubber-muscle interface and in gas-containing organs and the gastrointestinal tract; ruptures of the liver and spleen; and contusions of the kidney. Ketten *et al*. (2003) noted distinct injury patterns to the blubber, melon, and jaw fats of cadaver bottlenose dolphins due to the differences in density, and hence sound speed velocity, of these tissues from adjoining tissues. Compression also appears to cause air to enter tissues adjacent to air spaces in dead marine mammals exposed to explosives (Reidenberg and Laitman, 2003). Slight injury to any of these organs would be considered recoverable and would not ultimately be debilitating to the individual.

Exposures of animals to high peak pressure shock waves can result in injuries including concussive brain damage; cranial, skeletal, or shell fractures; hemorrhage; or massive inner ear trauma (Ketten, 1995). Depending on the size of the animal (with small animals being more susceptible), extremely high shock wave pressure impulses may or may not be lethally injurious to internal organs. However, overall system shock and significant external tissue damage, as well as severe localized damage to the skeletal system, would be expected from such a shock wave. These injuries, if not themselves fatal, would probably put the animal at increased risk of predation, secondary infection, or disease (DoN, 2001; 2007).

Indirect Tissue Effects

Indirect tissue effects may also be possible from underwater detonations, by means of the impulsive shock wave or its associated acoustic energy. For example, hemorrhage of the gastrointestinal tract can be caused by the direct effect of the shock wave or indirectly by the excitation of radial oscillations of small gas bubbles normally present in the intestines (Richmond *et al*., 1973 and Yelverton *et al*., 1973).

A plausible mechanism for indirect tissue effects may be from behaviorally mediated bubble growth. Although this hypothesis was originally proposed in relation to the effects of sonar on marine mammals, the general pathway could also be applicable to underwater detonations. By this

hypothesis, if the acoustic energy or impulsive force of an underwater detonation was great enough to startle marine mammals, it could trigger their flight response and cause them to react by changing their dive behavior (*i.e.* rapid ascent, staying at the surface or at depth longer to avoid exposure). Jepson *et al*. (2003) proposed that bubble formation might result from behavioral changes to normal dive profiles (such as accelerated ascent rate), causing excessive nitrogen supersaturation in the tissues (as occurs in decompression sickness). Because evidence of nitrogen bubble formation following a rapid ascent by marine mammals is arguable and requires further investigation, this EIS/OEIS makes no assumptions about it being a causative mechanism.

An alternative, but related hypothesis has also been suggested: stable micro-bubbles could become destabilized, or bubbles could be formed via cavitation following high level sound exposures, which could originate from impulsive sources. Under such a condition, bubble growth could then occur through static diffusion of gas out of the tissues. In this scenario, the marine mammal would need to be in a gas-supersaturated state for a long period of time for bubbles to become of a problematic size. While it is unlikely that the short duration of sonar pings or impulsive sounds from explosive sources would be long enough to drive bubble growth to any substantial size, such a phenomenon is within the realm of possibility. For a further discussion of these mechanisms refer back to the *Indirect Effects* section of the acoustic analysis.

Behavioral Effects

There have been few studies addressing the behavioral effect of explosives on marine mammals. While recognizing that the nature of shock waves produced by high explosives is different from that produced by airguns or MFAS, these sounds serve as the best proxy for assessing the effects of underwater detonations on marine life. Despite the difference in the character of the sound source, it is anticipated that the same general behavioral responses would result from explosive detonations. As a result, for a further discussion of the behavioral effects of underwater detonations on marine species, refer back to the *Behavior Block* section of the acoustic analysis.

Thresholds and Criteria for Impulsive Sound

Criteria and thresholds for estimating the exposures from a single explosive activity on marine mammals were established for the Seawolf Submarine Shock Test Final Environmental Impact Statement ("Seawolf") and subsequently used in the USS Winston S. Churchill (DDG-81) Ship Shock FEIS ("Churchill") (DoN, 1998 and 2001). NMFS adopted these criteria and thresholds in its final rule on unintentional taking of marine animals occurring incidental to the shock testing (NMFS, 2001a). Since the ship-shock events involve only one large explosive at a time, additional assumptions were made to extend the approach to cover multiple explosions for FIREX (with IMPASS) and BOMBEX. In addition, this section reflects a revised acoustic criterion for small underwater explosions (*i.e*., 23 lbs per square inch [psi] instead of previous acoustic criteria of 12 psi for peak pressure over all exposures), based on the final rule issued to the Air Force by NMFS (NMFS, 2005c). As was the case for Seawolf and Churchill, in the absence of specifically developed criteria, criteria and thresholds for impact on protected marine mammals are used for protected sea turtles. Figure 3.7-5 depicts the acoustic impact framework used in this assessment.

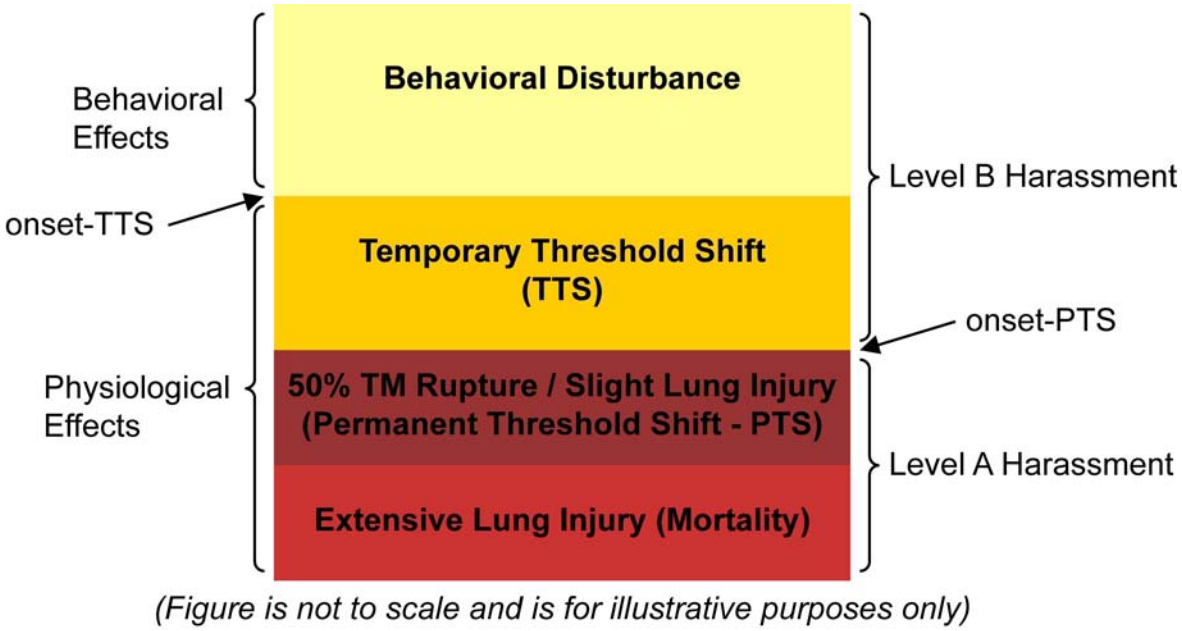


Figure 3.7-5 Physiological and Behavioral Acoustic Effects Framework for Explosives

Thresholds and Criteria for Injurious Physiological Effects

Single Explosion

For injury, the Navy uses dual criteria: eardrum rupture (*i.e.*, tympanic membrane [TM] rupture) and onset of slight lung injury. These criteria are considered indicative of the onset of injury. The threshold for TM rupture corresponds to a 50 percent rate of rupture (*i.e.*, 50% of animals exposed to the level are expected to suffer TM rupture); this is stated in terms of an Energy Flux Density Level (EFD) value of 1.17 inch pounds per square inch (in-lbs/in^2) (about 205 dB referenced to 1 microPascal squared second [dB re 1 µPa^2-sec]). This recognizes that TM rupture is not necessarily a serious or life-threatening injury, but is a useful index of possible injury that is well correlated with measures of permanent hearing impairment (Ketten [1998] indicates a 30% incidence of PTS at the same threshold).

The threshold for onset of slight lung injury is calculated for a small animal (a dolphin calf weighing 26.9 lbs), and is given in terms of the "Goertner modified positive impulse," indexed to 13 psi-millisecond (msec) (DoN, 2001). This threshold is conservative since the positive impulse needed to cause injury is proportional to animal mass, and therefore, larger animals require a higher impulse to cause the onset of injury. This analysis assumed that 100 percent of the marine species populations were small animals. The criterion with the largest potential exposure range (most conservative), either TM rupture (energy threshold) or onset of slight lung injury (peak pressure threshold), will be used in the analysis to determine injurious physiological exposures.

For mortality, the Navy uses the criterion corresponding to the onset of extensive lung injury. This is conservative in that it corresponds to a 1 percent chance of mortal injury, and yet any animal experiencing onset severe lung injury is counted as a lethal exposure. For small animals, the threshold is given in terms of the Goertner modified positive impulse, indexed to 30.5 psi-msec. Since the Goertner approach depends on propagation, source/animal depths, and animal mass in a

complex way, the actual impulse value corresponding to the 30.5 psi-msec index is a complicated calculation. To be conservative, the analysis used the mass of a calf dolphin (at 26.9 lbs) for 100 percent of the populations.

Multiple Explosions

For this analysis, the use of multiple explosions occurs during FIREX (with IMPASS) and the BOMBEX events where the MK-82 and MK-83 bombs are used. Since FIREX and portions of BOMBEX require multiple explosions, the Churchill approach had to be extended to cover multiple sound events at the same training site. For FIREX, the exercise is estimated to take up to 6 hours. For BOMBEX, the bombs are dropped roughly 3 minutes apart, so the exercise is approximately 12 minutes. For multiple exposures, accumulated energy over the entire training time is the natural extension for energy thresholds since energy accumulates with each subsequent shot (explosion); this is consistent with the treatment of multiple arrivals in Churchill. For positive impulse, it is consistent with Churchill to use the maximum value over all impulses received.

Thresholds and Criteria for Non-Injurious Physiological Effects

The Navy criterion for non-injurious harassment is TTS - a slight, recoverable loss of hearing sensitivity (DoN, 2001). For this assessment, there are dual thresholds for TTS, an energy threshold and a peak pressure threshold. The criterion with the largest potential exposure range (most conservative), either the energy threshold or peak pressure threshold, will be used in the analysis to determine non-injurious physiological (TTS) exposures.

Single Explosion –TTS-Energy Threshold

The first threshold is a 182 dB re 1 μPa^2-sec maximum energy flux density level in any 1/3-octave band at frequencies above 100 Hertz (Hz) for toothed whales/sea turtles and in any 1/3-octave band above 10 Hz for baleen whales. For large explosives, as in the case of the Churchill FEIS, frequency range cutoffs at 10 and 100 Hz produce different results in the range estimates resulting from the 10 and 100 Hz frequency range cutoffs. For small explosives (<1500 lbs NEW), as what was modeled for this analysis, the spectrum of the shot arrival is broad, and there is essentially no difference in exposure ranges for toothed whales/sea turtles or baleen whales.

The TTS energy threshold for explosives is derived from the Space and Naval Warfare Systems Center (SSC) pure-tone tests for TTS (Schlundt *et al*., 2000, Finneran and Schlundt, 2004). The pure-tone threshold (192 dB as the lowest value) is modified for explosives by (a) interpreting it as an energy metric, (b) reducing it by 10 dB to account for the time constant of the mammal ear, and (c) measuring the energy in 1/3-octave bands, the natural filter band of the ear. The resulting threshold is 182 dB re 1 μPa^2-sec in any 1/3-octave band. The energy threshold usually dominates over the peak pressure threshold and is used in the analysis to determine potential non-injurious physiological (TTS) exposures for single explosion ordnance.

Single Explosion –TTS-Peak Pressure Threshold

The second threshold applies to all species and is stated in terms of peak pressure at 23 psi (about 225 dB referenced to 1 microPascal [dB re 1 μPa]). This criterion was adopted for Precision Strike Weapons Testing and Training by Eglin Air Force Base in the Gulf of Mexico (NMFS, 2005c). It is important to note that for small shots near the surface (such as in this analysis), the 23-psi peak pressure threshold generally will produce longer exposure ranges than the 182-dB energy metric.

Furthermore, it is not unusual for the TTS exposure range for the 23-psi pressure metric to actually exceed the behavioral disturbance exposure range for the 177-dB energy metric.

Multiple Explosions –TTS

For multiple explosions, accumulated energy over the entire training time is the natural extension for energy thresholds since energy accumulates with each subsequent shot/detonation. This is consistent with the energy argument in Churchill. For peak pressure, it is consistent with Churchill to use the maximum value over all impulses received.

Thresholds and Criteria for Behavioral Effects

Single Explosion

For a single explosion, to be consistent with Churchill, TTS is the criterion for non-injurious physiological exposure. In other words, because behavioral disturbance for a single explosion is likely to be limited to a short-lived startle reaction, use of the TTS criterion is considered sufficient protection and, therefore, behavioral effects (without TTS) are not considered for single explosions.

Multiple Explosions—Without TTS

For this analysis, the use of multiple explosions occurs during FIREX (with IMPASS) and the BOMBEX events where MK-82 and MK-83 bombs are used. Because multiple explosions would occur within a discrete time period, a new acoustic criterion - behavioral disturbance - is used to account for behavioral effects significant enough to be judged as harassment, but occurring at lower noise levels than those that may cause TTS.

The threshold is based on test results published in Schlundt *et al.* (2000), with derivation following the approach of the Churchill FEIS for the energy-based TTS threshold. The original Schlundt *et al*. (2000) data and the report of Finneran and Schlundt (2004) are the basis for thresholds for behavioral disturbance. As reported by Schlundt *et al.* (2000), instances of altered behavior generally began at lower exposures than those causing TTS; however, there were many instances when subjects exhibited no altered behavior at levels above the onset-TTS levels. Regardless of reactions at higher or lower levels, all instances of altered behavior were included in the statistical summary.

The behavioral disturbance threshold for tones is derived from the SSC tests, and is found to be 5 dB below the threshold for TTS, or 177 dB re 1 μPa^2-sec maximum energy flux density level in any 1/3-octave band at frequencies above 100 Hz for toothed whales/sea turtles and in any 1/3-octave band above 10 Hz for baleen whales. As stated previously for TTS, for small explosives (<1500-lbs NEW), as what was modeled for this analysis, the spectrum of the shot arrival is broad, and there is essentially no difference in exposure ranges for toothed whales/sea turtles or baleen whales. In shallower water, the behavioral disturbance exposure range can be about twice the exposure range for TTS. However, in deeper water, the TTS pressure criteria (23 psi) exposure range can result in a longer exposure range than the behavioral disturbance criteria exposure range. This is due to the fact that in a deep water environment, it is more likely that there is a direct path for the shockwave to propogate, which results in a larger peak pressure range. In shallow water, there is reflection, absorption, and cancellation of the shockwave propagation due to interactions with the bottom, sediment type, etc., which can limit the peak pressure range.

Summary of Thresholds and Criteria for Impulsive Sounds

Table 3.7-4 summarizes the effects, criteria, and thresholds used in the assessment for impulsive sounds. Non-injurious effects are determined by either the dual physiological criteria for single detonations or by the behavioral criterion for multiple detonations. The criterion for behavioral disturbance used in this analysis is based on use of multiple explosives that only take place during a FIREX (with IMPASS) event or a BOMBEX event involving MK-82 or MK-83 bombs.

TABLE 3.7-4
EFFECTS, CRITERIA, AND THRESHOLDS FOR IMPULSIVE SOUNDS

Effect	Criteria	Metric	Threshold	MMPA
Mortality	Onset of Extensive Lung Injury	Goertner modified positive impulse	indexed to 30.5 psi-msec (assumes 100% small animal at 26.9 lbs)	Mortality
Injurious Physiological	50% Tympanic Membrane Rupture - PTS	Energy flux density	1.17 in-lbs/in^2 (about 205 dB re 1 μPa^2-sec)	*MMPA* - Level A
Injurious Physiological	Onset Slight Lung Injury -	Goertner modified positive impulse	indexed to 13 psi-msec (assumes 100% small animal at 26.9 lbs)	*MMPA* - Level A
Non-injurious Physiological	TTS	Greatest energy flux density level in any 1/3-octave band (above 100 Hz for toothed whales/sea turtles and above 10 Hz for baleen whales) - for total energy over all exposures	182 dB re 1 μPa^2-sec	*MMPA* - Level B
Non-injurious Physiological	TTS	Peak pressure for any single exposure	23 psi	*MMPA* - Level B
Non-injurious Behavioral	Behavioral Disturbance	Greatest energy flux density level in any 1/3-octave (above 100 Hz for toothed whales/sea turtles and above 10 Hz for baleen whales) - for total energy over all exposures (multiple explosions only)	177 dB re 1 μPa^2-sec	*MMPA* - Level B

MMPA = Marine Mammal Protection Act

TTS = Temporary Threshold Shift; PTS = Permanent Threshold Shift

Acoustic Environment

Sound propagation (the spreading or attenuation of sound) in the oceans of the world is affected by several environmental factors: water depth, variations in sound speed within the water column, surface roughness, and the geo-acoustic properties of the ocean bottom. These parameters can vary widely with location.

Four types of data are used to define the acoustic environment for each analysis site:

- **Seasonal Sound Velocity Profiles (SVP)** – Plots of propagation speed (velocity) as a function of depth, or SVPs, are a fundamental tool used for predicting how sound will travel. Seasonal SVP averages were obtained for each training area.

- **Seabed Geo-acoustics** – The type of sea floor influences how much sound is absorbed and how much sound is reflected back into the water column.
- **Wind Speeds** – Several environmental inputs, such as wind speed and surface roughness, are necessary to model acoustic propagation in the prospective training areas.
- **Bathymetry data** - Bathymetry data are necessary to model acoustic propagation and were obtained for each of the training areas.

Acoustic Effects Analysis

The exercises that use explosives include: FIREX with IMPASS, MISSILEX, BOMBEX, MINEX, and small arms training. Table 3.7-5 summarizes the number of events (per year) for the No Action Alternative and specific areas where each occurs for each type of explosive ordnance used. Table 3.7-6 summarizes the number of events (per year) for Alternative 1 and specific areas where each occurs for each type of explosive ordnance used. Table 3.7-7 summarizes the number of events (per year) for Alternative 2 and specific areas where each occurs for each type of explosive ordnance used. Events can take place at any time of year and can be assumed to be evenly distributed across all four seasons (unless specified otherwise).

TABLE 3.7-5
NUMBER OF EXPLOSIVE EVENTS WITHIN THE JAX STUDY AREA FOR NO ACTION ALTERNATIVE

Sub-Area	Ordnance	Annual Totals
	MISSILEX	
MLTR	Hellfire	30
MLTR	Maverick	3
	Small Arms	
UNDET (N, S)	MK3A2 grenades	8
	FIREX	
BB, CC	5" rounds*	10
	MINEX	
UNDET North	20 LBS**	9
UNDET South	20 LBS**	9
	BOMBEX	
Area 31J	MK-82***	15
Area 31J	MK-83***	3
Area 31J	MK-84	1
Area 31J	MK-20	4

**One event using the MK3A2 grenades consists of 10 grenades being thrown. Therefore, within UNDET North and South there will be a total of 80 grenades used per year.*

***In accordance with the current biological opinion for the Southeast, no live FIREX is conducted during North Atlantic right whale calving season and therefore no modeling was completed for the winter and spring seasons. Each FIREX event consists of 39 live rounds, therefore the 10 annual events that were modeled accounted for a total of 390 live rounds.*

****MINEX (20 lb) are more likely to take place during the summer. This was taken into account in the acoustic exposure analysis.*

***** One event using the MK-82 or MK-83 bombs consists of four bombs being dropped in succession. For example, in Area 31J there are 15 events for the MK-82, which means that a total of 60 bombs will be dropped per year.*

TABLE 3.7-6
NUMBER OF EXPLOSIVE EVENTS WITHIN THE JAX STUDY AREA FOR ALTERNATIVE 1

Sub-Area	Ordnance	Annual Totals
	MISSILEX	
MLTR	Hellfire	70
MLTR	Maverick	3
	Small Arms	
UNDET (N, S)	MK3A2 grenades	8
	FIREX	
BB,CC	5" rounds*	10
	MINEX	
UNDET North	20 LBS**	6
UNDET South	20 LBS**	6
	BOMBEX	
Area 31J	MK-82***	15
Area 31J	MK-83***	3
Area 31J	MK-84	1
Area 31J	MK-20	4

**One event using the MK3A2 grenades consists of 10 grenades being thrown. Therefore, within UNDET North and South there will be a total of 80 grenades used per year.*
***In accordance with the current biological opinion for the Southeast, no live FIREX is conducted during North Atlantic right whale calving season and therefore no modeling was completed for the winter and spring seasons. Each FIREX event consists of 39 live rounds, therefore the 10 annual events that were modeled accounted for a total of 390 live rounds.*
****MINEX events are more likely to take place during the summer. This was taken into account in the acoustic exposure analysis.*
***** One event using the MK-82 or MK-83 bombs consists of four bombs being dropped in succession. For example, in Area 31J there are 15 events for the MK-82, which means that a total of 60 bombs will be dropped per year.*

TABLE 3.7-7
NUMBER OF EXPLOSIVE EVENTS WITHIN THE JAX STUDY AREA FOR ALTERNATIVE 2

Sub-Area	Ordnance	Annual Totals
	MISSILEX	
MLTR	Hellfire	70
MLTR	Maverick	3
	Small Arms	
UNDET (N, S)	MK3A2 grenades	8
	FIREX	
BB,CC	5" rounds*	10
	MINEX	
UNDET North	20 LBS**	6
UNDET South	20 LBS**	6

**One event using the MK3A2 grenades consists of 10 grenades being thrown. Therefore, within UNDET North and South there will be a total of 80 grenades used per year.*
***In accordance with the current biological opinion for the Southeast, no live FIREX is conducted during North Atlantic right whale calving season and therefore no modeling was completed for the winter and spring seasons. Each FIREX event consists of 39 live rounds, therefore the 10 annual events that were modeled accounted for a total of 390 live rounds.*
*****MINEX events are more likely to take place during the summer. This was taken into account in the acoustic exposure analysis.*

Effect areas for a full FIREX (with IMPASS) event must account for the time and space distribution of 39 explosions, as well as the movement of animals (using 3 knot swim speed to account for movement to outside ZOI) over the several hours of the exercise. The total effect area for the 39-shot event (see Appendix J) is calculated as the sum of small effect areas for seven FIREX missions (each with four to six rounds fired) and one pre-FIREX action (with six rounds fired). Table 3.7-8 shows the Zone of Influence (ZOI) results of the model estimation.

TABLE 3.7-8
ESTIMATED ZOIS (KM^2) USED IN THE EXPOSURE CALCULATIONS FOR A SINGLE FIREX (WITH IMPASS) EVENT (39 ROUNDS)

Area	Estimated ZOI @ 177 dB re 1 μPa^2-sec (multiple explosions only)	Estimated ZOI @ 205 dB re 1 μPa^2-sec or 13 psi-ms
JAX		
BB, CC	6.1397*	0.16464

** In this area, which occurs in shallow water, the ZOI resulting from the 177 dB re 1 uPa^2-s (1/3 octave band) behavioral disturbance criterion is larger than the ZOI resulting from the 182 dB re 1 uPa^2-s (1/3 octave band)/23 psi (peak pressure) dual criteria for TTS, and was therefore used in the analysis to calculate non-injurious exposures.*

Figure 3.7-6 displays the areas where high explosive ordnance is used. The acoustic effects analysis presented in the following sections is briefly described for each major type of exercise. A more in-depth description of the modeling can be found in Appendix J.

FIREX (w/ IMPASS)

Modeling was completed for a 5-inch round, 8-lbs NEW charge exploding at a depth of 1 foot. The analysis approach begins using a high-fidelity acoustic model to estimate energy in each 5-inch explosive round. Effects areas are calculated by summing the energy from multiple explosions over a FIREX mission, and determining the effects area based on the thresholds and criteria. Non-injurious exposures were determined based on the 177 dB re 1 μPa^2-sec (energy) criteria for behavioral disturbance due to the use of multiple explosions.

The ZOI, when multiplied by the animal densities and the total number of events (Tables 3.7-5 to 3.7-7), provides the exposure estimates for that animal species for the nominal exercise case of 39 5-inch explosive rounds per event. The potential effects would occur within a series of small effect areas associated with the pre-calibration rounds and missions spread out over a period of several hours. Additionally, target locations are changed from event to event and, because of the time lag between events, it is highly unlikely, even if a marine mammal were present, that the marine mammal would be within the small exposure zone for more than one event. The exposure results based on the injurious criteria (13 psi-ms or 205 dB re 1 μPa^2-sec) were very low, and extrapolation showed there would be zero mortality exposures, so modeling was not completed for the 30.5 psi mortality criterion.

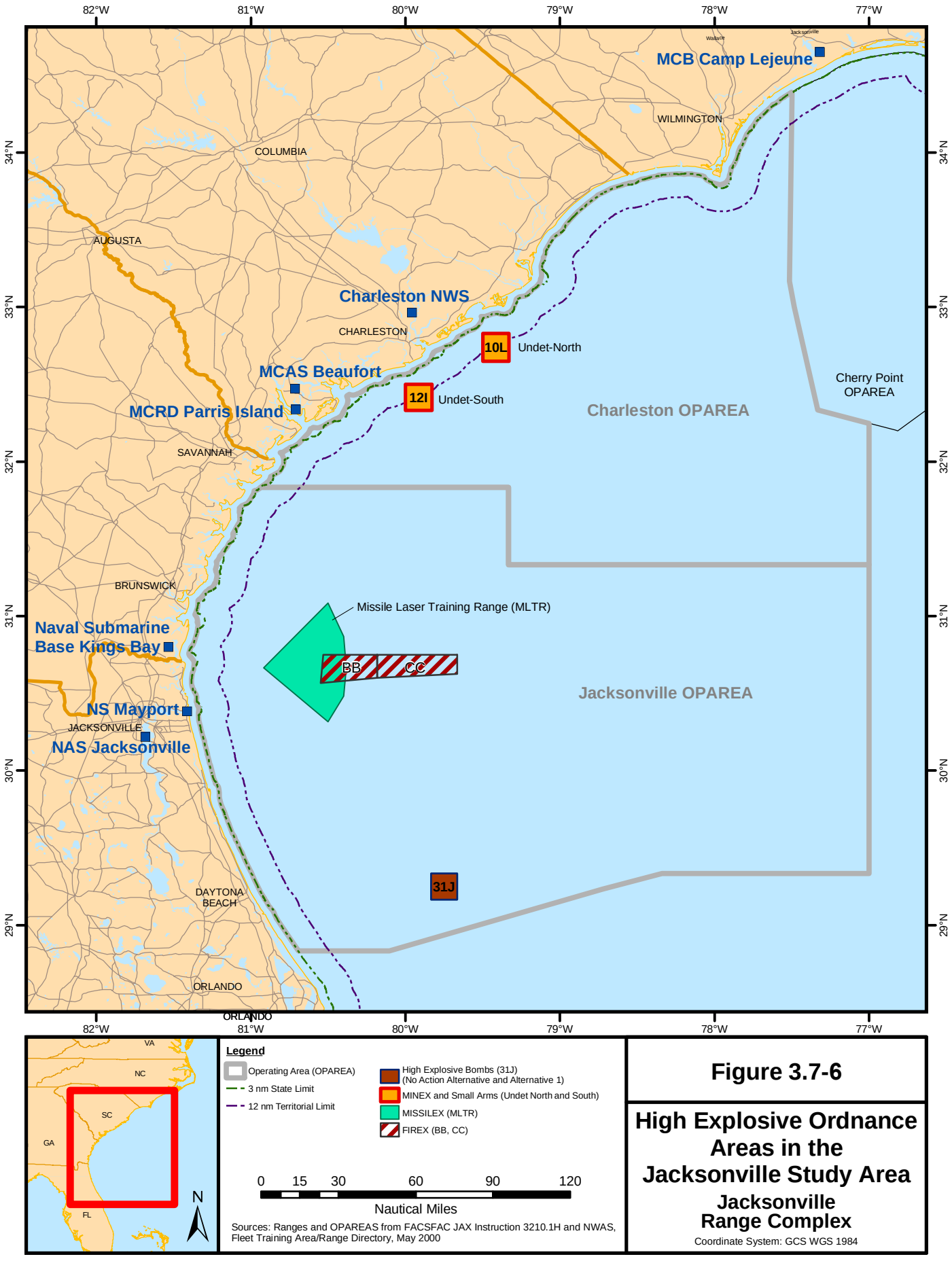


Figure 3.7-6

High Explosive Ordnance Areas in the Jacksonville Study Area

Jacksonville Range Complex

Coordinate System: GCS WGS 1984

FIREX (with IMPASS) is restricted to one location (BB, CC) (Figure 3.7-6). In addition to other mitigation measures (see Chapter 5), a dedicated lookout monitors the target area for marine mammals and sea turtles before the exercise, during deployment of the IMPASS array, and during the return to firing position. Ships will not fire on the target until the area is cleared and will suspend the exercise if any marine mammals or sea turtles enter the buffer area. Implementation of mitigation measures like these reduce the likelihood of exposure and potential effects in the ZOI.

BOMBEX

Modeling was completed for four explosive sources involved in BOMBEX, each assumed detonation at 1-m depth. The NEW used in simulations of the MK-82, MK-83 and MK-84 explosives are 192.2 lbs, 415.8 lbs, 944.7 lbs, respectively. The MK-20 explosive is a cluster bomb that houses 247 bomblets where each bomblet holds 0.4 lbs of an explosive mixture referred to as Comp B. The TNT equivalent weight of each bomblet is 0.444 lbs. All of the individual bomblets in the MK-20 cluster bomb detonate so close in time (on the order of seconds) and space, that for the purposes of the acoustic modeling, it is considered one explosion. Thus, the total equivalent weight of the MK-20 bomb is 109.7 lbs.

The MK-84 and MK-20 bombs are dropped one at a time and, therefore, are modeled as a single detonation event. More specifically, the single explosion dual TTS criteria were used to determine the ZOI for the non-injurious exposure analysis.

Determining the ZOI for the thresholds in terms of total energy flux density (EFD), impulse, peak pressure and 1/3-octave bands EFD must treat the sequential explosions differently than the single explosions. For the MK-82 and MK-83, two factors are involved for the sequential explosives that deal with the spatial and temporal distribution of the detonations as well as the effective accumulation of the resultant acoustics. In view of the ZOI determinations, the sequential explosions are modeled as a single point event with only the EFD summed incoherently:

$$Total\ EFD\ db = 10\log_{10}\sum_{i=1}^{n} 10^{(EFD_i/10)}$$

When the explosions are spaced at greater distance than a few wavelengths for the specific frequencies of interest (the spectral regions where acoustic energy is strongest), then the resulting energy flux density (EFD) levels in all directions can be assumed to be simply the sum of the individual EFDs (incoherent sum).

The multiple explosives behavioral disturbance energy criterion was used to determine the ZOI for the non-injurious exposure analysis for the MK-82 and MK-83 bombs.

Tables 3.7-9 and 3.7-10 show the ZOI results of the model estimation. The ZOI, when multiplied by the animal densities and total number of events (Tables 3.7-5 to 3.7-7), provides the exposure estimates for that animal species for the given bomb source.

BOMBEX training with live ordnance will not take place under Alternative 2. For Alternative 1 and the No Action Alternative, BOMBEX is limited to area 31J (Figure 3.7-6). In addition to other mitigation measures (see Chapter 5), aircraft will survey the target area for marine mammals and sea turtles before and during the exercise. Aircraft will not drop ordnance on the target until the area is surveyed and determined to be free of marine mammals and sea turtles. The exercise

will be suspended if any marine mammals or sea turtles enter the area. Implementation of mitigation measures like these reduce the likelihood of exposure and potential effects in the ZOI.

TABLE 3.7-9
ESTIMATED ZOIS (KM^2) USED IN EXPOSURE CALCULATIONS FOR BOMBEX INVOLVING SINGLE EXPLOSIVES

Area	Ordnance	Estimated ZOI @ 182 dB Re 1 μPa2-sec or 23 psi (peak)				Estimated ZOI @ 205 dB Re 1 μPa2-sec or 13 psi-ms				Estimated ZOI @ 30.5 psi-ms			
		Win	Spr	Sum	Fall	Win	Spr	Sum	Fall	Win	Spr	Sum	Fall
Area 31J	MK-84	12.80	14.25	13.28	16.04	0.57	0.57	0.57	0.57	<0.01	<0.01	<0.01	<0.01
	MK-20	2.69	2.69	2.69	2.69	0.07	0.07	0.07	0.07	<0.01	<0.01	<0.01	<0.01

Note: ZOIs for MK-84 and MK-20 bombs are modeled as single detonations.

TABLE 3.7-10
ESTIMATED ZOIS (KM^2) USED IN EXPOSURE CALCULATIONS FOR BOMBEX INVOLVING MULTIPLE EXPLOSIVES

Area	Ordnance	Estimated ZOI @ 177 dB re 1 μPa2-sec (multiple explosives only)				Estimated ZOI @ 205 dB Re 1 μPa2-sec or 13 psi-ms				Estimated ZOI @ 30.5 psi-ms			
		Win	Spr	Sum	Fall	Win	Spr	Sum	Fall	Win	Spr	Sum	Fall
Area 31J	MK-82	62.07	76.24	102.22	84.48	2.09	2.09	2.18	2.09	<0.01	<0.01	<0.01	<0.01
	MK-83	108.97	148.32	138.88	128.26	4.98	5.13	5.28	5.28	<0.01	<0.01	<0.01	<0.01

Note: ZOIs for MK-82 and MK-83 bombs are modeled as multiple detonations (4 bombs dropped at same location).

MINEX

The Comprehensive Acoustic System Simulation/Gaussian Ray Bundle (Oceanographic and Atmospheric Master Library [OAML], 2002) model, modified to account for impulse response, shock-wave waveform, and nonlinear shock-wave effects, was run for acoustic-environmental conditions derived from the OAML standard databases. The explosive source was modeled with standard similitude formulas, as in the Churchill FEIS. Because all the sites are shallow (less than 50 m), propagation model runs were made for bathymetry in the range from 10 m to 40 m.

Estimated ZOIs varied as much within a single area as from one area to another, which had been the case for the Virtual At Sea Training/IMPASS (DoN, 2003). There was, however, little season dependence. As a result, the ZOIs are stated as mean values with a percentage variation. Generally, in the case of ranges determined from energy metrics, as the depth of water increases, the range shortens. The single explosion dual TTS criteria (energy or peak pressure) were used to determine the ZOI for the non-injurious exposure analysis. Table 3.7-11 shows the ZOI results of the model estimation.

TABLE 3.7-11
ESTIMATED ZOIS (KM^2) USED IN EXPOSURE CALCULATION FOR MINEX

Threshold	ZOIs
	20-lbs NEW
Estimated ZOI @ 13 psi -ms	0.13 km^2 ± 10%
Estimated ZOI @ 182 dB re 1 μPa^2-sec	0.8 km^2 ± 25%

Note: The ZOI resulting from the 13 psi-ms criterion was larger than the ZOI resulting from the 205 dB re 1 uPa2-s (1/3 octave band) criterion, and was therefore used in the analysis to calculate injurious exposures. The ZOI resulting from the 182 dB re 1 uPa2-s (1/3 octave band) criterion was larger than the ZOI resulting from the 13 psi-ms criterion, and was therefore used in the analysis to calculate non-injurious exposures.

The ZOI, when multiplied by the seasonal animal densities and total number of events (Tables 3.7-5 to 3.7-7), provides the exposure estimates for that animal species for each specified charge. Because of the time lag between detonations, it is highly unlikely, even if a marine mammal were present ,that the marine mammal would be within the small exposure zone for more than one detonation. The results for the injurious exposures at the 13 psi criterion were very low, and extrapolation showed there would be zero mortality exposures, so modeling was not completed for the 30.5 psi mortality criteria.

Underwater detonations are restricted to two areas (UNDET North and UNDET South) (Figure 3.7-6). In addition to other mitigation measures (see Chapter 5), observers will survey the target area for marine mammals and sea turtles for 30 minutes prior through 30 minutes post detonation. Detonations will be suspended if a marine mammal or sea turtle enters the ZOI and will only restart after the area has been clear for a full 30 minutes. The majority of documented research (Table 3.7-12) has noted that most marine mammals complete dives averaging less than 30 minutes. Therefore, a 30 minute shutdown of naval exercises represents an adequate time period to assess marine mammal movements within the designated area and ensure the animal's safety before actions resume.

TABLE 3.7-12
MARINE MAMMAL DIVE TIMES

Common Name	*Scientific Name*	Average Dive Duration (min)	Maximum Dive Duration (min)	Citations
Mysticeti (baleen whales)				
Northern Atlantic right whale	*Eubalaena glacialis*	11.5 - 12.2		Goodyear, 1995; Baumgartner and Mate, 2003
Humpback whale	*Megaptera novaeangliae*	8.2	21	Dolphin, 1998 ; Schreer and Kovacs, 1997
Minke whale	*Balaenoptera acutorostrata*	4.43		Stern, 1992
Bryde's whale	*Balaenoptera brydei*	8	20	Wynne and Schwartz, 1999

TABLE 3.7-12 (Continued)
MARINE MAMMAL DIVE TIMES

Common Name	*Scientific Name*	Average Dive Duration (min)	Maximum Dive Duration (min)	Citations
Sei whale	*Balaenoptera boreali*		20	Lockyer and Waters, 1986 ; Martin, 1990
Fin whale	*Balaenoptera physalus*	5.5	14	Croll *et al*., 2001 ; Lockyer and Waters, 1986 ; Watkins *et al*., 1981
Blue whale	*Balaenoptera musculus*	6.6	18	Croll *et al*., 200; Lagerquist *et al*., 2000
Odontoceti (toothed whales)				
Sperm whale	*Physeter macrocephalus*	35.9 - 37	73	Amano and Yoshioka, 2003 Watkins *et al*., 1993; Omura, 1950; Watkins *et al*., 1993
Pygmy sperm whale	*Kogia breviceps*		12 -17.7	Evans, 1987; Hohn *et al*., 1995; Scott *et al*., 2001
Dwarf sperm whale	*Kogia sima*		43	Breese and Tershy, 1993
Cuvier's beaked whale	*Ziphius cavirostris*	28.6	68	Barlow, 1999; Baird et al., 2004; Barlow et al., 1997
Sowerby's beaked whale	*Mesoplodon bidens*	12 - 29		Hooker and Baird, 1999
Blainville's beaked whale	*Mesoplodon densirostris*		23	Baird et al., 2004
Rough-toothed dolphin	*Steno bredanensis*		15	Miyazaki and Perrin, 1994
Bottlenose dolphin	*Tursiops truncatus*		8	Evans, 1987; Ridgway and Harrison, 1986
Pantropical spotted dolphin	*Stenella attenuata*		4.7	Perrin *et a*l., 1987 Scott *et al*., 1993
Atlantic spotted dolphin	*Stenella frontalis*		5 - 6	Davis *et al*., 1996
Spinner dolphin	*Stenella longirostris*		3.5	Wursig *et al*., 1994
Common dolphin	*Dephinus delphis*		5	Heyning and Perin 1994; Evans, 1971
Atlantic white-sided dolphin	*Lagenorhynchus acutus*		4	Mate *et al*., 1994

TABLE 3.7-12 (Continued)
MARINE MAMMAL DIVE TIMES

Common Name	*Scientific Name*	Average Dive Duration (min)	Maximum Dive Duration (min)	Citations
Risso's dolphin	*Grampus griseus*		30	Clarke, 1986
False killer whale	*Pseudorca crassidens*	8 - 12		Ligon and Baird, 2001
Killer whale	*Orcinus orca*		10.4 - 15	Baird *et al*., 2005; Schreer and Kovacs, 1997
Long-finned pilot whale	*Globicephala melas*	8.1		Baird *et al.*, 2002
Short-finned pilot whale	*Globicephala macrorhynchus*		27	Baird *et al*., 2003
Sirenia (manatees and dugongs)				
West Indian manatee	*Trichechus manatus*		6	Schreer and Kovacs, 1997

MISSILEX (Hellfire and Maverick)

Modeling was completed for two explosive missiles involved in MISSILEX, each assumed detonation at 1-m depth. These missiles explode at the surface. The NEW used in simulations of the Hellfire and Maverick missiles are 8 lbs and 80 lbs, respectively. The single explosion dual TTS criteria (energy or peak pressure) were used to determine the ZOI for the non-injurious exposure analysis. Table 3.7-13 shows the ZOI results of the model estimation.

TABLE 3.7-13
ESTIMATED ZOIS (KM^2) USED IN EXPOSURE CALCULATIONSFOR MISSILEX

Area	Ordnance	Estimated ZOI @ 182 dB Re 1 μPa2-sec or 23 psi (peak)				Estimated ZOI @ 205 dB Re 1 μPa2-sec or 13 psi-ms				Estimated ZOI @ 30.5 psi-ms			
		Win	Spr	Sum	Fall	Win	Spr	Sum	Fall	Win	Spr	Sum	Fall
JAX													
MLTR	Hellfire	0.89	0.73	0.64	0.73	0.02	0.02	0.02	0.02	<0.01	<0.01	<0.01	<0.01
MLTR	Maverick	0.91	0.91	0.79	0.91	0.11	0.07	0.07	0.11	<0.01	<0.01	<0.01	<0.01

The total ZOI, when multiplied by the animal densities and total number of events (Tables 3.7-20 to 3.7-22), provides the exposure estimates for that animal species for each specified missile. Because of the time lag between detonations, it is highly unlikely, even if a marine mammal were present, that the marine mammal would be within the small exposure zone for more than one detonation.

MISSILEX is restricted to one location (MLTR) (Figure 3.7-6). In addition to other mitigation measures (Chapter 5), aircraft will survey the target area for marine mammals and sea turtles before and during the exercise. Aircraft will not fire on the target until the area is cleared and will

suspend the exercise if any enter the buffer area. Implementation of mitigation measures like these reduce the likelihood of exposure and potential effects in the ZOI.

Small Arms

Small arms training, involving the use of MK3A2 anti-swimmer concussion grenades is only conducted in the Jacksonville Range Complex. Modeling was completed for the MK3A2 explosive source, which assumed a 6 ft detonation depth. The NEW used in simulations of the MK3A2 grenade is 0.5 lb.

Determining the ZOI for the thresholds in terms of total energy flux density (EFD), impulse, peak pressure and 1/3-octave bands EFD must treat the sequential explosions differently than the single detonations. For the MK3A2, two factors are involved for the sequential explosives that deal with the spatial and temporal distribution of the detonations as well as the effective accumulation of the resultant acoustics. In view of the ZOI determinations, the sequential detonations are model as a single point event with only the EFD summed incoherently:

$$Total\ EFD\ db = 10\log_{10}\sum_{i=1}^{n}10^{(EFD_i/10)}$$

The multiple explosion energy criterion was used to determine the ZOI for the non-injurious behavioral (without TTS) exposure analysis.

Table 3.7-14 shows the ZOI results of the model estimation in the Jacksonville Range Complex. The ZOI, when multiplied by the animal densities and total number of events, provides the exposure estimates for that animal species. Grenade use is restricted to two locations (UNDET North and South) (see Figure 2.2-1). In addition to other mitigation measures (see Chapter 5.0), lookouts will visually survey the target area for marine mammals and sea turtles. The exercise will not be conducted until the area is clear and will suspend the exercise if any enter the buffer area. Implementation of mitigation measures like these reduce the likelihood of exposure and potential effects in the ZOI.

TABLE 3.7-14
ESTIMATED ZOIS (KM^2) FOR SMALL ARMS TRAINING (ANTI-SWIMMER GRENADES) IN THE JACKSONVILLE RANGE COMPLEX

Area	Ordnance	Estimated ZOI @ 177 dB re 1 μPa²-sec (multiple detonations only)				Estimated ZOI @ 205 dB re 1 μPa²-sec or 13 psi				Mortality ZOI @ 30.5 psi			
		Win	Spr	Sum	Fall	Win	Spr	Sum	Fall	Win	Spr	Sum	Fall
JAX													
UNDET North	MK3A2 grenade	4.25	4.30	3.97	3.97	0.09	0.09	0.09	0.09	<0.01	<0.01	<0.01	<0.01
UNDET South	MK3A2 grenade	4.67	4.72	4.24	4.59	0.09	0.09	0.09	0.09	<0.01	<0.01	<0.01	<0.01

Note: ZOIs for the MK3A2 grenades are modeled as multiple detonations (10 grenades being used during each event).

3.7.3.3 No Action Alternative

Vessel Movements

Overview

The No Action Alternative includes vessel movements. These involve transit to and from port to the various components of the Jacksonville Range Complex (*e.g.*, OPAREAs, UNDET North and South Boxes, MLTR), as well as vessel movements into, within, and through these distinct components. Many of the operations within the Study Area involve maneuvers by various types of surface ships, boats, and submarines (collectively referred to as vessels). Vessel movements have the potential to affect marine mammals by directly striking or disturbing individual animals. Both are analyzed below. The probability of vessel and marine mammal interactions occurring in the Study Area is dependent upon several factors including numbers, types, and speeds of vessels; the regularity, duration, and spatial extent of operations; the presence/absence and density of marine mammals; and mitigation measures implemented by the Navy. Currently, the number of Navy vessels operating in the Study Area varies based on training schedules and can range from 0 to about 10 vessels at any given time. Ship sizes range from 362 feet for an SSN to 1,092 feet for a CVN and speeds generally range from 10 to 14 knots. Operations involving vessel movements occur intermittently and are variable in duration, ranging from a few hours up to two weeks. These operations are widely dispersed in the JAX Study Area, which is a vast area encompassing 50,090 nm^2 (an area approximately the size of Florida). Consequently, the density of ships within the Study Area at any given time is extremely low (*i.e.*, less than 0.0002 ships/nm^2). The Navy logs about 1,000 total steaming days within the Study Area during a typical year.

Also, it should be noted that a variety of smaller craft, such as service vessels for routine operations and opposition forces used during training events will be operating within the study area. Small craft types, sizes and speeds vary. The Navy's rigid hull inflatable boat (RHIB) is one representative example of a small craft that may be used during training exercises. By way of example, the Naval Special Warfare RHIB is 35 feet in length and has a speed of 40+ knots. Other small craft, such as those used in maritime security training events, are of similar length and speed to the RHIB and often resemble, and often are, recreational fishing boats (i.e., a 30 - 35 foot center consol boat with twin outboard engines).

During training speeds generally range from 10 to 14 knots; however, ships/craft can and will, on occasion, operate within the entire spectrum of their specific operational capabilities. It is necessary for vessels/craft to operate at higher speeds during specific events, such as, but not limited to, pursuing and overtaking hostile vessels, evasive maneuvers, and maintenance/ performance checks, such as ship trials. During these types of events ships may often operate at high speeds (high end of the vessel's speed capability). In all cases, the vessels/craft will be operated in a safe manner consistent with the local conditions.

General Disturbance

Marine mammals are frequently exposed to vessels due to research, ecotourism, commercial and private vessel traffic, and government activities. The presence of vessels has the potential to alter the behavior patterns of marine mammals. It is difficult to differentiate between responses to vessel sound and visual cues associated with the presence of a vessel; thus, it is assumed that both play a role in prompting reactions from animals. Anthropogenic sound has increased in the marine environment over the past 50 years (NRC Richardson *et al.* 1995; NRC 2003) and can be attributed

to vessel traffic, marine dredging and construction, oil and gas drilling, geophysical surveys, sonar, and underwater explosions (Richardson *et al.,* 1995).

Marine mammals react to vessels in a variety of ways. Some respond negatively by retreating or engaging in antagonistic responses while other animals ignore the stimulus altogether (Watkins, 1986; Terhune and Verboom, 1999). The predominant reaction is neutral or avoidance behavior, rather than attraction behavior. Additional information regarding each listed species is provided below.

North Atlantic Right Whales

Although very few data exist examining the relationship between vessel presence and significant impact to the North Atlantic right whale, it is thought that any impacts from vessel disturbance would be minor and/or temporary in nature (NMFS, 2005a). North Atlantic right whales continually utilize habitats in high ship traffic areas (Nowacek *et al.*, 2004). Studies show that North Atlantic right whales have little, if any, reaction to sounds of vessel approaching or the presence of the vessels themselves (Terhune and Verboom, 1999; Nowacek *et al.*, 2004). In addition, North Atlantic right whales are protected through measures such as the 500-yard no-approach limit, which affords them additional protection and reduces any effect vessel traffic might have on behavior or distribution (NMFS, 1997).

Fin and Humpback Whales

Fin whales have been observed altering their swimming patterns by increasing speed and heading away from the vessel, as well as changing their breathing patterns in response to a vessel approach (Jahoda *et al.,* 2003). Observations show that when vessels remain 100 m or farther from fin and humpback whales, they were largely ignored (Watkins *et al.,* 1981). Only when vessels approached more closely did the fin whales in the study alter their behavior by increasing time at the surface and engaging in evasive maneuvers. In this study, humpback whales did not exhibit any avoidance behavior (Watkins *et al.*, 1981); however, in other instances, humpback whales did react to vessel presence. In a study of regional vessel traffic, Baker *et al.* (1983) found that when vessels were in the area, the respiration patterns of the humpback whales changed. The whales also exhibited two forms of behavioral avoidance: 1) horizontal avoidance (changing direction and/or speed) when vessels were between 2,000 and 4,000 m away, or 2) vertical avoidance (increased dive times and change in diving pattern) when vessels were between 0 and 2,000 m away (Baker *et al.*, 1983).

Based on existing studies, it is likely that fin and humpback whales would have little reaction to vessels that maintain a reasonable distance from the animals. The distance that will provoke a response varies based on many factors including, but not limited to, vessel size, geographic location, and individual animal tolerance levels (Watkins *et al.,* 1981; Baker *et al.*, 1983; Jahoda *et al.,* 2003). Should the vessels approach close enough to invoke a reaction, animals may engage in avoidance behaviors and/or alter their breathing patterns. Reactions exhibited by the whales would be temporary in nature. They would be expected to return to their pre-disturbance activities once the vessel has left the area.

Blue and Sei Whales

There is little information on blue whale or sei whale response to vessel presence (NMFS, 1998b; NMFS, 1998a). Sei whales have been observed ignoring the presence of vessels and passing close to the vessel (Weinrich *et al.,* 1986). The response of blue and sei whales to vessel traffic is

assumed to be similar to that of the other baleen whales, ranging from avoidance maneuvers to disinterest in the presence of vessels. Any behavioral response would be short-term in nature.

Sperm Whales

Sperm whales generally had little to no reaction to ships, except on close approaches (within several hundred meters); however, some did show avoidance behavior such as quick diving (Würsig *et al.,* 1998). In addition, in the presence of whale watching and research boats, changes in respiration and echolocation patterns were observed in male sperm whales (Richter *et al.,* 2006). Disturbance from boats does not generally result in a change in behavior patterns and is short-term in nature (Magalhães *et al.,* 2002).

West Indian Manatees

The presence of vessels has the potential to alter the behavior patterns of West Indian manatees. West Indian manatees respond to vessel movement via acoustic and possibly visual cues (Miksis-Olds *et al.*, 2007; Nowacek *et al.*, 2004b). West Indian manatees tend to move away from the approaching vessel, by increasing their rate of swimming speed and moving toward deeper water (Nowacek *et al.*, 2004b). The degree of response varies with individual West Indian manatees and may be more pronounced in areas of deeper water, where they are more easily able to locate the direction of the approaching vessel (Nowacek *et al.*, 2004b). This disturbance is a temporary response to the approaching vessel. West Indian manatees have also been shown to seek out areas with a lower density of vessels (Buckingham *et al.* 1999). West Indian manatees react (*i.e.*, exhibit a clear behavioral response) to vessels within distances of 25 to 50 m, but it is unclear at what distance the West Indian manatees first detect the presence of vessels (Nowacek *et al.*, 2004b). Vessel traffic and recreational activities that disturb West Indian manatees may cause them to leave preferred habitats and may alter biologically important behaviors such as feeding, suckling, or resting (Haubold *et al.*, 2006). The overall distribution of West Indian manatees may be affected by areas of high recreational boat activity (Buckingham *et al.*, 1999).

Delphinids

Species of delphinids can vary widely in their reaction to vessels. Many exhibit mostly neutral behavior, but there are frequent instances of observed avoidance behaviors (Hewitt, 1985; Würsig *et al.*, 1998). In addition, approaches by vessels can elicit changes in behavior, including a decrease in resting behavior or change in travel direction (Bejder *et al.*, 2006). Alternately, many of the delphinid species exhibit behavior indicating attraction to vessels. Many species such as common, rough-toothed and bottlenose dolphins are frequently observed bow riding or jumping in the wake of a vessel (Norris and Prescott, 1961; Shane *et al.*, 1986; Würsig *et al.*, 1998; Ritter 2002). These behavioral alterations are short-term and would not result in any lasting effects.

Dwarf and Pygmy Sperm Whales and Beaked Whales

Kogia spp. and beaked whales show strong adverse reactions to vessels. They engage is quick diving behavior and avoidance maneuvers (Würsig *et al.*, 1998).

Chronic Stress

Marine mammals exposed to a passing Navy vessel may not respond at all, or they could exhibit a short-term behavioral response, but not to the extent where natural behavioral patterns would be abandoned or significantly altered. Human disturbance to wild animals may elicit similar reactions to those caused by natural predators (Gill *et al.,* 2001; Beale and Monaghan, 2004). Behavioral

responses may also be accompanied by a physiological response (Romero, 2004), although this is very difficult to study in the wild. Short-term exposures to stressors result in changes in immediate behavior (Frid, 2003). Repeated exposure to stressors, including human disturbance such as vessel disturbance and anthropogenic sound, can result in negative consequences to the health and viability of an individual or population. In individual bottlenose dolphins, chronic stress due to physical injury or disease resulted in morphological changes to the adrenal glands (Clark *et al.*, 2006). Although this study related to natural induced stressors, similar physiological changes may result from other types of stressors such as anthropogenic disturbance. Chronic stress can result in decreased reproductive success (Lordi *et al.*, 2000; Beale and Monaghan, 2004), decreased energy budget (Frid, 2003), displacement from habitat (Southerland and Crockford, 1993), and lower survival rates of offspring (Lordi *et al.*, 2000). At this time, it is unknown what the long-term implications of chronic stress may be on marine mammal species.

Vessel movements under the No Action Alternative are not expected to result in chronic stress because, as discussed above, Navy vessel density in the Study Area would remain low and the Navy implements mitigation measures to avoid marine mammals.

Summary

Vessel traffic related to the proposed activity would interact with marine mammals only on an incidental basis. Most of the studies mentioned previously examine the reaction of animals to vessels that approach and intend to follow or observe an animal (*i.e.*, whale watching vessels, research vessels, *etc.*). Reactions to vessels not pursuing the animals, such as those transiting through an area or engaged in training exercises, may be similar but would likely result in less stress to the animal because they would not intentionally approach animals. In fact, Navy mitigation measures include several provisions to avoid approaching marine mammals (see Chapter 5 for a detailed description of mitigation measures). Listed cetacean species generally pay little attention to transiting vessel traffic as it approaches, although they may engage in last minute avoidance maneuvers (Laist *et al.*, 2001). As previously noted, all quick avoidance maneuvers are short-term alterations and not expected to permanently impact an animal. Most studies have ascertained the short-term response to vessel sound and vessel traffic (Watkins *et al.*, 1981; Baker, *et al.*, 1983; Magalhães *et al.*, 2002); however, the long-term implications of ship sound on marine mammals is largely unknown (NMFS, 2007c).

General disturbance associated with vessel movements may affect ESA-listed marine mammals, but is not expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, vessel disturbance in territorial waters would have no significant impact on marine mammals. Furthermore, vessel disturbance in non-territorial waters would not cause significant harm to marine mammals in accordance with EO 12114.

Vessel movements within the North Atlantic Right Whale critical habitat may cause short-term disturbance to the water column due to displacement of water and increase in sound. Critical habitat and the physical environment would return to normal once a vessel has left the immediate area. There would be no permanent impacts to the critical habitat.

Vessel Collisions

Collisions with commercial and Navy ships can result in serious injury and may occasionally cause fatalities to cetaceans and manatees. Although the most vulnerable marine mammals may be assumed to be slow-moving cetaceans or those that spend extended periods of time at the surface in order to restore oxygen levels within their tissues after deep dives (e.g., sperm whale), fin whales

are actually struck most frequently (Laist *et al.*, 2001). Manatees are also particularly susceptible to vessel interactions and collisions, with recreational watercraft constituting the leading cause of mortality (USFWS, 2007). Smaller marine mammals such as bottlenose and Atlantic spotted dolphins move more quickly throughout the water column and are often seen riding the bow wave of large ships. Marine mammal responses to vessels may include avoidance and changes in dive pattern (NRC, 2003).

After reviewing historical records and computerized stranding databases for evidence of ship strikes involving baleen and sperm whales, Laist *et al*. (2001) found that accounts of large whale ship strikes involving motorized boats in the area date back to at least the late 1800s. Ship collisions remained infrequent until the 1950s, after which point they increased. Laist *et al*. (2001) report that both the number and speed of motorized vessels have increased over time for trans-Atlantic passenger services that transit through the area. They concluded that most strikes occur over or near the continental shelf, that ship strikes likely have a negligible effect on the status of most whale populations, but that for small populations or segments of populations, the impact of ship strikes may be significant.

Although ship strike mortalities may represent a small proportion of whale populations, Laist *et al*. (2001) also concluded that, when considered in combination with other human-related mortalities in the area (e.g., entanglement in fishing gear), these ship strikes may present a concern for whale populations. Substantial evidence (Laist *et al*., 2001 and Jensen and Silber, 2003) indicates that ship speed is an important factor affecting the likelihood and lethality of whale/vessel collisions.

Of 11 species known to be hit by ships, fin whales are struck most frequently; right whales, humpback whales, sperm whales, and gray whales are all hit commonly (Laist *et al.,* 2001). In some areas, one-third of all fin whale and right whale strandings appear to involve ship strikes. Sperm whales spend long periods (typically up to 10 minutes; Jacquet *et al.,* 1996) "rafting" at the surface between deep dives. This could make them exceptionally vulnerable to ship strikes. Berzin (1972) noted there were "many" reports of sperm whales of different age classes being struck by vessels, including passenger ships and tug boats. There were also instances in which sperm whales approached vessels too closely and were cut by the propellers (NMFS, 2006b).

West Indian manatees are particularly susceptible to vessel collisions due to their propensity for very shallow waters and their inability to move with haste (Calleson and Frohlich, 2007; Haubold *et al.*, 2006; Runge *et al.*, 2007; USFWS, 2001c; 2007m). Vessel collisions are the largest known source of human-caused mortality to adult West Indian manatees (USFWS, 2007m), accounting for approximately 25% of all manatee deaths recorded in Florida since 1976 (Calleson and Frohlich, 2007). The large percentage of West Indian manatees in Florida that bear scars from previous collisions indicates that sub-lethal effects of vessel traffic are also a concern. Non-lethal injuries may reduce the breeding success of wounded females and may permanently remove some animals from the breeding population (Haubold *et al.*, 2006).

Accordingly, the Navy has adopted mitigation measures to reduce the potential for collisions with surfaced marine mammals (for more details refer to Chapter 5). These measures include the following:

- Using lookouts trained to detect all objects on the surface of the water, including marine mammals.
- Implementing reasonable and prudent actions to avoid the close interaction of Navy assets and marine mammals.

- Maneuvering to keep away from any observed marine mammal.

Navy shipboard lookouts (also referred to as "watchstanders") are highly qualified and experienced observers of the marine environment. Their duties require that they report all objects sighted in the water to the Officer of the Deck (*e.g.*, trash, a periscope, marine mammals, sea turtles) and all disturbances (*e.g.*, surface disturbance, discoloration) that may be indicative of a threat to the vessel and its crew. There are personnel serving as lookouts on station at all times (day and night) when a ship or surfaced submarine is moving through the water. Navy lookouts undergo extensive training to qualify as a lookout. This training includes on-the-job instruction under the supervision of an experienced lookout, followed by completion of the Personal Qualification Standard program, certifying that they have demonstrated the necessary skills (such as detection and reporting of partially submerged objects).

The Navy includes marine species awareness as part of its training for its bridge lookout personnel on ships and submarines. Lookouts are trained on how to look for marine species and report sightings to the Officer of the Deck so that action may be taken to avoid the marine species or adjust the exercise to minimize effects to the species. Marine Species Awareness Training was updated in 2006, and the additional training materials are now included as required training for Navy ship and submarine lookouts. Additionally, all Commanding Officers and Executive Officers of units involved in training exercises are required to undergo marine species awareness training. This training addresses the lookout's role in environmental protection, laws governing the protection of marine species, Navy stewardship commitments, and general observation information to aid in avoiding interactions with marine species.

North Atlantic Right Whales

North Atlantic right whales are of particular concern. On average one or two right whales are killed annually in collisions. Between 2001 and 2007, at least eight right whales, including four adult females, a juvenile male, a juvenile female, and a female calf died as a result of being struck by ships (MMC, 2008) (RWC, 2007).

Given the low abundance of North Atlantic right whales relative to other species, the frequency of occurrence of ship strikes to right whales suggests that the threat of ship strikes is proportionally greater to this species (Jensen and Silber, 2003). NMFS has implemented a right whale vessel collision reduction strategy to establish operational measures for the shipping industry to reduce the potential for large vessel ship strikes of North Atlantic right whales while transiting to and from mid-Atlantic ports during right whale migratory periods (NMFS 2008). Recent studies of right whales show that these whales tend to lack a response to the sounds of oncoming vessels (Nowacek et al., 2004).

To reduce the risk of ship strikes, the Navy instituted North Atlantic right whale mitigation measures that cover vessels operating along the Atlantic coast. Standing mitigation measures and annual guidance have been in place for ships in the vicinity of the right whale critical habitat off the southeast coast since 1997. In addition to specific operating guidelines, the Navy's efforts in the southeast include annual funding support to the Early Warning System (EWS), and organization of a communication network and reporting system to ensure the widest possible dissemination of right whale sighting information to DoD and civilian shipping.

Right whale mitigation measures are tailored according to the expected temporal and spatial distribution of right whales. During calving season and within the consultation area (roughly an

area to 80 nm seaward from Charleston, South Carolina, south to Sebastian Inlet, Florida) particular measures are in effect in accordance with the NMFS Biological Opinion issued in 1997 (NMFS, 1997). The southeast mitigation measures covering the right whale consultation area and southeast Critical Habitat include:

- Annual message sent to all ships prior to the November 15 through April 15 calving season.
- Movement through the Critical Habitat will be in the most direct manner possible, avoiding north – south transits during the calving season.
- Vessels will use extreme caution and operate at a slow, safe speed; that is the slowest speed consistent with essential mission, training, and operations at which the ship can take proper and effective action to avoid a collision and can be stopped within a distance appropriate to the prevailing circumstances and conditions.
- To the extent practicable and consistent with mission, training, and operations, naval vessel operations in the Critical Habitat and associated area of concern will be limited to daylight and periods of good visibility.

The mid-Atlantic is a principal migratory corridor for North Atlantic right whales that travel between the calving/nursery areas in the southeastern United States and feeding grounds in the northeast United States and Canada. Southward right whale migration generally occurs from mid- to late November, although some right whales may arrive off the Florida coast in early November and stay into late March (Kraus *et al.,* 1993). The northbound migration generally takes place between January and late March. Data indicate that during the spring and fall migration, right whales typically occur in shallow water immediately adjacent to the coast, with over half the sightings (63.8%) occurring within 10 nm, and 94.1 percent reported within 30 nm of the coast.

Although Navy vessel traffic generally represents only two to three percent of the overall large vessel traffic, based on this biological characteristic and the presence of critical Navy ports along the whales' mid-Atlantic migratory corridor, the Navy was the first federal agency to adopt additional mitigation measures for transits in the vicinity of mid-Atlantic ports during right whale migration. In 2002 right whale mitigation measures were promulgated for all Fleet activities occurring in the northeast region and most recently in December 2004, the Navy issued further guidance for all Fleet ships to increase awareness of right whale migratory patterns and implement additional mitigation measures along the mid-Atlantic coast. This includes areas where ships transit between southern New England and northern Florida. The Navy coordinated with NOAA NMFS for identification of seasonal right whale occurrence patterns in six major sections of the mid-Atlantic coast, with particular attention to port and coastal areas of key interest for vessel traffic management. The Navy's resulting guidance calls for extreme caution and operation at a slow, safe speed within 20 nm arcs of specified coastal and port reference points. The guidance reiterates previous instructions that Navy ships post two lookouts, one of whom must have completed marine mammal recognition training, and emphasizes the need for utmost vigilance in performance of these watchstander duties.

Specifically, the Navy has unilaterally adopted the following mitigation measures:

- During months of expected North Atlantic right whale occurrence, Navy vessels will practice increased vigilance with respect to avoidance of vessel-whale interactions along the mid-Atlantic coast, including transits to and from any mid-Atlantic ports.
- All surface units transiting within 30 nm of the coast in the mid-Atlantic will ensure at least two lookouts are posted. Personnel on lookout will follow visual search procedures employing a

scanning methodology in accordance with the Lookout Training Handbook (NAVEDTRA 12968 D) and have completed the Navy's Marine Species Awareness Training (MSAT).
- Navy vessels will avoid knowingly approaching any whale head on and will maneuver to keep at least 1,500 ft away from any observed whale, consistent with vessel safety.

For purposes of these measures, the mid-Atlantic is defined broadly to include ports south and east of Block Island Sound southward to South Carolina. These measures are similar to vessel transit procedures in place since 1997 for Navy vessels in the vicinity of designated right whale critical habitat in the southeastern United States.

Summary

Based on the implementation of Navy mitigation measures, especially during times of anticipated right whale occurrence, and the relatively low density of Navy ships in the Study Area, the likelihood that a vessel collision would occur is very low. However, vessel collisions may affect ESA-listed cetaceans in the JAX Study Area.

West Indian manatees are not expected to occur greater than 3 nm offshore or in relatively deep waters of the Jacksonville/Charleston OPAREAs where most of the vessel movements occur. However, West Indian manatees are expected to occur in the nearshore zone and coastal manatees may be affected by vessel collisions associated with shallow water training and transiting to and from ports to the offshore portion of the JAX Range Complex. Informal consultation with USFWS for the preferred alternative resulted in the determination that training activites are not likely to adversely affect manatees in Lake George (Appendix C).

General disturbance associated with vessel movements may affect ESA-listed marine mammals, but is not expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, collisions associated with vessel movements in territorial waters would have no significant impact on marine mammals. Furthermore, collisions associated with vessel movements in non-territorial waters would not cause significant harm to marine mammals in accordance with Executive Order 12114.

Aircraft Overflights (Disturbance)

Overview

Various types of fixed-wing aircraft and helicopters are used in training exercises in the JAX Study Area (see Chapter 2 and Appendix D). These aircraft overflights would produce airborne noise and some of this energy would be transmitted into the water. Marine mammals could be exposed to noise associated with subsonic and supersonic fixed-wing aircraft overflights and helicopter operations while at the surface or while submerged (see Section 3.5 – Noise Environment for a description of the existing noise environment and Appendix H for an overview of airborne and underwater acoustics). In addition to sound, marine mammals could react to the shadow of a low-flying aircraft and/or, in the case of helicopters, surface disturbance from the downdraft.

Transmission of sound from a moving airborne source to an underwater receptor is influenced by numerous factors and was addressed by Urick (1972), Young (1973), Richardson *et al.* (1985), Eller and Cavanagh (2000), Laney and Cavanagh (2000), and others. Sound is transmitted from an airborne source to a receptor underwater by four principal means: (1) a direct path, refracted upon passing through the air-water interface; (2) direct-refracted paths reflected from the bottom in

shallow water; (3) lateral (evanescent) transmission through the interface from the airborne sound field directly above; and (4) scattering from interface roughness due to wave motion.

Aircraft sound is refracted upon transmission into water because sound waves move faster through water than through air (a ratio of about 0.23:1). Based on this difference, the direct sound path is totally reflected if the sound reaches the surface at an angle more than 13 degrees from vertical. As a result, most of the acoustic energy transmitted into the water from an aircraft arrives through a relatively narrow cone with a 26 degree apex angle extending vertically downward from the aircraft (Figure 3.7-7). The intersection of this cone with the surface traces a "footprint" directly beneath the flight path, with the width of the footprint being a function of aircraft altitude.

The sound pressure field is actually doubled at the air-to-water interface because the large difference in the acoustic properties of water and air. For example, a sonic boom with a peak pressure of 10 pounds per square foot (psf) at the sea surface becomes an impulsive wave in water with a maximum peak pressure of 20 psf. The pressure and sound levels then decrease with increasing depth.

Eller and Cavanagh (2000) modeled estimates of sound pressure level as a function of time at selected underwater locations (receiver animal depths of 2, 10, and 50 m) for F-18 aircraft subsonic overflights (250 knots) at various altitudes (300, 1000, and 3,000 m). As modeled for all deep water scenarios, the sound pressure levels ranged from approximately 120 to 150 dB (referenced to 1 μPa). They concluded that it is difficult to construct cases (for any aircraft at any altitude in any propagation environment) for which the underwater sound is sufficiently intense and long lasting to cause harm to any form of marine life.

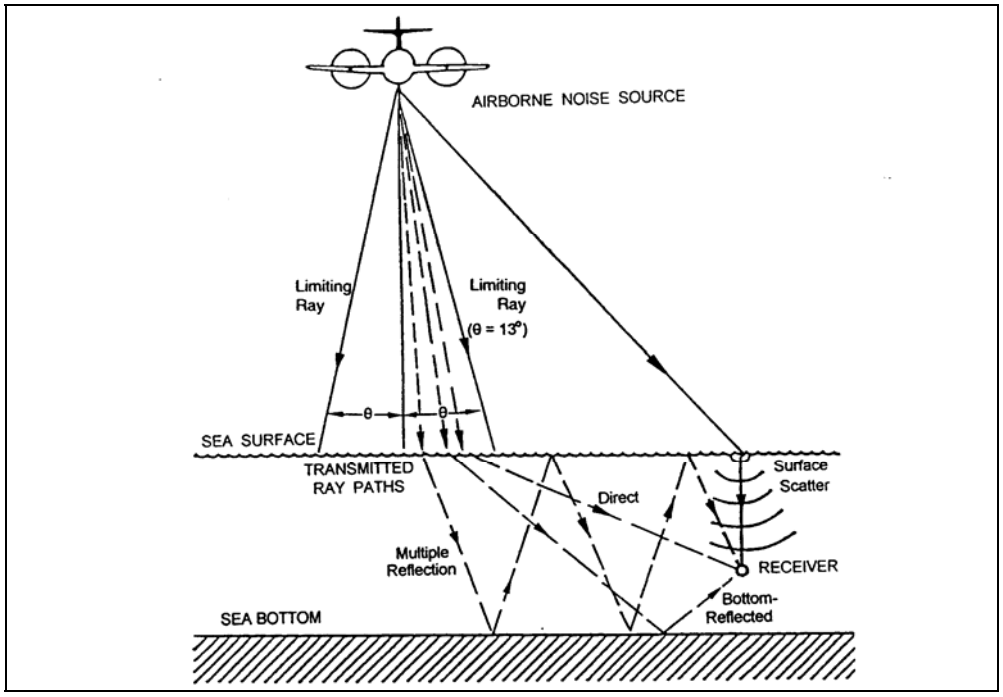


Figure 3.7-7 Characteristics of Sound Transmission through Air-Water Interface

The maximum overpressures calculated for F/A-18 aircraft supersonic overflights range from 5.2 psf at 10,000 feet to 28.8 psf at 1,000 feet (Ogden, 1997). Considering an extreme case of a sonic boom that generates maximum overpressure of 50 psf in air, it would become an impulsive wave in water with a maximum peak pressure of 100 psf or about 0.7 pounds psi. Therefore, even a worst case situation for sonic booms would produce a peak pressure in water well below the 12 psi threshold for impulsive noise commonly considered to cause harassment of marine mammals or sea turtles (Laney and Cavanagh, 2000). Since the paper was written, the threshold has been revised to 23 psi; sonic booms were not analyzed further in the analysis because the 0.7 psi is substantially below the 23 psi threshold.

It should be noted that most of the aircraft overflight exposures analyzed in the studies mentioned above are different than Navy aircraft overflights. Survey and whale watching aircraft are expected to fly at lower altitudes than typical Navy fixed-wing overflights. Exposure durations would be longer for aircraft intending to observe or follow an animal. These factors might increase the likelihood of a response to survey or whale watching aircraft. Exposure to Navy overflights would be very brief, but the noise levels might be higher based on aircraft type and airspeed.

Aircraft overflights would have no impact on North Atlantic right whale critical habitat since overflights will not contact the critical habitat.

Fixed-Wing Aircraft Overflights

Approximately 1,642 fixed-wing sorties would occur in the JAX Study Area annually under the No Action Alternative and approximately 68 percent of the sorties would be above 5,000 feet. While fixed-wing aircraft operations can occur in Special Use Airspace in the Study Area, a majority of the sorties are associated with Air Combat Maneuver (ACM) training. Under the No Action Alternative, approximately 1,132 ACM sorties (F/A-18 aircraft) would occur annually (average of three sorties per day). Altitudes range from 5,000 to 30,000 feet and typical airspeeds range from very low (less than 100 knots) to high subsonic (less than 600 knots). Sound exposure levels at the sea surface from most ACM overflights are expected to be less than 85 dBA (based on an FA-18 aircraft flying at an altitude of 5,000 feet and at a subsonic airspeed [400 knots]). Some ACM training involves supersonic flight, which produces sonic booms, but such airspeeds are infrequent and occur above 30,000 feet. Approximately 64 fixed-wing aircraft sorties (P-3C aircraft) would occur annually at the Lake George Range under the No Action Alternative as part of Mine Delivery training. Altitudes range from 500 to 3,000 feet above the ground.

Exposure to fixed-wing aircraft noise would be brief (seconds) as an aircraft quickly passes overhead. Exposures would be infrequent based on the transitory and dispersed nature of the overflights; repeated exposure to individual animals over a short period of time (hours or days) is extremely unlikely. Furthermore, the sound exposure levels would be relatively low to marine mammals that spend the majority of their time underwater.

Most observations of cetacean responses to aircraft overflights are from aerial scientific surveys that involve aircraft flying at relatively low altitudes and low airspeeds. Mullin *et al.* (1991) reported that sperm whale reactions to aerial survey aircraft (standard survey altitude of 750 feet) were not consistent. Some sperm whales remained on or near the surface the entire time the aircraft was in the vicinity, while others dove immediately or a few minutes after the sighting.

Smultea *et al.* (2001) reported that a group of sperm whales responded to a circling aircraft (altitude of 800 to 1,100 feet) by moving closer together and forming a fan-shaped semi-circle with

their flukes to the center and their heads facing the perimeter. Several sperm whales in the group were observed to turn on their sides, to apparently look up toward the aircraft. Smultea *et al.* (2008) reported that observed reactions of sperm whales to brief fixed-wing aircraft overflights were short-term and probably of no long-term biological significance. Richter *et al.* (2003) reported that the number of sperm whale blows per surfacing increased when recreational whale watching aircraft were present, but the changes in ventilation were small and probably of little biological consequence. The presence of whale watching aircraft also apparently caused sperm whales to turn more sharply, but did not affect blow interval, surface time, time to first click, or the frequency of aerial behavior (Richter *et al.*, 2003). A review of behavioral observations of baleen whales indicates that whales will either demonstrate no behavioral reaction to an aircraft or, occasionally, display avoidance behavior such as diving (Koski *et al.,* 1998).

Marine mammals exposed to a low-altitude fixed-wing aircraft overflights could exhibit a short-term behavioral response, but not to the extent where natural behavioral patterns would be abandoned or significantly altered. Fixed-wing aircraft overflights are not expected to result in chronic stress because it is extremely unlikely that individual animals would be repeatedly exposed to low altitude overflights.

Fixed-wing aircraft overflights under the No Action Alternative may affect ESA-listed marine mammals, but are not expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, fixed-wing aircraft overflights over territorial waters would have no significant impact on marine mammals. Furthermore, fixed-wing aircraft overflights over non-territorial waters would not cause significant harm to marine mammals in accordance with EO 12114.

Helicopter Overflights

Approximately 734 helicopter sorties would occur in the JAX Study Area annually under this Alternative. Helicopter overflights can occur in the OPAREAs and at the Lake George Range. Unlike fixed-wing aircraft, helicopter training operations often occur at low altitudes (75 to 100 feet), which increases the likelihood that marine mammals would respond.

Very little data are available regarding reactions of cetaceans to helicopters. One study observed that sperm whales showed no reaction to a helicopter until the whales encountered the downdrafts from the rotors (Clarke, 1956). Other species such as bowhead whale and beluga whales show a range of reactions to helicopter overflights, including diving, breaching, change in direction or behavior, and alteration of breathing patterns, with belugas exhibiting behavioral reactions more frequently than bowheads (38% and 14% of the time, respectively) (Patenaude *et al.*, 2002). These reactions were less frequent as the altitude of the helicopter increased to 150 m or higher. Manatees have been shown to exhibit behavioral reactions to helicopters flying below 100 m by abandoning resting behavior and fleeing to deeper water (Rathbun, 1988).

Marine mammals exposed to a low-altitude helicopter overflights could exhibit a short-term behavioral response, but not to the extent where natural behavioral patterns would be abandoned or significantly altered. Helicopter overflights are not expected to result in chronic stress because it is extremely unlikely that individual animals would be repeatedly exposed.

Helicopter overflights under the No Action Alternative may affect ESA-listed marine mammals, but are not expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, helicopter overflights over territorial waters would have no significant

impact on marine mammals. Furthermore, helicopter overflights over non-territorial waters would not cause significant harm to marine mammals in accordance with EO 12114.

Towed Mine Warfare Devices

As described in Section 2 and Appendix D, MIW Exercises are conducted far offshore in the Study Area and include the use of the AN/AQS-20 mine detection system that is towed through the water by helicopters flying approximately 75 feet above the water at low airspeeds. Approximately 78 towed MIW device sorties would occur under the No Action Alternative in the OPAREAs.

While the potential exists for marine mammals to be struck by a towed MIW device, there are no documented instances of this occurring. The probability of a towed MIW device striking a marine mammal would be extremely low based on the low number of sorties and that helicopter crew members monitor the water's surface during training to identify and avoid any objects that might damage the equipment. Based on the low flight altitudes and relatively slow air speeds, it is likely that crew members would be able see marine mammals at or near the surface and avoid them. Marine mammals, at or near the surface may see or hear the oncoming helicopter or feel the downdraft, which could initiate avoidance behavior. The water column disturbance and sound created by the towed MIW device would likely elicit short-term behavioral responses similar to those discussed for vessel movements and aircraft overflights.

The use of towed MIW devices under the No Action Alternative may affect listed marine mammals, but the potential effects of collisions would be discountable because they are extremely unlikely to occur. There would be no effect on the manatee as they are not expected to occur in areas of towed MIW device use. The use of towed MIW devices is not expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, towed device use in territorial waters would have no significant impact on marine mammals. Furthermore, towed device use in non-territorial waters would not cause significant harm to marine mammals in accordance with EO 12114.

MIW devises may temporarily disturb the water column by displacing water; however, these disturbances would be minor and temporary. The water column would return to baseline conditions after the towed array is removed from the immediate vicinity. There would be no permanent impacts to North Atlantic right whale critical habitat.

Munitions Use/Non-Explosive Practice Munitions (NEPM)

Current Navy training operations in the OPAREAs include firing a variety of weapons and employ a variety of NEPM, including bombs, missiles, naval gun shells, cannon shells, and small caliber ammunition. The majority of ordnance fired in the JAX Study Area consists of NEPM (Table 2.2-6). The analysis presented in this section focuses on NEPM, while potential effects of explosive rounds are analyzed below in the explosives section. Training exercises that involve weapons firing and ordnance use take place in several training areas in the OPAREAs (see Table 2.2-6 for a summary of ordnance use by training area). See Section 3.11 for analysis of potential effects at Lake George to West Indian manatees from NEPM strikes.

NEPM Strikes

Direct ordnance strikes and disturbance associated with sound from firing weapons are potential stressors to marine mammals. Ingestion of expended ordnance is also a potential concern for some marine mammal species and is analyzed below under MEM. The primary concern is potential

exposure of marine mammals at or near the water's surface, which could result in injury or mortality.

The potential for marine mammals to be struck by fired ordnance was evaluated using statistical probability modeling as described in Appendix I. Model input values include ordnance use data (frequency and type) and marine mammal density data for each season and training area where ordnance use occurs. The model first calculates the probability of a marine mammal being struck and then calculates the number of exposures (marine mammal/ordnance strikes) for the given season and training area. The model outputs for marine mammal/ordnance strikes are biased by the following assumptions and data/model limitations:

- The model is two-dimensional and assumes that all marine mammals would be at or near the surface 100 percent of the time, when in fact, marine mammals spend up to 90 percent of their time under the water (Costa, 1993).
- The model does not take into account standard mitigation measures used by the Navy to avoid and minimize marine mammal/ordnance strikes.
- The model assumes the animal is stationary and does not account for any movement of the marine mammal or any potential avoidance of the training.

The ordnance strike model is not expected to produce false negatives because the assumptions will more likely produce an overestimate of impacts. A model output of less than one exposure provides a high level of certainty that marine mammals would not be struck and that ordnance strikes would have no effect on marine mammals.

Appendix I provides a breakdown of the model input/output values for each group of marine mammals (for which density estimates are available) by training area where ordnance is fired or released. All model output values for every marine mammal species are substantially less than one (Appendix I), indicating that marine mammal/ordnance strikes are extremely unlikely to occur. The probability of a direct ordnance strike is further reduced by Navy mitigation measures (see Chapter 5).

NEPM use under the No Action Alternative would have no effect on marine mammals. For all marine mammal species, NEPM use is not expected to result in Level A or Level B harassment as defined by the MMPA. NEPM use would have no impact on North Atlantic right whale critical habitat. In accordance with NEPA, NEPM use in territorial waters would have no significant impact on marine mammals. Furthermore, NEPM use in non-territorial waters would not cause significant harm to marine mammals in accordance with EO 12114.

NEPM Disturbance

Sound Transmitted Directly Into the Environment

A gun fired from a ship on the surface of the water propagates a blast wave away from the gun muzzle. This spherical blast wave reflects off and diffracts around objects in its path. As the blast wave hits the water, it reflects back into the air, transmitting a sound pulse back into the water in proportions related to the angle at which it hits the water.

Propagating energy is transmitted into the water in a finite region below the gun. A critical angle (about 13°, as measured from the vertical) can be calculated to determine the region of transmission in relation to a ship and gun (DoN, 2006).

The largest proposed shell size for these operations is a five-inch shell. This will produce the highest pressure and all analysis will be done using this as a conservative measurement of produced and transmitted pressure, assuming that all other smaller ammunition sizes would fall under these levels.

Aboard the USS Cole in June 2000, a series of pressure measurements were taken during the firing of a five-inch gun. Average pressure measured approximately 200 dB with reference pressure of one micro Pascal (dB re: 1 µPa) at the point of the air and water interface. Based on the USS Cole data, down-range peak pressure levels were calculated to be less than 186 dB re: 1 µPa at 100 m (DoN, 2000) and as the distance increases, the pressure would decrease.

In reference to the EFD harassment criteria, the EFD levels (greatest in any 1/3 octave band above 10 Hz) of a 5-inch gun muzzle blast were calculated to be 190 dB re: 1 μPa^2-sec) directly below the gun muzzle decreasing to 170 dB re: 1 µPa2-sec at 100 m (328 feet) into the water (DoN, 2006). The rapid dissipation of the sound pressure wave coupled with the mitigation measures implemented by the Navy (see Chapter 5 for details) to detect marine mammals in the area prior to implementing operations, would result in a blast from a gun muzzle having no effect on ESA-listed marine mammal species. For all marine mammal species, transmitted gunnery sound is not expected to result in Level A or Level B harassment as defined by the MMPA. Gunnery sound would have no impact on North Atlantic right whale critical habitat. In accordance with NEPA there would be no significant impact to marine mammals from transmitted gunnery sound during training exercises within territorial waters. In accordance with EO 12114, there would be no significant harm to marine mammals resulting from transmitted gunnery sound during training exercises in non-territorial waters.

Sound Transmitted Through Ship Hull

A gun blast will also transmit sound waves through the structure of the ship that can propagate into the water. The 2000 study aboard the USS Cole also examined the rate of sound pressure propagation through the hull of a ship (DoN, 2000). The structurally borne component of the sound consisted of low-level oscillations on the pressure time histories that preceded the main pulse, due to the air blast impinging on the water (DoN, 2006).

The structural component for a standard round was calculated to be 6.19 percent of the air blast (DoN, 2006). Given that this component of a gun blast was a small portion of the sound propagated into the water from a gun blast, and far less than the sound from the gun muzzle itself, the transmission of sound from a gun blast through the ship's hull would have no effect on listed marine mammal species and no impact on North Atlantic right whale critical habitat. For all marine mammal species, transmission of sound from a gun blast through the ship's hull is not expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA there would be no significant impact to marine mammals from sound transmitted through a ship hull during training exercises within territorial waters. In accordance with EO 12114, there would be no significant harm to marine mammals resulting from sound transmitted through a ship hull during training exercises in non-territorial waters.

Underwater Detonations and High Explosive Ordnance Use

Overview

Explosions that occur in the OPAREAs are associated with training exercises that use explosive ordnance, including bombs (BOMBEX), missiles (MISSILEX), and naval gun shells (FIREX, IMPASS, 5-inch HE rounds), small arms training (MKA32 anti-swimmer grenades), as well as

underwater detonations associated with Mine Neutralization training (MINEX). Explosive ordnance use and underwater detonations are limited to a few specific training areas (see Table 2.2-7 for a summary of explosions by training area). Water depth in areas where ordnance is fired ranges from about 65 feet to well over 650 feet in areas more than 3 nm offshore. Explosive ordnance would not be used within 3 nm of the Atlantic Ocean shoreline under any of the alternatives. Therefore, underwater detonations and explosive ordance use would have no effect on the manatee.

Effects from exposure to explosives vary depending on the level of exposure. Behavioral responses can include shorter surfacings, shorter dives, fewer blows per surfacing, longer intervals between blows (breaths), ceasing or increasing vocalizations, shortening or lengthening vocalizations, and changing frequency or intensity of vocalizations (NRC, 2005). However, it is not known how these responses relate to significant effects (*e.g.*, long-term effects or population consequences) (NRC, 2005). In addition, animals exposed to thresholds that equate to a TTS, may experience a slight, recoverable loss of hearing sensitivity.

Exposures that result in long-term injuries such as PTS may limit an animal's ability to find food, communicate with other animals, and/or interpret the environment around them. Impairment of these abilities can decrease an individual's chance of survival or impact their ability to successfully reproduce. Mortality of an animal would remove the animal entirely from the population as well as eliminate any future reproductive potential.

An explosive analysis was conducted to estimate the number of marine mammals that could be exposed to impacts from explosions. Appendix J contains a technical report describing the scientific basis, methods, and assumptions of the explosive analysis. Tables 3.7-15 and 3.7-16 provide a summary of the explosive analysis results for the No Action Alternative. For each species, in order to determine the total non-injurious (MMPA Level B) potential exposures for all operations, the two columns for non-injurious exposures (182 dB criteria for TTS and 177 dB criteria for behavioral disruption) need to be added together between the two tables (Tables 3.7-15 and 3.7-16). For each species, the total for injurious (MMPA Level A) potential exposures can be determined by adding the 205 dB re 1 mPa2-s/13 psi columns together between the two tables. For each species, the total mortality potential exposures can be determined by adding the 30.5 psi columns together between the two tables. No mortality potential exposures are predicted.

TABLE 3.7-15
SUMMARY OF POTENTIAL EXPOSURES FROM SINGLE DETONATION EXPLOSIVE ORDNANCE (PER YEAR) FOR MARINE MAMMALS IN THE JAX STUDY AREA—NO ACTION ALTERNATIVE

Species/Training Operation	Potential Exposures @ 182 dB re μPa^2-s or 23 psi (peak)	Potential Exposures @ 205 dB re μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Fin whale			
BOMBEX (MK-84/MK-20)	0	0	0
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0

TABLE 3.7-15 (Continued)
SUMMARY OF POTENTIAL EXPOSURES FROM SINGLE DETONATION EXPLOSIVE ORDNANCE (PER YEAR) FOR MARINE MAMMALS IN THE JAX STUDY AREA—NO ACTION ALTERNATIVE

Species/Training Operation	Potential Exposures @ 182 dB re μPa^2-s or 23 psi (peak)	Potential Exposures @ 205 dB re μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Humpback whale			
BOMBEX (MK-84/MK-20)	0	0	0
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
North Atlantic right whale			
BOMBEX (MK-84/MK-20)	0	0	0
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Sperm whale			
BOMBEX (MK-84/MK-20)	0	0	0
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Atlantic Spotted dolphin			
BOMBEX (MK-84/MK-20)	0	0	0
MISSILEX training	14	1	0
MINEX training	3	0	0
Total Exposures	17	1	0
Beaked whale			
BOMBEX (MK-84/MK-20)	0	0	0
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Bottlenose dolphin			
BOMBEX (MK-84/MK-20)	19	1	0
MISSILEX training	1	0	0
MINEX training	3	1	0
Total Exposures	23	2	0
Clymene dolphin			
BOMBEX (MK-84/MK-20)	0	0	0
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0

TABLE 3.7-15 (Continued)
SUMMARY OF POTENTIAL EXPOSURES FROM SINGLE DETONATION EXPLOSIVE ORDNANCE (PER YEAR) FOR MARINE MAMMALS IN THE JAX STUDY AREA—NO ACTION ALTERNATIVE

Species/Training Operation	Potential Exposures @ 182 dB re μPa^2-s or 23 psi (peak)	Potential Exposures @ 205 dB re μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Common dolphin			
BOMBEX (MK-84/MK-20)	0	0	0
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Kogia spp.			
BOMBEX (MK-84/MK-20)	0	0	0
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Minke whale			
BOMBEX (MK-84/MK-20)	0	0	0
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Pantropical spotted dolphin			
BOMBEX (MK-84/MK-20)	1	0	0
MISSILEX training	1	0	0
MINEX training	0	0	0
Total Exposures	2	0	0
Pilot whales			
BOMBEX (MK-84/MK-20)	1	0	0
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	1	0	0
Risso's dolphin			
BOMBEX (MK-84/MK-20)	0	0	0
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Rough-toothed dolphin			
BOMBEX (MK-84/MK-20)	0	0	0
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0

TABLE 3.7-15 (Continued)
SUMMARY OF POTENTIAL EXPOSURES FROM SINGLE DETONATION EXPLOSIVE ORDNANCE (PER YEAR) FOR MARINE MAMMALS IN THE JAX STUDY AREA—NO ACTION ALTERNATIVE

Species/Training Operation	Potential Exposures @ 182 dB re μPa^2-s or 23 psi (peak)	Potential Exposures @ 205 dB re μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Striped dolphin			
BOMBEX (MK-84/MK-20)	0	0	0
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0

TABLE 3.7-16
SUMMARY OF POTENTIAL EXPOSURES FROM MULTIPLE DETONATION EXPLOSIVE ORDNANCE (PER YEAR) FOR MARINE MAMMALS IN THE JAX STUDY AREA—NO ACTION ALTERNATIVE

Species/Training Operation	**Potential Exposures @ 177 dB r μPa^2-s (multiple detonations only)**	**Potential Exposures @ 205 dB r μPa^2-s or 13 psi-ms**	**Potential Exposures @ 30.5 psi-ms**
Fin whale			
BOMBEX (MK-82/83)	0	0	0
FIREX training	0	0	0
Small Arms (grenades)	0	0	0
Total Exposures	0	0	0
Humpback whale			
BOMBEX (MK-82/83)	1	0	0
FIREX training	0	0	0
Small Arms (grenades)	0	0	0
Total Exposures	1	0	0
North Atlantic right whale			
BOMBEX (MK-82/83)	0	0	0
FIREX training	0	0	0
Small Arms (grenades)	0	0	0
Total Exposures	0	0	0
Sperm whale			
BOMBEX (MK-82/83)	0	0	0
FIREX training	0	0	0
Small Arms (grenades)	0	0	0
Total Exposures	0	0	0

TABLE 3.7-16
SUMMARY OF POTENTIAL EXPOSURES FROM MULTIPLE DETONATION EXPLOSIVE ORDNANCE (PER YEAR) FOR MARINE MAMMALS IN THE JAX STUDY AREA—NO ACTION ALTERNATIVE (Continued)

Species/Training Operation	Potential Exposures @ 177 dB r μPa^2-s (multiple detonations only)	Potential Exposures @ 205 dB r μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Atlantic Spotted dolphin			
BOMBEX (MK-82/83)	0	0	0
FIREX training	23	1	0
Small Arms (grenades)	6	0	0
Total Exposures	29	1	0
Beaked whale			
BOMBEX (MK-82/83)	1	0	0
FIREX training	0	0	0
Small Arms (grenades)	0	0	0
Total Exposures	1	0	0
Bottlenose dolphin			
BOMBEX (MK-82/83)	920	24	0
FIREX training	10	0	0
Small Arms (grenades)	8	0	0
Total Exposures	938	24	0
Clymene dolphin			
BOMBEX (MK-82/83)	13	0	0
FIREX training	1	0	0
Small Arms (grenades)	0	0	0
Total Exposures	14	0	0
Common dolphin			
BOMBEX (MK-82/83)	0	0	0
FIREX training	0	0	0
Small Arms (grenades)	0	0	0
Total Exposures	0	0	0
Kogia spp.			
BOMBEX (MK-82/83)	1	0	0
FIREX training	0	0	0
Small Arms (grenades)	0	0	0
Total Exposures	1	0	0
Minke whale			
BOMBEX (MK-82/83)	0	0	0
FIREX training	0	0	0
Small Arms (grenades)	0	0	0
Total Exposures	0	0	0

TABLE 3.7-16
SUMMARY OF POTENTIAL EXPOSURES FROM MULTIPLE DETONATION EXPLOSIVE ORDNANCE (PER YEAR) FOR MARINE MAMMALS IN THE JAX STUDY AREA—NO ACTION ALTERNATIVE (Continued)

Species/Training Operation	Potential Exposures @ 177 dB r μPa^2-s (multiple detonations only)	Potential Exposures @ 205 dB r μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Pantropical spotted dolphin			
BOMBEX (MK-82/83)	27	1	0
FIREX training	1	0	0
Small Arms (grenades)	1	0	0
Total Exposures	29	1	0
Pilot whales			
BOMBEX (MK-82/83)	60	2	0
FIREX training	1	0	0
Small Arms (grenades)	0	0	0
Total Exposures	61	2	0
Risso's dolphin			
BOMBEX (MK-82/83)	20	1	0
FIREX training	3	0	0
Small Arms (grenades)	0	0	0
Total Exposures	23	1	0
Rough-toothed dolphin			
BOMBEX (MK-82/83)	1	0	0
FIREX training	0	0	0
Small Arms (grenades)	0	0	0
Total Exposures	1	0	0
Striped dolphin			
BOMBEX (MK-82/83)	0	0	0
FIREX training	0	0	0
Small Arms (grenades)	0	0	0
Total Exposures	0	0	0

Summary of Exposure Results for Individual Marine Mammals

Humpback whales, Atlantic spotted dolphins, beaked whales, bottlenose dolphins, Clymene dolphins, *Kogia* spp., pantropical spotted dolphins, pilot whales, Risso's dolphins and rough-toothed dolphins may be exposed at levels that could result in behavioral disturbance (Table 3.7-16, 177 dB column). Atlantic spotted dolphins, bottlenose dolphins, pantropical spotted dolphins, and pilot whales may be exposed at levels that could result in temporary threshold shift, or non-injurious physiological effects (Table 3.7-15, 182 dB/23 psi column). Atlantic spotted dolphins, bottlenose dolphins, pantropical spotted dolphins, pilot whales and Risso's dolphins may be exposed at levels that could result in permanent threshold shift, or injurious physiological effects (Tables 3.7-15 and 3.7-16, 205 dB/13 psi column). No marine mammal species are expected to be exposed to levels that would result in mortality.

Exposure estimates could not be calculated for several species (blue whale, sei whale, Bryde's whale, killer whale, pygmy killer whale, false killer whale, melon-headed whale, spinner dolphin, and Fraser's dolphin) because density data could not be calculated due to the limited available data for these species. However, the likelihood of exposure should be even lower than that estimated for other species with given densities since they are less likely to occur in the JAX Study Area. Therefore, no exposures are expected for these species. In addition to the low likelihood of exposure, mitigation measures presented in Chapter 5 will be implemented prior to the release of ordnance.

Effects on Marine Mammal Populations

Effects from the use of explosive ordnance are not anticipated to have lasting impacts on any marine mammal population due to the following factors:

- Most exposures are within the non-injurious TTS or behavioral effects zones.
- Although the numbers presented in Tables 3.7-15 and 3.7-16 represent estimated harassment and injury, as described above, they are probably over estimates as the model calculates harassment without taking into consideration standard mitigation measures.

The mitigation measures described in Chapter 5 are designed to reduce exposure of marine mammals to potential impacts to achieve the least practicable adverse effect on marine mammal species or populations. Lookouts will monitor the area before ordnance is used. Fin, humpback whales, and sperm whales will have high detections rates at the surface because of their large body size and pronounced blows. Because of large group sizes, it is likely that lookouts would detect Atlantic spotted dolphins, bottlenose dolphins, Clymene, pantropical spotted dolphins, Risso's dolphins and rough-toothed dolphins. Implementation of mitigation measures will reduce the likelihood of exposure and potential effects.

Endanger Species Act Conclusions

Even though no exposures are predicted for certain ESA-listed species, a may affect determination has been made for all ESA-listed species that may occur in the vicinity of the activity. Underwater detonations and explosive ordnance use under the No Action Alternative may affect fin, North Atlantic right whales, sei, blue, humpback, and sperm whales. However, the effects on blue and sei whales are most likely discountable based on the low likelihood of encountering these species in the Study Area. Manatees are not expected to occur greater than 3 nm offshore in the OPAREAs,

therefore underwater detonations and explosive ordnance use under the No Action Alternative will have no effect on the manatee.

Marine Mammal Protection Act Conclusions

Exposure estimates for underwater detonations indicate potential for Level A and Level B harassment as defined by MMPA. No exposures would result in mortality. Although there may be impacts to individual marine mammals, the impacts at the population, stock, or species level would be negligible.

National Environmental Policy Act and Executive Order 12114 Conclusions

The analysis presented above indicates that underwater detonations and explosive ordnance use under the No Action Alternative would affect individual marine mammals, but any effects observed at the population, stock, or species level would be negligible. Therefore, in accordance with NEPA there would be no significant impact to marine mammals from underwater detonations and explosive ordnance use during training exercises within territorial waters. In accordance with EO 12114, there would be no significant harm to marine mammals resulting from underwater detonations and explosive ordnance use during training exercises in non-territorial waters.

Military Expended Material

Ordnance-Related Material

Ordnance-related material includes various sizes of non-explosive training rounds and shrapnel from explosive rounds (Tables 2.2-5 and 2.2-6). The solid metal material would quickly move through the water column and settle to the sea floor. The analyses presented in Sections 3.2.3 and 3.3.3 indicate that this material would become encrusted by natural processes and incorporated into the seafloor, with no significant accumulations in any particular area and no negative effects to water quality. However, benthic foraging marine mammals could be exposed to expended ordnance through ingestion. Ingestion of expended ordnance is not expected to occur in the water column because ordnance quickly sinks. Some materials such as an intact non-explosive training bomb would be too large to be ingested by a marine mammal, but many materials such as cannon shells, small caliber ammunition, and shrapnel are small enough to be ingested. Records indicate that generally metal debris ingested by marine mammals are small (e.g., fishhooks, bottle caps, metal spring; (Walker and Coe, 1990; Laist, 1997). The effects of ingesting solid metal objects on marine mammals are unknown. A documented instance indicates that certain types of metal debris, in this case a lead sinker, may cause toxicosis in marine mammals (Zabka *et al*., 2006). Ordnance materials, made of different alloys than a sinker, would not necessarily cause a similar physiological reaction. Another instance of lead toxicosis was documented in a captive bottlenose dolphin that had ingested 55 air gun pellets (which contain 40% lead) resulting in mortality (Schlosberg *et al*. 1997). Expended ordnance which contains lead may have the potential to induce toxicosis in marine mammals in some circumstances. Ingestion of marine debris in general can also cause digestive tract blockages or damage the digestive system (Gorzelany, 1998; Stamper et al., 2006). Relatively small objects with smooth edges such a cannon shell or small caliber ammunition might pass through the digestive tract without causing harm, while a piece of metal shrapnel with sharp edges would be more likely to cause damage.

The potential for ordnance ingestion depends on species-specific feeding habitats. Blue, fin, North Atlantic right, and sei whales feed at the surface or in the water column and would not ingest ordnance from the bottom. While humpback whales feed predominantly by lunging through the

water after krill and fish, there have been instances of humpback whales disturbing the bottom in an attempt to flush prey, the northern sand lance (*Ammodytes dubius*) (Hain *et al.*, 1995). This behavior has been observed on Stellwagen Bank off eastern Massachusetts. Although observations of humpback whales feeding in mid-Atlantic waters (Swingle *et al.*, 1993; Smith *et al.*, 1996) have led to the supposition that a supplemental winter feeding ground may exist in the U.S. mid-Atlantic (Barco *et al.*, 2002), humpback whale feeding primarily takes place farther north than the OPAREAs (CETAP, 1982; Whitehead, 1982; Kenney and Winn, 1986; Weinrich *et al.*, 1997). Humpback whales are not expected to ingest ordnance because feeding in the JAX Study Area would be limited and they primarily feed in the water column. Manatees are not expected in areas where ordnance is used. Ordnance ingestion under the No Action Alternative would have no effect on the manatee, blue whale, fin whale, humpback whale, North Atlantic right whale, or sei whale.

Although sperm whales feed predominantly on cephalopods, they also frequently feed on or near the bottom (Whitehead *et al.*, 1992). In doing so, animals will ingest non-food items such as rocks and sand (NMFS, 2006). Sperm whales are known to incidentally ingest foreign objects while foraging (Walker and Coe, 1990), suggesting that the potential exists to ingest debris that has settled on the ocean floor as a result of the proposed activities. Sperm whales display a strong offshore preference (Rice, 1989) and are mostly associated with waters over the continental shelf edge, continental slope, and offshore waters (CETAP, 1982; Hain *et al.,* 1985; Smith *et al.*, 1996; Waring *et al.*, 2001; Davis *et al.,* 2002). Consequently, the likelihood that a sperm whale would encounter and subsequently ingest a piece of expended ordnance is extremely low. Ordnance ingestion under the No Action Alternative may affect sperm whales, but the effects would be considered discountable because ingestion is extremely unlikely to occur.

Most non-listed marine mammal species feed at the surface or in the water column and would have a little chance of encountering expended ordnance on the bottom. Baleen and toothed whales, which feed at the surface or in the water column, would not be expected to ingest ordnance from the bottom. Beaked whales have exhibited bottom feeding behavior using suction feeding techniques (MacLeod *et al*., 2003) and are known to incidentally ingest foreign objects while foraging (Walker and Coe, 1990). Although the potential exists for ingestion of expended ordnance, the amount of ordnance that an animal would encounter is low. In addition, an animal would not likely ingest every piece of ordnance that it encounters. Thus, it is unlikely that an animal would both encounter and ingest ordnance. Ordnance related materials are not expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, ordnance related materials would have no significant impact on marine mammals in territorial waters. Furthermore, ordnance related materials would not cause significant harm to marine mammals in non-territorial waters in accordance with Executive Order 12114.

Ordnance will sink quickly through the water column, causing only temporary impacts. Once it hits the sea floor they may impact critical habitat.

Upon striking the sea floor, the exercise components may disturb existing benthic communities, sediment, or other bottom habitat. This may result in temporary changes, such as increased turbidity which would not permanently impact critical habitat. However, the disturbance may be longer term or even permanent if the sea floor habitat is destroyed by being directly struck.

These components may also change the topography of the benthic habitat by creating craters due to impacts or increasing the height of the sea floor through displacement of sediment or presence of the material themselves.

Once on the sea floor, ordnance will become part of the marine environment until broken down by natural processes. Their presence will alter the long-term make up of the benthic habitat, possibly alter water quality, and add anthropogenic foreign objects to the marine environment.

Ordnance may impact North Atlantic right whale critical habitat. Although the water column may be disrupted on a very short-term basis, it is unlikely that the reproductive behaviors of the North Atlantic right whale will be altered. Impacts to the sea floor may be longer term in nature; however, they are unlikely to affect the function of the right whale calving ground critical habitat. Therefore, the proposed actions may alter North Atlantic critical habitat, but is not likely to destroy or adversely modify critical habitat.

Target Related Material

A variety of at-sea targets are used in the JAX Study Area, ranging from high-tech remotely operated airborne and surface targets (*e.g.*, airborne drones and Seaborne Powered Targets) to low-tech floating at-sea targets (*e.g.*, inflatable targets, 55-gallon metal drums) and airborne towed banners. Many of the targets are designed to be recovered for reuse and are not destroyed during training because ordnance is set to detonate before impacting the target. The only expendable airborne targets used in the Study Area are Tactical Air-Launched Decoys, which are non-powered, constructed of extruded aluminum, weigh about 400 lbs, and are about 7 feet long. Expendable targets such as floating at-sea inflatable targets are recovered after use and properly disposed of onshore. Some targets such as 55-gallon metal drums cannot be recovered and sink to the sea floor after use. Unrecoverable floating material generated by target use are expected to be minimal. Descriptions of the targets used in the JAX Study Area and information on fate and transport are provided in Section 3.2.

As previously discussed for ordnance related material, species that feed on or near the bottom (*i.e.*, sperm whales and beaked whales) may encounter an expended target while feeding; however, the size of the target would prohibit any listed species from ingesting it. Therefore, the use of targets under the No Action Alternative would have no effect on listed marine mammals. Targets are not expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, targets would have no significant impact on marine mammals in territorial waters. Furthermore, targets would not cause significant harm to marine mammals in non-territorial waters in accordance with EO 12114.

Targets will sink quickly through the water column, causing only temporary impacts. Once they hit the sea floor they may impact critical habitat.

Upon striking the sea floor, the exercise components may disturb existing benthic communities, sediment, or other bottom habitat. This may result in temporary changes, such as increased turbidity which would not permanently impact critical habitat. However, the disturbance may be longer term or even permanent if the sea floor habitat is destroyed by being directly struck.

These components may also change the topography of the benthic habitat by creating craters due to impacts or increasing the height of the sea floor through displacement of sediment or presence of the material themselves.

Once on the sea floor, targets will become part of the marine environment until broken down by natural processes. Their presence will alter the long-term make up of the benthic habitat, possibly alter water quality, and add anthropogenic foreign objects to the marine environment.

Targets may impact North Atlantic right whale critical habitat. Although the water column may be disrupted on a very short-term basis, it is unlikely that the reproductive behaviors of the North Atlantic right whale will be altered. Impacts to the sea floor may be longer term in nature; however, they are unlikely to affect the function of the right whale calving ground critical habitat. Therefore, the proposed actions may alter North Atlantic critical habitat, but is not likely to destroy or adversely modify critical habitat.

Chaff Fibers, End-Caps, and Pistons

Radiofrequency chaff (chaff) is an electronic countermeasure designed to reflect radar waves and obscure aircraft, ships, and other equipment from radar tracking sources. Chaff is composed of an aluminum alloy coating on glass fibers of silicon dioxide. The coating is about 99.4 percent aluminum by weight and contains negligible amounts of silicon, iron, copper, manganese, magnesium, zinc, vanadium, and titanium (USAF, 1997). These aluminum-coated glass fibers (about 60% silica and 40% aluminum by weight) range in lengths of 0.8 to 7.5-cm with a diameter of about 40 micrometers. Chaff is released or dispensed from military vehicles in cartridges or projectiles that contain millions of chaff fibers. When deployed, a diffuse cloud of fibers is formed that is undetectable to the human eye. Chaff is a very light material that can remain suspended in air anywhere from 10 minutes to 10 hours and can travel considerable distances from its release point, depending on prevailing atmospheric conditions (USAF, 1997; Arfsten *et al.*, 2002). Doppler radar has tracked chaff plumes containing approximately 900 grams of chaff drifting 200 miles from the point of release with the plume covering a volume of greater than 400 cubic miles (Arfsten *et al.*, 2002).

Various types of chaff systems are used in the JAX Study Area. Fixed-wing aircraft use RR-144A/AL and R-129 chaff cartridges, which contain about 150 grams of chaff or about five million fibers. For each cartridge used, a plastic end-cap and Plexiglas piston is released into the environment in addition to the chaff fibers. The end-cap and piston are both round and are 1.3 inches in diameter and 0.13 inches thick (Spargo, 2007). As summarized in Table 3.7-24, a total of 3,770 RR-144A/AL and R-129 cartridges would be used per year under the No Action Alternative. The amount of chaff used on any given day varies based on scheduled training events and could range from 0 to 360 cartridges per day.

Ships use MK-214 or MK-216 Super Rapid Off-board Chaff. The MK-214 contains about 11 kg of chaff or more than 360 million fibers, while the MK-216 contains about 7.6 kg of chaff or more than 250 million fibers. The RR-181/AL chaff cartridge is also used for ship protection, but is deployed from a helicopter. It contains about 7.3 kg of chaff or more than 240 million fibers. As summarized in Table 3.7-24, a total of 404 MK-214, MK-216, and RR-181/AL cartridges would be used per year in the JAX Study Area.

Based on the dispersion characteristics of chaff, large areas of open water within the OPAREAs would be exposed to chaff, but the chaff concentrations would be low. For example, Hullar *et al.* (1999) calculated that a 4.97 miles by 7.46 miles (37.1 mi^2 or 28 nm^2) area would be affected by deployment of a single cartridge containing 150 grams of chaff. The resulting chaff concentration would be about 5.4 g/nm^2. This corresponds to less than 179,000 $fibers/nm^2$ or less than 0.005 $fibers/ft^2$, assuming that each canister contains five million fibers.

The chaff concentrations that marine life could be exposed to following release of multiple cartridges (*e.g.*, following a single day of training) is difficult to accurately estimate because it depends on several unknown factors. First of all, specific release points are not recorded and tend

to be random, and chaff dispersion in air depends on prevailing atmospheric conditions. After falling from the air, chaff fibers would be expected to float on the sea surface for some period of time depending on wave and wind action. The fibers would be dispersed farther by sea currents as they float and slowly sink toward the bottom. Chaff concentrations in benthic habitats following release of a single cartridge would be lower than the values noted above based on dispersion by currents and the enormous dilution capacity of the receiving waters. Some fibers may become entrained in *Sargassum* mats and remain at or near the surface for longer periods of time. Consequently, chaff concentrations in *Sargassum* mats might be higher than those in the water column or on the bottom.

Table 3.7-17 summarizes changes in chaff use and relative environmental concentrations that could occur under the proposed action. Note that the relative environmental concentrations presented in Table 3.7-17 are based on the assumption that chaff would be evenly distributed in the area where it is used, and are primarily presented for comparison purposes. Actual concentrations would depend on the factors discussed above and would be dynamic. Nonetheless, actual chaff concentrations are expected to be low. For example, a chaff concentration of 1.8 fibers/ft2 would be expected given a totally unrealistic (worst-case) assumption of simultaneous release of 360 RR-144A/AL chaff cartridges at a single release point.

Several literature reviews and controlled experiments have indicated that chaff poses little environment risk except at concentrations substantially higher than those that could reasonably occur from military training use (Arfsten *et al.*, 2002, Hullar *et al.*, 1999, and USAF, 1997). Nonetheless, some marine mammal species within the JAX Study Area could be exposed to chaff through direct body contact, inhalation, and ingestion. As discussed in more detail below, chemical alteration of water and sediment resulting from decomposition of chaff fibers is not expected to result in exposure.

TABLE 3.7-17
CHAFF USE AND RELATIVE ENVIRONMENTAL CONCENTRATIONS PER ALTERNATIVE THAT COULD OCCUR UNDER THE PROPOSED ACTION

Annual Chaff Use and Relative Concentration1	No Action	Alternative 1	Alternative 2
JAX and Charleston OPAREAs - RR-144A/AL and R-129 Cartridges			
Number of Cartridges	3,770	4,150	4,150
Chaff Released (kg/year)	566	623	623
Relative Chaff Concentration (kg/nm^2/year)1	0.181	0.199	0.199
Relative Chaff Concentration (fibers/nm2/year)1	6,032,000	6,640,000	6,640,000
Number of End-caps and Pistons	7,450	8,300	8,300
Relative End-cap/Piston Concentration (pieces/nm^2/year)1	2.4	2.7	2.7
JAX and Charleston OPAREAs – MK-214, MK-216, and RR-181/AL Cartridges			
Number of Cartridges	404	453	453
Chaff Released (kg/year)	4,088	4,583	4,583
Relative Chaff Concentration (kg/nm2/year)2	0.082	0.091	0.091
Relative Chaff Concentration (fibers/nm2/year)2	2,720,437	3,049,511	3,049,511

[1]Concentration based on even dispersion in W-157A (3,125 nm^2).

[2]Concentration based on even dispersion in JAX/Charleston OPAREAs (50,090 nm^2).

Based on the dispersion characteristics of chaff it is likely that marine mammals would occasionally come in direct contact with chaff fibers while at the water's surface and while submerged, but such contact would be inconsequential. Chaff is similar in form to fine human hair (USAF, 1997). Due to its flexible nature and softness, external contact with chaff would not be expected to adversely affect most wildlife (USAF, 1997) and the fibers would quickly wash off shortly after contact. Given the properties of chaff, skin irritation is not expected to be a problem (USAF, 1997).

The potential exists for marine mammals to inhale chaff fibers if they are at the surface while chaff is airborne. Arfsten *et al.* (2002), Hullar *et al.* (1999), and USAF (1997) reviewed the potential effects of chaff inhalation on humans, livestock, and animals and concluded that the fibers are too large to be inhaled into the lung. If inhaled, the fibers are predicted to be deposited in the nose, mouth, or trachea and are either swallowed or expelled. However, these reviews did not specifically consider marine mammals. It is possible that marine mammals, particularly large whales, could inhale chaff fibers into the lung based on their size and respiratory system characteristics.

In terrestrial environments chaff fibers could break into smaller particles by various physical processes. If resuspended, the small particles could be available for inhalation (USAF, 1997). However, this is not a concern in the marine environment because chaff fibers would not break up on the water's surface or be resuspended. Any effects of chaff inhalation on marine mammals are considered insignificant given the low concentration of airborne fibers (1.8 fibers/ft^2 for a worst-case scenario of 360 chaff cartridges simultaneously released at a single drop point), and the fact that marine mammals spend significant time submerged.

Based on the small size of chaff fibers, it appears unlikely that marine mammals would confuse the fibers with prey items or purposefully feed on chaff fibers. However, marine mammals could occasionally ingest low concentrations of chaff incidentally from the surface, water column, or sea floor. While no studies have been conducted to evaluate the effects of chaff ingestion on marine mammals, the effects are expected to be negligible based the low concentrations that could reasonably be ingested, the small size of chaff fibers, and available data on the toxicity of chaff and aluminum. In laboratory studies conducted by the University of Delaware (Systems Consultants, 1977), blue crabs and killifish were fed a food-chaff mixture daily for several weeks and no significant mortality was observed at the highest exposure treatment (1,000 times the exposure level expected to be found in Chesapeake Bay). Similar results were found when chaff was added directly to exposure chambers containing filter-feeding menhaden. Histological examination indicated no damage by chaff exposures. A study on cows that were fed chaff found no evidence of digestive disturbance or other clinical symptoms (USAF, 1997).

Silicon dioxide, also known as silica, is an abundant compound in nature prevalent in soil, rocks, and sand (USAF, 1997). Silicon is the second most abundant element in the earth's crust, making up approximately 28.2 percent by weight (Jefferson Lab, 2007). As such, the diet of benthic foraging marine animals that routinely ingest sediment while feeding likely contains relatively high concentrations of silicon dioxide. Silicon dioxide is chemically unreactive in the environment (USEPA, 1991) and the acute and chronic oral toxicity of silicon dioxide is low. No significant toxicity or mortality has been reported in animals given doses of up to 3,000 mg/kg of body weight per day (EVM, 2003). No observed adverse effect levels of 2,500 and 7,500 mg/kg of body weight per day were obtained for mice and rats, respectively in long-term studies (up to 24 months) (Takizawa *et al*., 1988).

Aluminum is the third most abundant element in the earth's crust, making up approximately 8.2 percent by weight (Jefferson Lab, 2007). Similar to silicon dioxide, the diet of benthic foraging marine animals that routinely ingest sediment while feeding likely contains relatively high concentrations of aluminum. Aluminum can be toxic if ingested in high doses. Aluminum toxicosis in domestic animals is largely expressed as secondary phosphorus deficiency, presumably because it binds phosphorus in an unabsorbable complex in the intestine (NRC, 1980). Signs of phosphorus deficiency have been observed in sheep, chicks, rats, and mice receiving high levels of dietary aluminum (as summarized in NRC, 1980).

Scheuhammer (1987) reviewed the metabolism and toxicology of aluminum in birds and terrestrial mammals. Intestinal absorption of orally ingested aluminum salts was very poor, and the small amount absorbed was almost completely removed from the body by excretion in urine. Rats and mice presented with a moderately high dietary aluminum content (160 to 335 mg/kg) excreted most of it in the feces (NRC, 1980). However, aluminum can be deposited in the liver, skeleton, brain, and other tissues, and the amount of aluminum retained is positively related to the amount consumed (NRC, 1980). High concentrations of aluminum have been found in the stomach content, liver, and brain of stranded gray whales (Varanasi *et al.*, 1993) and in the stomach content of subsistence harvested (presumably healthy) gray whales (Tilbury *et al.*, 2002), which appears to be consistent with the ingestion of sediments by this benthic foraging species. The aluminum concentrations in brain tissue of gray whales are within the range for some terrestrial mammals that may receive high concentrations of aluminum in their diets, suggesting a broad range in tolerance to aluminum in mammals (Varanasi *et al.*, 1993).

Dietary aluminum normally has small effects on healthy birds and terrestrial mammals, and often high concentrations (>1,000 mg/kg) are needed to induce effects such as impaired bone development, reduced growth, and anemia (Nybo, 1996). Studies suggest that the maximum tolerable level of aluminum for cattle and sheep is about 1,000 mg/kg (of body weight) (NRC, 1980). A marine animal weighing 1 kg would need to ingest more than 83,000 chaff fibers per day to receive a daily aluminum dose equal to 1,000 mg/kg (based on chaff consisting of 40% aluminum by weight and a 150-g chaff canister containing 5 million fibers). An adult male sperm whale weighing 40,800 kg would need to ingest more than 3 billion chaff fibers per day to receive a daily aluminum dose equal to 1,000 mg/kg. It is highly unlikely that a marine mammal would ingest a toxic dose of chaff based on the anticipated environmental concentration of chaff (1.8 fibers/ft^2 for a worst-case scenario of 360 chaff cartridges simultaneously released at a single drop point).

Marine mammals would not be indirectly affected by changes in water quality resulting from the degradation of chaff in water. Any changes in water quality from chaff use would be negligible based on the low concentration of chaff, the slow rate at which it degrades in saltwater (USAF, 1997), and the enormous dilution capacity of the receiving waters of the OPAREAs. In addition, available data indicate that chaff is relatively non-toxic in marine environments. Laboratory toxicity tests conducted using two marine indicator organisms (mysid shrimp and sheepshead minnow) indicated that chaff is not acutely toxic at concentrations greater than 1,000 mg/L (Haley and Kurnas, 1992). The bioavailability and toxicity of aluminum is relatively low in marine environments compared to freshwater environments because of the high pH levels and high calcium and sodium concentrations in saltwater (Lydersen and Lofgren, 2002). The USEPA has not designated aluminum as a priority pollutant and has not established ambient water quality criteria for aluminum in saltwater (USEPA, 2007). A review of numerous toxicological studies indicated that the principal components of chaff are unlikely to have significant effects on humans

and the environment based on the general toxicity of the components, the dispersion patterns, and the unlikelihood of the components to interact with other substances in nature to produce synergistic toxic effects (USAF, 1997). In addition, available evidence suggests that chaff use does not result in significant accumulation of aluminum in sediments even after prolonged training. Sediment samples collected from an area of the Chesapeake Bay where chaff has been used for approximately 25 years indicated that aluminum concentrations in sediments were not significantly different than background concentrations (Wilson *et al.*, 2002).

Chaff cartridge plastic end-caps and pistons would also be released into the marine environment, where they could persist for long periods and could be ingested by marine mammals. Chaff end-caps and pistons sink in saltwater (Spargo, 2007), which reduces the likelihood of ingestion by marine mammals at the surface or in the water column. As discussed above for ordnance-related material, the sperm whale is the only listed marine mammal species expected to routinely forage on or near the bottom. Sperm whales are known to ingest anthropogenic debris similar to the end-caps and pistons during the course of feeding (Walker and Coe, 1990; Laist, 1997); however, this does not always result in negative consequences to health or vitality (Walker and Coe, 1990). Walker and Coe (1990) theorized that for larger animals, such as beaked whales, it would take a high volume of foreign debris to result in death or debilitation resulting from impaction. This can be extrapolated to sperm whales as well. Based on the small size of chaff end-caps and pistons (1.3-inch diameter, 0.13-inch thick), it appears unlikely that sperm whales would confuse them with prey items or purposefully feed on them. The likelihood of a sperm whale ingesting an end-cap or piston appears to be extremely low based on the number of pieces released per year (3,770), the low environmental concentration (2.4 pieces/nm^2/year), and the fact that sperm whale foraging is expected to be limited to areas east of the continental shelf break. If ingested, it is likely that the small, round end-cap or piston would be excreted without causing harm. Sperm whales primarily feed on squid and their digestive systems are capable of excreting indigestible squid beaks. However, ingestion of foreign material has been noted to result in negative consequences to marine mammals, including mortality, due to disruption of the digestive tract and/or intestinal blockage (Stamper, *et al.*, 2006; Gorzelany, 1998). Documented instances of this are rare, particularly for smaller items (Laist, 1997; Walker and Coe, 1990). Although instances of impacts from ingestion of debris have been recorded, the low concentration and minimal likelihood that a sperm whale would ingest an end-cap or piston make the potential effects discountable.

Chaff use under the proposed action may affect blue, fin, humpback, North Atlantic right, sei, and sperm whales. Manatees are not expected in areas where chaff is used and chaff would not be expectd to drift over miles into manatee habitat, therefore, chaff would have no effect on this species. Chaff is not expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, chaff would have no significant impact on marine mammals in territorial waters. Furthermore, chaff would not cause significant harm to marine mammals in non-territorial waters in accordance with EO 12114.

Chaff would temporarily impact the water surface and water column after its release until it sinks and settles on the bottom. The timetable may vary, but these impacts would only last a finite period of time. End-caps and pistons would sink rapidly through the water column to the sea floor causing only temporary impacts.

Once on the sea floor, chaff, end-caps, and pistons will become part of the marine environment until broken down by natural processes. Their presence will alter the long-term make up of the

benthic habitat, possibly alter water quality, and add anthropogenic foreign objects to the marine environment.

Although the water column may be disrupted on a very short-term basis, it is unlikely the reproductive behaviors of the North Atlantic right whale would be altered. Impacts to the sea floor may be longer term in nature; however, they are unlikely to affect the function of the right whale calving ground critical habitat. Therefore, the proposed actions may alter North Atlantic critical habitat, but is not likely to destroy or adversely modify critical habitat.

Self-Protection Flares

Self-protection flares consist of a magnesium/Teflon formulation that, when ignited and released from an aircraft, burn for a short period of time (less than 10 seconds) at very high temperatures. Flares release heat and light to disrupt tracking of Navy aircraft by enemy infrared tracking devices or weapons. Flares are designed to burn completely. Under normal operations, the only material that would enter the water would be a small, round plastic end-cap (approximately 1.4-inch diameter). About 1,740 self-protection flares would be used per year under the No Action Alternative.

An extensive literature review and controlled experiments conducted by the Air Force revealed that self-protection flare use poses little risk to the environment or animals (USAF, 1997). Nonetheless, marine mammals within the JAX Study Area could be exposed to light generated by the flares and flare plastic end-caps. The light generated by flares would have no effect on marine mammals based on short burn time, relatively high altitudes where they are used, and the wide-spread and infrequent use. Flare end-caps have similar properties as chaff end-caps and pistons, therefore, the analysis of potential impacts from chaff end-caps and pistons is applicable to flare end-caps as well. Although instances of impacts from ingestion of debris have been recorded, the low concentration and minimal likelihood that a sperm whale would ingest an end-cap or piston make the potential effects discountable.

Manatees are not expected in areas where self-protection flares are used and, therefore, self-protection flares would have no effect on this species. Self-protection flares under the No Action Alternative would have no effect on the blue whale, fin whale, humpback whale, North Atlantic right whale, or sei whale. Self-protection flares are not expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, flares would have no significant impact on marine mammals in territorial waters. Furthermore, flares would not cause significant harm to marine mammals in non-territorial waters in accordance with EO 12114.

Flare end caps will sink through the water column, causing only temporary impacts. Once they hit the sea floor they may impact critical habitat. Upon striking the sea floor, the exercise components may disturb existing benthic communities, sediment, or other bottom habitat. This may result in temporary changes, such as increased turbidity which would not permanently impact critical habitat. However, the disturbance may be longer term or even permanent if the sea floor habitat is destroyed by being directly struck.

Once on the sea floor, flares will become part of the marine environment until broken down by natural processes. Their presence will alter the long-term make up of the benthic habitat, possibly alter water quality, and add anthropogenic foreign objects to the marine environment.

Flares may impact North Atlantic right whale critical habitat. Although the water column may be disrupted on a very short-term basis, it is unlikely the reproductive behaviors of the North Atlantic

right whale would be altered. Impacts to the sea floor may be longer term in nature; however, they are unlikely to affect the function of the right whale calving ground critical habitat. Therefore, the proposed actions may alter North Atlantic critical habitat, but is not likely to destroy or adversely modify critical habitat.

Marine Markers

The MK-25 and MK-58 marine markers produce chemical flames and regions of surface smoke and are used in various training exercises to mark a surface position to simulate divers, ships, and points of contact on the surface of the ocean. When the accompanying cartridge is broken, an area of smoke is released. The smoke dissipates in the air, having little effect on the marine environment. The marker burns similar to a flare, producing a flame until all burn components have been used. While the light generated from the marker is bright enough to be seen up to three miles away in ideal conditions, the resulting light would either be reflected off the water's surface or would enter the water and attenuate in brightness over depth. The point source of the light would be focused and be less intense than if an animal were to look to the surface and encounter the direct path of the sun. The MK-25 is composed of aluminum and contains either one or two seawater-activated batteries (depending on the model) and a red phosphorus pyrotechnic composition. The MK-25 marine marker is 18.5 inches long and 2.9 inches in diameter. It produces yellow flame and white smoke for 10 to 20 minutes (The Ordnance Shop, 2007). The MK-58 is composed of tin and contains two red phosphorus pyrotechnic candles and a seawater-activated battery. The MK-58 marine marker is 21.78 inches long and 5.03 inches in diameter, weighs 12.8 lbs, and produces a yellow flame and white smoke for a minimum of 40 minutes and a maximum of 60 minutes (The Ordnance Shop, 2007). The marker itself is not designed to be recovered and would eventually sink to the bottom and become encrusted and/or incorporated into the sediments. Approximately 300 marine markers would be used in the Study Area per year under the No Action Alternative.

It is unlikely that marine mammals would be exposed to any chemicals that produce either flames or smoke since these components are consumed in their entirety during the burning process. Animals are unlikely to approach and/or get close enough to the flame to be exposed to any chemical components.

Expended marine markers are a potential ingestion hazard for marine mammals while they are floating or after they sink to the bottom. However, the probability of ingestion is extremely low based on the low number of marine markers expended per year (309) and the low concentration (0.006/nm2/year). Marine marker ingestion under the No Action Alternative may affect ESA-listed marine mammals, but the effects would be considered discountable because ingestion is extremely unlikely to occur. Manatees are not expected in areas where marine markers are used and, therefore, marine markers would have no effect on this species. The use of marine markers is not expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, there would be no significant impact to marine mammals from marine marker use during training exercises within territorial waters. In accordance with EO 12114, there would be no significant harm to marine mammals resulting from use of marine markers during training exercises in non-territorial waters.

Marine markers will sink quickly through the water column, causing only temporary impacts. Once they hit the sea floor they may impact critical habitat.

Upon striking the sea floor, the exercise components may disturb existing benthic communities, sediment, or other bottom habitat. This may result in temporary changes, such as increased

turbidity which would not permanently impact critical habitat. However, the disturbance may be longer term or even permanent if the sea floor habitat is destroyed by being directly struck.

These components may also change the topography of the benthic habitat by creating craters due to impacts or increasing the height of the sea floor through displacement of sediment or presence of the material themselves.

Once on the sea floor, marine markers will become part of the marine environment until broken down by natural processes. Their presence will alter the long-term make up of the benthic habitat, possibly alter water quality, and add anthropogenic foreign objects to the marine environment.

Marine markers may impact North Atlantic right whale critical habitat. Although the water column may be disrupted on a very short-term basis, it is unlikely the reproductive behaviors of the North Atlantic right whale would be altered. Impacts to the sea floor may be longer term in nature; however, they are unlikely to affect the function of the right whale calving ground critical habitat. Therefore, the proposed actions may alter North Atlantic critical habitat, but is not likely to destroy or adversely modify critical habitat.

3.7.3.4 Alternative 1

Vessel Movements

The number of operations involving vessel movements would increase in the Study Area under Alternative 1 with a total of 1,050 steaming days per year; an increase of five percent over the No Action Alternative (Table 2.2-5). These changes would result in increased potential for short-term behavioral reactions to vessels. Potential for collision would increase slightly compared to the No Action Alternative; however, Navy mitigation measures (see Chapter 5) would reduce the probability. Vessel movements under Alternative 1 may affect ESA-listed marine mammals. Vessel movements are not expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, vessel movements would have no significant impact on marine mammals in territorial waters. Furthermore, vessel movements would not cause significant harm to marine mammals in non-territorial waters in accordance with EO 12114.

Aircraft Overflights

The number of operations involving fixed-wing aircraft overflights would increase 8 percent, to 1,773 in the JAX Study Area under Alternative 1. These changes would result in increased exposures of marine mammals to fixed-wing overflights. Elevated numbers of overflights would increase the potential for behavioral disturbance from sound and shadow-effects. Operations involving helicopter overflights would increase 25 percent, to 916 per year. Behavioral reactions to fixed-wing and helicopter overflights would be the same as discussed under the No Action Alternative. Aircraft overflights under Alternative 1 may affect ESA-listed marine mammals, but the effects are expected to be insignificant. Aircraft overflights are not expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, aircraft overflights would have no significant impact on marine mammals in territorial waters. Furthermore, aircraft overflights would not cause significant harm to marine mammals in non-territorial waters in accordance with EO 12114.

Towed Mine Warfare Devices

Towed Mine Warfare (MIW) device activities would increase 92% to 150 per year under Alternative 1. The use of towed MIW devices under Alternative 1 may affect ESA-listed marine mammals, but

the potential effects of collisions would be discountable because they are extremely unlikely to occur and the effects of disturbance would be insignificant. Towed MIW devices are not expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, towed MIW devices would have no significant impact on marine mammals in territorial waters. Furthermore, towed MIW devices would not cause significant harm to marine mammals in non-territorial waters in accordance with Executive Order 12114.

Non-Explosive Practice Munitions Strikes

NEPM Strikes

The amount of NEPM used would increase (4 to 10 percent) in the OPAREAs under Alternative 1, but would not change at the Lake George Range (Table 2.2-5 and 2.2-6). These changes would result in increased potential exposure for marine mammal ordnance strikes in the OPAREAs compared to baseline conditions. However, ordnance strike modeling predicts that no marine mammals would be exposed to direct ordnance strikes under Alternative 1 (see Appendix I). Additionally, Navy mitigation measures further reduce the probability of ordnance-related exposure. The use of non-explosive ordnance would have no effect on ESA-listed marine mammal species. Non-explosive ordnance use is not expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, non-explosive ordnance would have no significant impact on marine mammals in territorial waters. Furthermore, non-explosive ordnance would not cause significant harm to marine mammals in non-territorial waters in accordance with EO 12114.

Disturbance

The number of weapons firings in the Study Area would increase under Alternative 1. As presented in the discussion under the No Action Alternative, the sound from firing of weapons would not result in an exposure of marine mammals, therefore any additional weapon firings under Alternative 1 would have no effect on ESA-listed marine mammals. Weapons firing sound disturbance is not expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, weapons firing sound disturbance would have no significant impact on marine mammals in territorial waters. Furthermore, weapons firing sound disturbance would not cause significant harm to marine mammals in non-territorial waters in accordance with EO 12114.

Underwater Detonations and High Explosive Ordnance

Overview

The number and location of explosions occurring in the JAX Study Area would not change under Alternative 1, with the exception of missiles and 20-lbs NEW underwater detonation charges (Tables 2.2-5 and 2.2-7). Forty additional Hellfire missile explosions (133 percent increase over No Action Alternative) would occur in the Study Area. The number of 20-lbs UNDET charges in the north and south UNDET boxes would decrease from 18 to 12 per year (33 percent decrease from No Action Alternative).

Effects from exposure to explosives vary depending on the level of exposure. Behavioral responses can include shorter surfacings, shorter dives, fewer blows per surfacing, longer intervals between blows (breaths), ceasing or increasing vocalizations, shortening or lengthening vocalizations, and changing frequency or intensity of vocalizations (NRC, 2005). However, it is not known how these responses relate to significant effects (*e.g.*, long-term effects or population

consequences) (NRC, 2005). In addition, animals exposed to thresholds that equate to a TTS, may experience a slight, recoverable loss of hearing sensitivity.

Exposures that result in long-term injuries such as PTS may limit an animal's ability to find food, communicate with other animals, and/or interpret the environment around them. Impairment of these abilities can decrease an individual's chance of survival or impact their ability to successfully reproduce. Mortality of an animal will remove the animal entirely from the population as well as eliminate any future reproductive potential.

An explosive analysis was conducted to estimate the number of marine mammals that could be exposed to impacts from explosions. Appendix J contains a technical report describing the scientific basis, methods and assumptions of the explosive analysis. Tables 3.7-18 and 3.7-19 provide a summary of the explosive analysis for Alternative 1. For each species, in order to determine the total non-injurious (MMPA Level B) potential exposures for all operations, the two columns for non-injurious exposures (182 dB criteria for TTS and 177 dB criteria for behavioral disruption) need to be added together between the two tables Tables 3.7-18 and 3.7-19). For each species, the total for injurious (MMPA Level A) potential exposures can be determined by adding the 205 dB re 1 mPa2-s/13 psi columns together between the two tables. For each species, the total mortality potential exposures can be determined by adding the 30.5 psi columns together between the two tables.

TABLE 3.7-18
SUMMARY OF POTENTIAL EXPOSURES FROM SINGLE DETONATION EXPLOSIVE ORDNANCE (PER YEAR) FOR MARINE MAMMALS IN THE JAX STUDY AREA—ALTERNATIVE 1

Species/Training Operation	Potential Exposures @ 182 dB re μPa^2-s or 23 psi (peak)	Potential Exposures @ 205 dB re μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Fin whale			
BOMBEX (MK-84/MK-20)	0	0	0
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Humpback whale			
BOMBEX (MK-84/MK-20)	0	0	0
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
North Atlantic right whale			
BOMBEX (MK-84/MK-20)	0	0	0
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Sperm whale			
BOMBEX (MK-84/MK-20)	0	0	0

TABLE 3.7-18 (Continued)
SUMMARY OF POTENTIAL EXPOSURES FROM SINGLE DETONATION EXPLOSIVE ORDNANCE (PER YEAR) FOR MARINE MAMMALS IN THE JAX STUDY AREA—ALTERNATIVE 1

Species/Training Operation	Potential Exposures @ 182 dB re μPa^2-s or 23 psi (peak)	Potential Exposures @ 205 dB re μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Atlantic Spotted dolphin			
BOMBEX (MK-84/MK-20)	0	0	0
MISSILEX training	31	1	0
MINEX training	2	0	0
Total Exposures	33	1	0
Beaked whale			
BOMBEX (MK-84/MK-20)	0	0	0
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Bottlenose dolphin			
BOMBEX (MK-84/MK-20)	19	1	0
MISSILEX training	3	0	0
MINEX training	2	0	0
Total Exposures	24	1	0
Clymene dolphin			
BOMBEX (MK-84/MK-20)	0	0	0
MISSILEX training	1	0	0
MINEX training	0	0	0
Total Exposures	1	0	0
Common dolphin			
BOMBEX (MK-84/MK-20)	0	0	0
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Kogia spp.			
BOMBEX (MK-84/MK-20)	0	0	0
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0

TABLE 3.7-18 (Continued)
SUMMARY OF POTENTIAL EXPOSURES FROM SINGLE DETONATION EXPLOSIVE ORDNANCE (PER YEAR) FOR MARINE MAMMALS IN THE JAX STUDY AREA—ALTERNATIVE 1

Species/Training Operation	Potential Exposures @ 182 dB re μPa^2-s or 23 psi (peak)	Potential Exposures @ 205 dB re μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Minke whale			
BOMBEX (MK-84/MK-20)	0	0	0
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Pantropical spotted dolphin			
BOMBEX (MK-84)	1	0	0
MISSILEX training	1	0	0
MINEX training	0	0	0
Total Exposures	2	0	0
Pilot whales			
BOMBEX (MK-84/MK-20)	1	0	0
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	1	0	0
Risso's dolphin			
BOMBEX (MK-84/MK-20)	0	0	0
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Rough-toothed dolphin			
BOMBEX (MK-84/MK-20)	0	0	0
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Striped dolphin			
BOMBEX (MK-84/MK-20)	0	0	0
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0

TABLE 3.7-19
SUMMARY OF POTENTIAL EXPOSURES FROM MULTIPLE DETONATION EXPLOSIVE ORDNANCE (PER YEAR) FOR MARINE MAMMALS IN THE JAX STUDY AREA—ALTERNATIVE 1

Species/Training Operation	Potential Exposures @ 177 dB r μPa^2-s (multiple detonations only)	Potential Exposures @ 205 dB r μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Fin whale			
BOMBEX (MK-82/83)	0	0	0
FIREX training	0	0	0
Small Arms (grenades)	0	0	0
Total Exposures	0	0	0
Humpback whale			
BOMBEX (MK-82/83)	1	0	0
FIREX training	0	0	0
Small Arms (grenades)	0	0	0
Total Exposures	1	0	0
North Atlantic right whale			
BOMBEX (MK-82/83)	0	0	0
FIREX training	0	0	0
Small Arms (grenades)	0	0	0
Total Exposures	0	0	0
Sperm whale			
BOMBEX (MK-82/83)	0	0	0
FIREX training	0	0	0
Small Arms (grenades)	0	0	0
Total Exposures	0	0	0
Atlantic Spotted dolphin			
BOMBEX (MK-82/83)	0	0	0
FIREX training	23	1	0
Small Arms (grenades)	6	0	0
Total Exposures	29	1	0
Beaked whale			
BOMBEX (MK-82/83)	1	0	0
FIREX training	0	0	0
Small Arms (grenades)	0	0	0
Total Exposures	1	0	0
Bottlenose dolphin			
BOMBEX (MK-82/83)	920	24	0
FIREX training	10	0	0
Small Arms (grenades)	8	0	0
Total Exposures	938	24	0

TABLE 3.7-19
SUMMARY OF POTENTIAL EXPOSURES FROM MULTIPLE DETONATION EXPLOSIVE ORDNANCE (PER YEAR) FOR MARINE MAMMALS IN THE JAX STUDY AREA—ALTERNATIVE 1 (Continued)

Species/Training Operation	Potential Exposures @ 177 dB r μPa^2-s (multiple detonations only)	Potential Exposures @ 205 dB r μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Clymene dolphin			
BOMBEX (MK-82/83)	13	0	0
FIREX training	1	0	0
Small Arms (grenades)	0	0	0
Total Exposures	14	0	0
Common dolphin			
BOMBEX (MK-82/83)	0	0	0
FIREX training	0	0	0
Small Arms (grenades)	0	0	0
Total Exposures	0	0	0
Kogia spp.			
BOMBEX (MK-82/83)	1	0	0
FIREX training	0	0	0
Small Arms (grenades)	0	0	0
Total Exposures	1	0	0
Minke whale			
BOMBEX (MK-82/83)	0	0	0
FIREX training	0	0	0
Small Arms (grenades)	0	0	0
Total Exposures	0	0	0
Pantropical spotted dolphin			
BOMBEX (MK-82/83)	27	1	0
FIREX training	1	0	0
Small Arms (grenades)	1	0	0
Total Exposures	29	1	0
Pilot whales			
BOMBEX (MK-82/83)	60	2	0
FIREX training	1	0	0
Small Arms (grenades)	0	0	0
Total Exposures	61	2	0
Risso's dolphin			
BOMBEX (MK-82/83)	20	1	0
FIREX training	3	0	0

TABLE 3.7-19
SUMMARY OF POTENTIAL EXPOSURES FROM MULTIPLE DETONATION EXPLOSIVE ORDNANCE (PER YEAR) FOR MARINE MAMMALS IN THE JAX STUDY AREA—ALTERNATIVE 1 (Continued)

Species/Training Operation	Potential Exposures @ 177 dB r μPa^2-s (multiple detonations only)	Potential Exposures @ 205 dB r μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Small Arms (grenades)	0	0	0
Total Exposures	23	1	0
Rough-toothed dolphin			
BOMBEX (MK-82/83)	1	0	0
FIREX training	0	0	0
Small Arms (grenades)	0	0	0
Total Exposures	1	0	0
Striped dolphin			
BOMBEX (MK-82/83)	0	0	0
FIREX training	0	0	0
Small Arms (grenades)	0	0	0
Total Exposures	0	0	0

Summary of Exposure Results for Individual Marine Mammals

Humpback whales, Atlantic spotted dolphins, beaked whales, bottlenose dolphins, Clymene dolphins, *Kogia* spp., pantropical spotted dolphins, pilot whales, Risso's dolphins and rough-toothed dolphins may be exposed at levels that could result in behavioral disturbance (Table 3.7-19, 177 dB column). Atlantic spotted dolphins, bottlenose dolphins, Clymene dolphins, pantropical spotted dolphins, and pilot whales may be exposed at levels that could result in temporary threshold shift, or non-injurious physiological effects (Table 3.7-18, 182 dB/23 psi column). Atlantic spotted dolphins, bottlenose dolphins, pantropical spotted dolphins, pilot whales and Risso's dolphins may be exposed at levels that could result in permanent threshold shift, or injurious physiological effects (Tables 3.7-18 and 3.7-19, 205 dB/13 psi column). No mortalities are predicted (Tables 3.7-18 and 3.7-19, 30.5 psi column).

Exposure estimates could not be calculated for several species (blue whale, sei whale, Bryde's whale, killer whale, pygmy killer whale, false killer whale, melon-headed whale, spinner dolphin, and Fraser's dolphin) because density data could not be calculated due to the limited available data for these species. However, the likelihood of exposure should be even lower than that estimated for other species with given densities since they are less likely to occur in the Study Area. Therefore, no exposures are expected for these species. In addition to the low likelihood of exposure, mitigation measures presented in Chapter 5 will be implemented prior to release of ordnance.

Effects on Marine Mammal Populations

Effects from the use of explosive ordnance are not anticipated to have lasting impacts on any marine mammal population due to the following factors:

- Most exposures are within the non-injurious TTS or behavioral effects zones.
- Although the numbers presented in Tables 3.7-16 and 3.7-17 represent estimated harassment and injury, as described above, they are probably over estimates as the model calculates harassment without taking into consideration standard mitigation measures.

The mitigation measures described in Chapter 5 are designed to reduce exposure of marine mammals to potential impacts to achieve the least practicable adverse effect on marine mammal species or populations. Lookouts will monitor the area before ordnance is used. Fin, humpback whales, and sperm whales will have high detections rates at the surface because of their large body size and pronounced blows. Because of large group sizes, it is likely that lookouts would detect Atlantic spotted dolphins, bottlenose dolphins, Clymene, pantropical spotted dolphins, Risso's dolphins and rough-toothed dolphins. Implementation of mitigation measures will reduce the likelihood of exposure and potential effects.

Endangered Species Act Conclusions

Even though no exposures are predicted for certain ESA-listed species, a may affect determination has been made for all ESA-listed species that may occur in the vicinity of the activity. Underwater detonations and explosive ordnance use under Alternative 1 may affect fin, North Atlantic right whales, sei, blue, humpback, and sperm whales. However, the effects on blue and sei whales are most likely discountable based on the low likelihood of encountering these species in the Study Area. Manatees are not expected to occur greater than 3 nm offshore in the OPAREAs, therefore underwater detonations and explosive ordnance use under Alternative 1 would have no effect on the manatee.

Marine Mammal Protection Act Conclusions

Exposure estimates from underwater detonations indicate potential for Level A and level B harassment as defined by MMPA. No marine mammals would be exposed at levels that would result in mortality. Although there may be impacts to individual marine mammals, the impacts at the population, stock, or species level would be negligible.

National Environmental Policy Act and Executive Order 12114 Conclusions

The analysis presented above indicates that underwater detonations and explosive ordnance use under Alternative 1 would affect individual marine mammals, but any effects observed at the population, stock, or species level would be negligible. Therefore, in accordance with NEPA, there would be no significant impact to marine mammal populations from explosive ordnance use during training exercises within territorial waters. In accordance with EO 12114, there would be no significant harm to marine mammal populations resulting from explosive ordnance use during training exercises in non-territorial waters.

Military Expended Material

Potential impacts to right whale critical habitat will be similar to those discussed under the No Action Alternative. Although temporary disturbance and long-term benthic habitat changes may increase slightly under Alternative 1, it is not likely to destroy or adversely modify critical habitat.

Ordnance-Related Material

The amount of ordnance fired would increase (4%) in the OPAREAs under Alternative 1, but would not change at the Lake George Range (Table 2.2-5 and 2.2-6). Similar to the No Action Alternative, only sperm whales would potentially be exposed to expended ordnance via ingestion from foraging off the bottom. Based on sperm whale habitat preferences and known feeding behaviors discussed above, it is extremely unlikely they would encounter and ingest expended ordnance. Ingestion of ordnance under Alternative 1 may affect the sperm whale, but the effects would be discountable. Ordnance ingestion under Alternative 1 would have no effect on the manatee, blue whale, fin whale, humpback whale, North Atlantic right whale, or sei whale based on the feeding habits of these species. Ordnance-related material would not be expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, ordnance-related material would have no significant impact on marine mammals in territorial waters. Furthermore, ordnance-related material would not cause significant harm to marine mammals in non-territorial waters in accordance with EO 12114.

Target-Related Material

The number of targets used in the JAX Study Area would increase from 40 to 44 per year (10%) under Alternative 1 (Table 2.2-5). As discussed above for the No Action Alternative, species that feed on or near the bottom (*i.e.*, sperm whales) may encounter an expended target while feeding; however, the size of the target would prohibit any listed species from ingesting it. Therefore, the use of targets under Alternative 1 would also have no effect on listed marine mammals. Targets would not be expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, targets would have no significant impact on marine mammals in territorial waters. Furthermore, targets would not cause significant harm to marine mammals in non-territorial waters in accordance with EO 12114.

Chaff Fibers, End-caps, and Pistons

The amount of chaff used in the JAX Study Area would increase by about 10 percent per year under Alternative 1 (Tables 2.2-5 and 3.7-17). This increase in chaff use would result in negligible increases in relative environmental concentrations of chaff fibers, end-caps, and pistons (Table 3.7-17). Similar to the No Action Alternative, chaff use under Alternative 1 would have no effect on manatees because it would not be used at the Lake George Range. Effects of direct body contact, inhalation, and any changes to water or sediment quality would be insignificant. The potential for marine mammals to ingest chaff fibers would increase under Alternative 1, but ingestion of a toxic dose (greater than 1,000 mg/kg) would continue to be highly unlikely based on the anticipated low environmental concentration (1.8 fibers/ft^2). Sperm whales could ingest chaff end-caps and pistons under Alternative 1, but the likelihood of ingest remains extremely low based on the low environmental concentration (2.7 pieces/nm^2). If ingested, it is likely the small end-cap or piston would be excreted without causing harm. Chaff use under Alternative 1 would have no effect on the West Indian manatee, but may affect other ESA-listed marine mammals. Chaff use would not be expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, chaff would have no significant impact on marine mammals in territorial waters. Furthermore, chaff would not cause significant harm to marine mammals in non-territorial waters in accordance with EO 12114.

Self-Protection Flares

The number of self-protection flares used in the JAX Study Area would increase under Alternative 1 from 1,740 to 2,470 per year (42%). Similar to the No Action Alternative, ingestion of flare end-caps under Alternative 1 may affect sperm whales, but the effects would be considered discountable because ingestion is extremely unlikely to occur. Self-protection flares would have no effect on all other listed marine mammal species. Self-protection flares would not be expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, flares would have no significant impact on marine mammals in territorial waters. Furthermore, flares would not cause significant harm to marine mammals in non-territorial waters in accordance with EO 12114.

Marine Markers

The number of marine markers used in the JAX Study Area would stay the same under Alternative 1; therefore, the effects would be the same as the No Action Alternative. Marine marker ingestion under Alternative 1 may affect ESA-listed marine mammals, but the effects would be considered discountable because ingestion is extremely unlikely to occur. Manatees are not expected in areas where marine markers are used and, therefore, marine markers would have no effect on this species. The use of marine markers would not be expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, there would be no significant impact to marine mammals from marine marker use during training exercises within territorial waters. In accordance with EO 12114, there would be no significant harm to marine mammals resulting from use of marine markers during training exercises in non-territorial waters.

3.7.3.5 Alternative 2 (Preferred Alternative)

All Stressors

As detailed in Chapter 2 and Table 2.2-5, Alternative 2 would include all activities proposed under Alternative 1 except for the elimination of BOMBEX with live ordnance and establishment of MIW Training Areas in the north and south UNDET boxes. Fixed-wing aircraft sorties would increase to 1,786 per year while helicopter sorties would increase to 1,258 per year. Other operational parameters would not change under Alternative 2. Therefore, the Alternative 1 analyses are applicable to Alternative 2. The analysis for Alternative 2 focuses on the establishment of the MIW Training Areas (non-explosive mine shape deployment/recovery).

Mine Warfare Training (Non-explosive Mine Shape Deployment/Recovery)

As discussed in Chapter 2, new MIW Training Areas would be designated in the north and south UNDET boxes. This section addresses potential effects on marine mammals associated with designating and maintaining these training areas (*i.e.*, non-explosive mine shape deployment/recovery). The effects of conducting training exercises in these areas are analyzed under aircraft overflights, towed MIW devices, and explosions.

The effects of MIW Training would be limited to short-term and localized disturbances of the water column. The non-explosive mine shape deployment and recovery process would have no effect on marine mammals. The effects of Mine Warfare Training Area establishment would be limited to short-term and localized disturbances of the water column and benthic habitat associated with deployment and recovery of non-explosive mineshapes. In some cases (shallow waters) the entire assembly (mine shape, mooring line, and anchor) would be deployed concurrently from a

boat and recovered immediately following the exercise. The mooring lines would not present an entanglement risk for marine mammals because they would be held taut by the anchor and mine shape. Mooring lines would only be left in place for as long as the mine shape is in the water. The establishment of Mine Warfare Training Areas would not be expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, the establishment of Mine Warfare Training Areas would have no significant impact on marine mammals in territorial waters. Furthermore, the establishment of Mine Warfare Training Areas would not cause significant harm to marine mammals in non-territorial waters in accordance with EO 12114.

There would be no destruction or adverse modification of critical habitat from the establishment of Mine Warfare Training Areas under Alternative 2 because this action would take place only in designated areas outside of North Atlantic Right Whale Habitat.

Underwater Detonations and High Explosive Ordnance

Overview

Explosive ordnance associated with BOMBEX would no longer occur under Alternative 2. Therefore, explosive ordnance use associated with BOMBEX would have no impact on any marine mammals under Alternative 2.

Behavioral responses can include shorter surfacings, shorter dives, fewer blows per surfacing, longer intervals between blows (breaths), ceasing or increasing vocalizations, shortening or lengthening vocalizations, and changing frequency or intensity of vocalizations (NRC, 2005). However, it is not known how these responses relate to significant effects (*e.g.*, long-term effects or population consequences) (NRC, 2005). In addition, animals exposed to thresholds that equate to a TTS, may experience a slight, recoverable loss of hearing sensitivity.

Exposures that result in long-term injuries such as PTS may limit an animal's ability to find food, communicate with other animals, and/or interpret the environment around them. Impairment of these abilities can decrease an individual's chance of survival or impact their ability to successfully reproduce. Mortality of an animal will remove the animal entirely from the population as well as eliminate any future reproductive potential. As discussed for the No Action Alternative, effects from exposure to explosives vary depending on the level of exposure.

An explosive analysis was conducted to estimate the number of marine mammals that could be exposed to impacts from explosions. Appendix J of the EIS contains a technical report describing the scientific basis, methods and assumptions of the explosive analysis. Tables 3.7-20 and 3.7-21 provide a summary of the explosive analysis for Alternative 2. For each species, in order to determine the total non-injurious (MMPA Level B) potential exposures for all operations, the two columns for non-injurious exposures (182 dB criteria for TTS and 177 dB criteria for behavioral disruption) need to be added together between the two tables Tables 3.7-20 and 3.7-21). For each species, the total for injurious (MMPA Level A) potential exposures can be determined by adding the 205 dB re 1 mPa2-s/13 psi columns together between the two tables. For each species, the total mortality potential exposures can be determined by adding the 30.5 psi columns together between the two tables.

TABLE 3.7-20
SUMMARY OF POTENTIAL EXPOSURES FROM SINGLE DETONATION EXPLOSIVE ORDNANCE (PER YEAR) FOR MARINE MAMMALS IN THE JAX STUDY AREA—ALTERNATIVE 2

Species/Training Operation	Potential Exposures @ 182 dB re μPa^2-s or 23 psi (peak)	Potential Exposures @ 205 dB re μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Fin whale			
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Humpback whale			
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
North Atlantic right whale			
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Sperm whale			
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Atlantic Spotted dolphin			
MISSILEX training	31	1	0
MINEX training	2	0	0
Total Exposures	33	1	0
Beaked whale			
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Bottlenose dolphin			
MISSILEX training	3	0	0
MINEX training	2	0	0
Total Exposures	5	0	0
Clymene dolphin			
MISSILEX training	1	0	0
MINEX training	0	0	0
Total Exposures	1	0	0

TABLE 3.7-20 (Continued)
SUMMARY OF POTENTIAL EXPOSURES FROM SINGLE DETONATION EXPLOSIVE ORDNANCE (PER YEAR) FOR MARINE MAMMALS IN THE JAX STUDY AREA—ALTERNATIVE 2

Species/Training Operation	Potential Exposures @ 182 dB re μPa^2-s or 23 psi (peak)	Potential Exposures @ 205 dB re μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Common dolphin			
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Kogia spp.			
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Minke whale			
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Pantropical spotted dolphin			
MISSILEX training	1	0	0
MINEX training	0	0	0
Total Exposures	1	0	0
Pilot whales			
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Risso's dolphin			
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Rough-toothed dolphin			
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0
Striped dolphin			
MISSILEX training	0	0	0
MINEX training	0	0	0
Total Exposures	0	0	0

TABLE 3.7-21
SUMMARY OF POTENTIAL EXPOSURES FROM MULTIPLE DETONATION EXPLOSIVE ORDNANCE (PER YEAR) FOR MARINE MAMMALS IN THE JAX STUDY AREA—ALTERNATIVE 2

Species/Training Operation	Potential Exposures @ 177 dB r μPa^2-s (multiple detonations only)	Potential Exposures @ 205 dB r μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Fin whale			
FIREX training	0	0	0
Small Arms (grenades)	0	0	0
Total Exposures	0	0	0
Humpback whale			
FIREX training	0	0	0
Small Arms (grenades)	0	0	0
Total Exposures	0	0	0
North Atlantic right whale			
FIREX training	0	0	0
Small Arms (grenades)	0	0	0
Total Exposures	0	0	0
Sperm whale			
FIREX training	0	0	0
Small Arms (grenades)	0	0	0
Total Exposures	0	0	0
Atlantic Spotted dolphin			
FIREX training	23	1	0
Small Arms (grenades)	6	0	0
Total Exposures	29	1	0
Beaked whale			
FIREX training	0	0	0
Small Arms (grenades)	0	0	0
Total Exposures	0	0	0
Bottlenose dolphin			
FIREX training	10	0	0
Small Arms (grenades)	8	0	0
Total Exposures	18	0	0
Clymene dolphin			
FIREX training	1	0	0
Small Arms (grenades)	0	0	0
Total Exposures	1	0	0
Common dolphin			
FIREX training	0	0	0
Small Arms (grenades)	0	0	0
Total Exposures	0	0	0

TABLE 3.7-21 (Continued)
SUMMARY OF POTENTIAL EXPOSURES FROM MULTIPLE DETONATION EXPLOSIVE ORDNANCE (PER YEAR) FOR MARINE MAMMALS IN THE JAX STUDY AREA—ALTERNATIVE 2

Species/Training Operation	Potential Exposures @ 177 dB r μPa^2-s (multiple detonations only)	Potential Exposures @ 205 dB r μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Kogia spp.			
FIREX training	0	0	0
Small Arms (grenades)	0	0	0
Total Exposures	0	0	0
Minke whale			
FIREX training	0	0	0
Small Arms (grenades)	0	0	0
Total Exposures	0	0	0
Pantropical spotted dolphin			
FIREX training	1	0	0
Small Arms (grenades)	1	0	0
Total Exposures	2	0	0
Pilot whales			
FIREX training	1	0	0
Small Arms (grenades)	0	0	0
Total Exposures	1	0	0
Risso's dolphin			
FIREX training	3	0	0
Small Arms (grenades)	0	0	0
Total Exposures	3	0	0
Rough-toothed dolphin			
FIREX training	0	0	0
Small Arms (grenades)	0	0	0
Total Exposures	0	0	0
Striped dolphin			
FIREX training	0	0	0
Small Arms (grenades)	0	0	0
Total Exposures	0	0	0

Summary of Exposure Results for Individual Marine Mammals

Atlantic spotted dolphins, bottlenose dolphins, Clymene dolphins, pantropical spotted dolphins, pilot whales and Risso's dolphins may be exposed at levels that could result in behavioral disturbance (Table 3.7-21, 177 dB column). Atlantic spotted dolphins, bottlenose dolphins, Clymene dolphins, and pantropical spotted dolphins may be exposed at levels that could result in temporary threshold shift, or non-injurious physiological effects (Table 3.7-20, 182 dB/23 psi column). Atlantic spotted dolphins may be exposed at levels that could result in permanent threshold shift, or injurious physiological effects (Tables 3.7-20 and 3.7-21, 205 dB/13 psi column). No mortalities are predicted (Tables 3.7-20 and 3.7-21, 30.5 psi column).

Exposure estimates could not be calculated for several species (blue whale, sei whale, Bryde's whale, killer whale, pygmy killer whale, false killer whale, melon-headed whale, spinner dolphin, and Fraser's dolphin) because density data could not be calculated due to the limited available data for these species. However, the likelihood of exposure should be even lower than that estimated for other species with given densities since they are less likely to occur in the JAX Study Area. Therefore, no exposures are expected for these species. In addition to the low likelihood of exposure, the mitigation measures presented in Chapter 5 will be implemented prior to release of ordnance.

Effects on Marine Mammal Populations

Effects from the use of explosive ordnance are not anticipated to have lasting impacts on any marine mammal population due to the following factors:

- Most exposures are within the non-injurious TTS or behavioral effects zones.
- Although the numbers presented in Tables 3.7-20 and 3.7-21 represent estimated harassment and injury, as described above, they are probably over estimates as the model calculates harassment without taking into consideration standard mitigation measures.
- The exposure analsis predicts that no marine mammals would be exposed to levels that would result in mortality.

The mitigation measures described in Chapter 5 are designed to reduce exposure of marine mammals to potential impacts to achieve the least practicable adverse effect on marine mammal species or populations. Lookouts will monitor the area before ordnance is used. Fin, humpback whales, and sperm whales will have high detections rates at the surface because of their large body size and pronounced blows. Because of large group sizes, it is likely that lookouts would detect Atlantic spotted dolphins, bottlenose dolphins, Clymene, pantropical spotted dolphins and Risso's dolphins. Implementation of mitigation measures will reduce the likelihood of exposure and potential effects.

Endangered Species Act Conclusions

Even though no exposures are predicted for certain ESA-listed species, a may affect determination has been made for all ESA-listed species that may occur in the vicinity of the activity. Underwater detonations and explosive ordnance use under Alternative 2 may affect fin, North Atlantic right whales, sei, blue, humpback, and sperm whales. However, the effects on blue and sei whales are most likely discountable based on the low likelihood of encountering these species in the Study Area. The Navy has initiated the ESA Section 7 formal consultation process with NMFS for listed whales and Alternative 2 (preferred alternative). Manatees are not expected to occur greater than 3 nm offshore in the OPAREAs, therefore underwater detonations and explosive ordnance use under

Alternative 2 will have no effect on the manatee. The Navy has completed the ESA Section 7 informal consultation process with USFWS for the manatee and preferred alternative. In a letter dated October 7, 2008, the USFWS concurred with the Navy's determination that explosive ordnance use would have no effect on the manatee.

Marine Mammal Protection Act Conclusions

Exposure estimates from underwater detonations indicate potential for Level A and Level B harassment as defined by MMPA. No marine mammals would be exposed to levels that would result in mortality. The Navy has submitted to NMFS an application for a Letter of Authorization under MMPA for Alternative 2 (the Preferred Alternative).

National Environmental Policy Act and Executive Order 12114 Conclusions

The analysis presented above indicates that underwater detonations and explosive ordnance use under Alternative 2 would affect individual marine mammals, but any effects observed at the population, stock, or species level would be negligible. Therefore, in accordance with NEPA there would be no significant impact to marine mammals from underwater detonations and explosive ordnance use during training exercises within territorial waters. In accordance with EO 12114, there would be no significant harm to marine mammals resulting from underwater detonations and explosive ordnance use during training exercises in non-territorial waters.

3.7.4 Unavoidable Significant Environmental Effects

The Navy is working with the NMFS through the ESA Section 7 consultation process to ensure that unavoidable significant effects to marine mammals do not result from implementation of the proposed action.

3.7.5 Summary of Environmental Effects

3.7.5.1 Endangered Species Act

The Navy is consulting under Section 7 of ESA with NMFS regarding its determination of effect for federally listed marine mammals and critical habitat under their jurisdiction. The Navy has completed consultation with USFWS regarding its determination of effect for manatee and critical habitat (see Section 3.11). Table 3.7-22 provides a summary of the Navy's determination of effect under Alternative 2, the Preferred Alternative for federally listed marine mammals that potentially occur in the JAX Study Area.

Proposed actions may result in temporary changes to the water column and potential long-term or permanent alterations to the benthic habitat. This area designated as critical habitat for the North Atlantic right whale serves as the only known calving ground for the species (NMFS, 1994; NMFS, 2002; NMFS, 2005a). Although the water column may be disrupted on a very short-term basis, it is unlikely that reproductive behaviors of the North Atlantic right whale would be altered. Impacts to the sea floor may be longer term in nature; however, they are unlikely to affect the function of the right whale calving ground critical habitat. Therefore, the proposed actions may alter North Atlantic critical habitat, but is not likely to destroy or adversely modify critical habitat.

TABLE 3.7-22
SUMMARY OF THE NAVY'S DETERMINATION OF EFFECT FOR FEDERALLY LISTED MARINE MAMMALS THAT MAY OCCUR IN THE JAX STUDY AREA ALTERNATIVE 2

Stressor	Blue Whale	Fin Whale	Humpback Whale	North Atlantic Right Whale	Sei Whale	Sperm Whale	West Indian Manatee*
Vessel Movements							
Disturbance	May Affect	May Affect	May Affect	May Affect	May Affect	May Affect	May Affect
Collisions	May Affect	May Affect	May Affect	May Affect	May Affect	May Affect	May Affect
Aircraft Overflights							
Disturbance	May Affect	May Affect	May Affect	May Affect	May Affect	May Affect	May Affect
Towed MIW devices							
Strikes	May Affect	May Affect	May Affect	May Affect	May Affect	May Affect	No Effect
Mine Warfare Training							
Inert Mine Shape Deployment/Recovery	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect
Non-Explosive Practice Munitions							
Disturbance	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect
Strikes	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect
UNDETs and HE Ordnance							
HE	May Affect	May Affect	May Affect	May Affect	May Affect	May Affect	No Effect
UNDETs	May Affect	May Affect	May Affect	May Affect	May Affect	May Affect	No Effect
Mk3A2 grenades	May Affect	May Affect	May Affect	May Affect	May Affect	May Affect	No Effect
MEM							
Ordnance Related	No Effect	No Effect	No Effect	No Effect	No Effect	May Affect	No Effect
Target Related	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect
Chaff	May Affect	May Affect	May Affect	May Affect	May Affect	May Affect	No Effect
Self-Protection Flares	No Effect	No Effect	No Effect	No Effect	No Effect	May Affect	No Effect
Marine Markers	May Affect	May Affect	May Affect	May Affect	May Affect	May Affect	No Effect

**The analysis for manatees in Lake George is presented in Section 3.11.*

3.7.5.2 Marine Mammal Protection Act

The analysis presented above indicates that the Atlantic spotted dolphin, bottlenose dolphin, Clymene dolphin, pantropical spotted dolphin, pilot whales, and Risso's dolphin could be exposed to impacts associated with UNDETs and explosive ordnance use under Alternative 2 (Preferred Alternative) that could result in Level A or Level B harassment as defined by MMPA provisions that are applicable to the Navy. Exposure estimates are provided in Tables 3.7-20 and 3.7-21. Although some individuals may be exposed at levels that could result in Level A or B harassment, it is unlikely that there would be adverse effects on the recruitment or survival of any species at the population level. Other stressors associated with Alternative 2 are not expected to result in Level A or Level B harassment. The Navy is working with NMFS through the MMPA permitting process to ensure compliance with the MMPA.

3.7.5.3 National Environmental Policy Act and Executive Order 12114

Based on best available science, Navy concludes that takes due to explosive ordnance and underwater detonations would result in only short-term effects to most individuals exposed and would likely not affect annual rates of recruitment or survival of the species. The mitigation measures presented in Ch. 5 would further reduce the potential for exposures, and there would be no mortality of marine mammals from the proposed training activities.

As summarized in Table 3.7-23, the No Action Alternative, Alternative 1, and Alternative 2 would have no significant impact on marine mammals in territorial waters in accordance with NEPA. Furthermore, in accordance with EO 12114 the No Action Alternative, Alternative 1, and Alternative 2 would not cause significant harm to marine mammals in non-territorial waters.

TABLE 3.7-23
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON MARINE MAMMALS IN THE JAX STUDY AREA

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	NEPA (U.S. Territory)	Executive Order 12114 (Non-Territorial Waters, >12 nm)
No Action		
Vessel Movements	Short-term behavioral responses from general vessel disturbance. Low potential for injury from vessel collisions.	Short-term behavioral responses from general vessel disturbance. Low potential for injury from vessel collisions.
Aircraft Overflights	Potential for short-term behavioral responses to overflights. No long-term population-level effects.	Potential for short-term behavioral responses to overflights. No long-term population-level effects.
Towed MIW Devices	Low potential for towed MIW device strikes. No long-term population-level effects.	No effect.
Mine Warfare Training	No effect.	No effect.
NEPM	No effect based on extremely low probability of direct strikes.	No effect based on extremely low probability of direct strikes.
UNDETs and Explosive Ordnance	Potential for short-term behavioral responses. Potential for injury within limited ZOI.	Potential for short-term behavioral responses. Potential for injury within limited ZOI.
MEM	Low potential for ingestion of ordnance-related material and chaff and/or flare plastic end-caps and pistons.	Low potential for ingestion of ordnance-related material and chaff and/or flare plastic end-caps and pistons.
Conclusion	No significant impact to marine mammals.	No significant harm to marine mammals.

TABLE 3.7-23 (Continued)
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON MARINE MAMMALS IN THE JAX STUDY AREA

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	NEPA (U.S. Territory)	Executive Order 12114 (Non-Territorial Waters, >12 nm)
Alternative 1		
Vessel Movements	Short-term behavioral responses from general vessel disturbance. Low potential for injury from vessel collisions. Slight increase compared to No Action.	Short-term behavioral responses from general vessel disturbance. Low potential for injury from vessel collisions. Slight increase compared to No Action.
Aircraft Overflights	Potential for short-term behavioral responses to overflights. Slight increase compared to No Action. No long-term population-level effects.	Potential for short-term behavioral responses to overflights. Slight increase compared to No Action. No long-term population-level effects.
Towed MIW Devices	Low potential for towed MIW device strikes. Slight increase compared to No Action. No long-term population-level effects.	No effect.
Mine Warfare Training	No effect.	No effect.
NEPM	No effect based on extremely low probability of direct strikes.	No effect based on extremely low probability of direct strikes.
UNDET and Explosive Ordnance	Potential for short-term behavioral responses. Potential for injury within limited ZOI. Slight increase compared to No Action.	Potential for short-term behavioral responses. Potential for injury within limited ZOI. Slight increase compared to No Action.
MEM	Low potential for ingestion of ordnance-related material and chaff and/or flare plastic end-caps and pistons. Slight increase compared to No Action.	Low potential for ingestion of ordnance-related material and chaff and/or flare plastic end-caps and pistons. Slight increase compared to No Action.
Conclusion	No significant impact to marine mammals.	No significant harm to marine mammals.
Alternative 2		
Vessel Movements	Short-term behavioral responses from general vessel disturbance. Low potential for injury from vessel collisions. Slight increase compared to No Action.	Short-term behavioral responses from general vessel disturbance. Low potential for injury from vessel collisions. Slight increase compared to No Action.
Aircraft Overflights	Potential for short-term behavioral responses to overflights. Slight increase compared to No Action. No long-term population-level effects.	Potential for short-term behavioral responses to overflights. Slight increase compared to No Action. No long-term population-level effects.
Towed MIW Devices	Low potential for towed MIW device strikes. Slight increase compared to No Action. No long-term population-level effects.	No effect.
MIW Training	No effect.	No effect.
NEPM	No effect based on extremely low probability of direct strikes.	No effect based on extremely low probability of direct strikes.
UNDET and Explosive	Potential for short-term behavioral responses.	Potential for short-term behavioral

TABLE 3.7-23 (Continued)
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON MARINE MAMMALS IN THE JAX STUDY AREA

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	NEPA (U.S. Territory)	Executive Order 12114 (Non-Territorial Waters, >12 nm)
Ordnance	Potential for injury within limited ZOI. Slight increase compared to No Action.	responses. Potential for injury within limited ZOI. Slight increase compared to No Action.
MEM	Low potential for ingestion of ordnance-related material and chaff and/or flare plastic end-caps and pistons. Slight increase compared to No Action.	Low potential for ingestion of ordnance-related material and chaff and/or flare plastic end-caps and pistons. Slight increase compared to No Action.
Conclusion	No significant impact to marine mammals.	No significant harm to marine mammals.

3.8 SEA TURTLES

3.8.1 Introduction and Methods

3.8.1.1 Regulatory Framework

Endangered Species Act

The ESA established protection over and conservation of threatened and endangered species. An "endangered" species is a species that is in danger of extinction throughout all or a significant portion of its range, while a "threatened" species is one that is likely to become endangered within the foreseeable future throughout all or in a significant portion of its range. The USFWS and NMFS jointly administer the ESA and are also responsible for the listing of species (*i.e.*, the labeling of a species as either threatened or endangered). The USFWS has primary management responsibility for management of terrestrial and freshwater species, including nesting sea turtles. The NMFS has primary responsibility for sea turtles in the marine environment. The ESA requires federal agencies to conserve listed species and consult with the USFWS and/or NMFS to ensure that proposed actions that may affect listed species or critical habitat are consistent with the requirements of the ESA. The ESA specifically requires agencies not to "take" or "jeopardize" the continued existence of any endangered or threatened species, or to destroy or adversely modify habitat critical to any endangered or threatened species. Under Section 7 of the ESA, "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect. Harm is further defined by USFWS to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. Harass is defined by USFWS as actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering (50 CFR §17.3). Under Section 7 of the ESA, "jeopardize" means to engage in any action that would be expected to reduce appreciably the likelihood of the survival and recovery of a listed species by reducing its reproduction, numbers, or distribution.

All five species of sea turtles that potentially occur in the JAX Study Area are listed as threatened or endangered under the ESA. For purposes of ESA compliance, the Navy analyzed effects of the action to make a determination of effect for listed species (*e.g.*, no effect or may affect). The definitions used in making the determination of effect under Section 7 of the ESA are based on the USFWS and NMFS *Endangered Species Consultation Handbook* (USFWS and NMFS, 1998). "No effect" is the appropriate conclusion when a listed species will not be affected, either because the species will not be present or because the project does not have any elements with the potential to affect the species. "No effect" does not include a small effect or an effect that is unlikely to occur: if effects are insignificant (in size), discountable (extremely unlikely), or wholly beneficial a "may affect" determination is appropriate. Insignificant effects relate to the magnitude or extent of the impact (*i.e.*, they must be small and would not rise to the level of a take of a species). Discountable effects are those extremely unlikely to occur and based on best judgment, a person would not: (1) be able to meaningfully measure, detect, or evaluate insignificant effects; or (2) expect discountable effects to occur.

The Navy has initiated the ESA Section 7 formal consultation process with NMFS to determine if the action would adversely affect ESA-listed sea turtles or jeopardize the continued existence of a listed species. Copies of correspondence with NMFS are provided in Appendix C of this EIS/OEIS.

National Environmental Policy Act and Executive Order 12114

In addition to addressing ESA requirements, potential effects were analyzed in accordance with the National Environmental Policy Act (NEPA) to determine if the action would result in significant impacts to sea turtles in territorial waters and in accordance with Executive Order (EO) 12114 to determine if the action would result in significant harm to sea turtles in non-territorial waters.

For purposes of NEPA and EO 12114, the Navy considered context and intensity to determine the significance of effects. Context refers to the affected environment in which the action would occur and intensity refers to the severity of impacts. The Navy considered several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality. The duration of effects (*e.g.*, short-term, long-term, temporary, permanent); degree of controversy; degree of highly uncertain effects or unique or unknown risks; precedent-setting effects; cumulative impacts; adverse effect on ESA-listed species or designated critical habitat; and whether the action threatens a violation of law or requirements imposed for the protection of the environment were also considered. The potential for adverse effects to be observed at the population or species level was a primary factor considered by the Navy in determining the significance of effects to sea turtles. While the factors outlined above for ESA were considered in making NEPA and EO 12114 significance conclusions, it should be recognized that the terminology used to characterize effects varies under these Acts. For example, take of an individual sea turtle under ESA does not necessarily equate to a significant impact under NEPA. Rather, the Navy considered context, intensity, and population-level effects in making its significance conclusions for sea turtles.

3.8.1.2 Assessment Methods and Data Used

General Approach to Analysis

The general approach to analysis for sea turtles is the same as the approach described for marine mammals in Section 3.7.1.2.

Study Area

The Study Area for sea turtles is described in Section 1.5 and is shown in Figure 1.5-1. The Study Area does not include the inland ranges for purposes of the analysis under Section 7 of the ESA.

Data Sources

A comprehensive and systematic review of relevant literature data was conducted to complete this analysis for sea turtles. These data sources are described in Section 3.7.1.2.

Marine Resource Assessments

The information contained in this Chapter relies heavily on the data gathered in the MRAs. The Navy MRA Program was implemented by the Commander, Fleet Forces Command, to initiate collection of data and information concerning the protected and commercial marine resources found in the Navy's OPAREAs. Specifically, the goal of the MRA Program is to describe and document the marine resources present in each of the Navy's OPAREAs. The MRA for the Charleston and JAX OPAREAs was finalized in 2008 (DoN, 2008).

The MRA data were used to provide a regional context for each species. The MRA represents a compilation and synthesis of available scientific literature (*e.g.*, journals, periodicals, theses,

dissertations, project reports, and other technical reports published by government agencies, private businesses, or consulting firms), and NMFS reports including recovery plans, and survey reports.

Navy OPAREA Density Estimates Report

The density estimates that were used in previous Navy environmental documents have been recently updated to provide a compilation of the most recent data and information on the occurrence, distribution, and density of sea turtles. The updated density estimates presented in this EIS/OEIS are derived from *the Navy OPAREA Density Estimates (NODEs) for the Southeast OPAREAs: VACAPES, CHPT, JAX/CHASN, and Southeastern Florida & AUTEC Andros* report (DoN, 2007). The NODE report represents the most current density estimates for sea turtles (DoN, 2007) in the Study Area and were obtained through spatial modeling of survey data provided by NMFS (SEFSC and NEFSC).

Density estimates for sea turtles were modeled using available line-transect survey data. Using the model-based approach, density estimates were calculated for each species within areas containing survey effort. A relationship between these density estimates and the associated environmental parameters such as depth, slope, distance from the shelf break, sea surface temperature (SST), and chlorophyll *a* (chl *a*) concentration was formulated using generalized additive models (GAMs). This relationship was then used to generate a two-dimensional density surface for the region by predicting densities in areas where no survey data exist.

The analyses for sea turtles were based on sighting data collected through aerial surveys conducted by NMFS-Northeast Fisheries Science Center (NEFSC) and Southeast Fisheries Science Center (NMFS-SEFSC) between 1998 and 2005. For specifics of data used in these analyses refer to DoN (2007). All spatial models and density estimates were reviewed by and coordinated with NMFS Science Center technical staff and scientists with the University of St. Andrews, Scotland, Centre for Environmental and Ecological Modeling (CREEM).

Density estimates were generated for the leatherback turtle, loggerhead turtle, Kemp's ridley turtle, and the group "hardshell turtles". The species incorporated into the hardshell turtles group include green, hawksbill, and unidentified hardshell turtles and were pooled together because the numbers of sightings for each species or group were not sufficient to allow spatial modeling. This category did not include leatherback turtles since identification is not difficult. The NODE report did not include density estimates for waters less than 10 m deep.

Table 3.8-1 summarizes the density estimates for training areas where explosive ordnance use may occur in the Jacksonville Range Complex.

3.8.1.3 Warfare Areas and Associated Environmental Stressors

The Navy used a screening process to identify aspects of the proposed action that could act as stressors to sea turtles. Navy subject matter experts de-constructed the warfare areas and operations included in the proposed action to identify specific activities that could act as stressors. Public and agency scoping comments, previous environmental analyses, previous agency consultations, laws, regulations, Executive Orders, and resource-specific information were also evaluated. This process was used to focus the information presented and analyzed in the affected environment and environmental consequences sections of this FEIS/OEIS. As summarized in Table 3.8-2, potential stressors to sea turtles include vessel movements (disturbance and collisions), aircraft overflights (disturbance), towed MIW devices (strikes), inert mine shape deployment/recovery (habitat alteration), weapons firing/ordnance use (disturbance and strikes),

TABLE 3.8-1
SEASONAL DENSITY ESTIMATES FOR SEA TURTLES IN THE JAX STUDY AREA WHERE EXPLOSIVE ORDNANCE MAY OCCUR

Species and Training Area	Density (animals/km^2)			
	Winter (Dec-Feb)	Spring (Mar-May)	Summer (June-Aug)	Fall (Sept-Nov)
Loggerhead Turtle				
BB, & CC	0.13133	0.13133	0.13859	0.13133
31J	0.13133	0.13133	0.13859	0.13133
MLTR	0.11329	0.11329	0.11658	0.11329
CHAS UNDET North	0.03966	0.03966	0.06878	0.03966
CHAS UNDET South	0.05970	0.05970	0.06823	0.05970
Leatherback Turtle				
BB, & CC	0.08251	0.08251	0.08251	0.08251
31J	0.08251	0.08251	0.18951	0.08251
MLTR	0.04512	0.04512	0.05248	0.04512
CHAS UNDET North	0.00016	0.00016	<0.00001	0.00016
CHAS UNDET South	0.00190	0.00190	0.00059	0.00190
Kemp's ridley Turtle				
BB, & CC	0.00969	0.00969	0.00969	0.00969
31J	0.00969	0.00969	0.00969	0.00969
MLTR	0.02092	0.02092	0.02092	0.02092
CHAS UNDET North	0.00336	0.00336	0.00336	0.00336
CHAS UNDET South	0.00222	0.00222	0.00222	0.00222
Hardshell Turtles[(1)]				
BB, & CC	0.07629	0.07629	0.07629	0.07629
31J	0.07629	0.07629	0.06855	0.07629
MLTR	0.07929	0.07929	0.06473	0.07929
CHAS UNDET North	0.00923	0.00923	0.00523	0.00923
CHAS UNDET South	0.00999	0.00999	0.01020	0.00999

Source: (DoN, 2007)

[(1)]Hardshell turtle density estimates include all sightings of unidentified hardshell turtles, green, and hawksbill turtles.

TABLE 3.8-2
SUMMARY OF POTENTIAL STRESSORS TO SEA TURTLES

Warfare Area and Operation	Training Areas	Vessel Movements (Disturbance)	Vessel Movements (Collisions)	Aircraft Overflights (Disturbance)	Mine Warfare Deployment/Recovery	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Material
Mine Warfare (MIW)								
Mine Laying	Lake George Range							
MCM	Carrier Operating Areas	✓	✓	✓	✓	✓		
Mine Neutralization	Charleston OPAREA (North and South UNDET Boxes)	✓	✓		✓	✓	✓	✓
Surface Warfare (SUW)								
MISSILEX (A-S)	JAX OPAREA (MLTR)			✓		✓	✓	✓
GUNEX (A-S)	W-132, W-133, W-134, W-157, W-158			✓		✓		✓
GUNEX (S-S) Boat	Charleston OPAREA (Areas 11J)	✓	✓			✓		✓
GUNEX (S-S) Ship	JAX OPAREA (AA, BB, and CC)	✓	✓			✓		✓
BOMBEX (A-S) (at sea)	HE, W-158 (31J); NEPM, W157A/B and W-158 A/B			✓		✓	✓	✓
Laser Targeting	W-132, W-133, W-134, W-157, W-158			✓				
GUNEX (S-S) (FAC/FIAC)	Amber Strait: Charleston OPAREA (Boxes Q-9&10, R-9&10)	✓	✓					
VBSS/MIO-Ship	JAX and Charleston OPAREAs	✓	✓					

TABLE 3.8-2 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO SEA TURTLES

Warfare Area and Operation	Training Areas	Vessel Movements (Disturbance)	Vessel Movements (Collisions)	Aircraft Overflights (Disturbance)	Mine Warfare Deployment/Recovery	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Material
VBSS/MIO-Helicopter	W-157A (Area 4X) and W-159A (Area 5X)			✓				
Air Warfare (AW)								
ACM	W-157A (Areas 3X & 4X)			✓				✓
Air Intercept Control	JAX and Charleston OPAREAs			✓				
ACM Chaff Exercise	W-157A (Areas 3X & 4X)	✓	✓	✓				✓
ACM Flare Exercise	W-157A (Areas 3X & 4X)							
MISSILEX (A-A)	W-132, W-133, W-134, W-157, W-158			✓		✓	✓[1]	✓
MISSILEX (S-A)	JAX and Charleston OPAREAs							✓
Detect-to-Engage	W-132, W-133, W-134, W-157, W-158	✓	✓	✓				
GUNEX (S-A)	JAX OPAREA (BB and CC)	✓	✓	✓		✓		✓
GUNEX (A-A)	W-157A/W-133 (Area 2X)							✓
Amphibious Warfare (AMW)								
FIREX (Surface-to-Surface) with IMPASS	JAX OPAREA (BB and CC)	✓	✓			✓	✓	✓
Strike Warfare (STW)								
BOMBEX (A-G)	Rodman Range							
CSAR and Convoy Operations	Rodman Range							
Electronic Combat (EC)								
EC Operations - Aircraft	W-132, W-133, W-134, W-157, W-158			✓				

TABLE 3.8-2 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO SEA TURTLES

Warfare Area and Operation	Training Areas	Vessel Movements (Disturbance)	Vessel Movements (Collisions)	Aircraft Overflights (Disturbance)	Mine Warfare Deployment/Recovery	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Material
EC Operations - Surface Ships	JAX and Charleston OPAREAs	✓	✓					
Chaff Exercise	JAX and Charleston OPAREAs	✓	✓	✓				✓
Flare Exercise- Helicopter	Lake George Range							
Other Training								
SESEF Utilization	5-15 nm east of Mayport	✓	✓					
Precision Anchoring	NS Mayport	✓						
Small Arms with anti-swimmer grenades (MK3A2)	Charleston OPAREA (Area 10L, 12I)	✓	✓				✓	✓

[1] Missile explodes in air, no explosive sound in the water.

explosions, and MEM (ordnance-related material, targets, chaff, self-protection flares, and marine markers). The potential effects of these stressors on sea turtles are analyzed in detail in Section 3.8.3.

As discussed in Section 3.3 – Water Resources and Section 3.4 – Air Quality, some water and air pollutants would be released into the environment as a result of the proposed action. The analyses presented in Sections 3.3 and 3.4 indicate that any increases in water or air pollutant concentrations resulting from Navy training in the Study Area would be negligible and localized, and impacts to water and air quality would be less than significant. Based on the analyses presented in Sections 3.3 and 3.4, water and air quality changes would have no effect or negligible effects on sea turtles. Accordingly, the effects of water and air quality changes on sea turtles are not addressed further in this FEIS/OEIS.

3.8.2 Affected Environment

3.8.2.1 Regional Overview

Five sea turtle species (loggerhead, leatherback, Kemp's ridley, green, and, hawksbill) are known to occur in the Study Area (Table 3.8-3). Along the U.S. Atlantic coast, four sea turtle species (leatherback, loggerhead, Kemp's ridley, and green) migrate seasonally from offshore and warmer southern waters far into northern latitudes each summer (Morreale, 2005). Nesting is also documented for beaches bordering the region.

Sea turtle distribution in temperate waters generally shifts on a seasonal basis off the U.S. Atlantic coast in response to changes in water temperature and prey availability (Lutcavage and Musick, 1985; Musick and Limpus, 1997; Coles and Musick, 2000). During winter months, sea turtle distribution shifts either south or offshore, where water temperatures are warmer and their prey are more abundant (Epperly *et al*., 1995b; Epperly *et al*., 1995a). Throughout the rest of the year, sea turtles are common residents of inshore and nearshore waters along the U.S. Atlantic coast as far north as Massachusetts. A notable distinction is the increasing proportion of small and apparently young individuals along a northward gradient (Morreale and Standora, 2005). This pattern is evident in loggerheads and green turtles, and is "starkly obvious" in Kemp's ridleys (Morreale and Standora, 2005). In North Carolina and Virginia, the proportion of breeding adult loggerheads in bays and estuaries is smaller than in Georgia and Florida, with most individuals classified as medium- sized juveniles. For Kemp's ridley, most individuals throughout the range are immature, but the latitudinal gradient still exists (Morreale and Standora, 2005). In southern and mid-Atlantic states (Florida, Georgia, South Carolina, Virginia), a few larger individuals are reported, but the vast majority are small (Morreale and Standora, 2005). In the northeastern waters of New York and Massachusetts, only small-sized Kemp's ridleys are documented.

TABLE 3.8-3
SEA TURTLES KNOWN TO OCCUR IN THE STUDY AREA

Common Name	Scientific Name	Status
Green turtle	*Chelonia mydas*	Threatened[(1)]
Hawksbill turtle	*Eretmochelys imbricata*	Endangered
Kemp's ridley turtle	*Lepidochelys kempii*	Endangered
Leatherback turtle	*Dermochelys coriacea*	Endangered
Loggerhead turtle	*Caretta caretta*	Threatened

[(1)]As a species, the green turtle is listed as threatened. However, the Florida and Mexican Pacific coast nesting populations are listed as endangered. It should be noted that not all green turtles found in the Study Area come from the Florida population.

3.8.2.2 Green Turtle

General Description

The green turtle is the largest hard-shelled sea turtle; adults commonly reach 100 cm in carapace length and 150 kg in weight (NMFS and USFWS, 1991).

Very young green turtles are omnivorous, leaning to carnivory (Bjorndal, 1985; Bjorndal, 1997). Salmon *et al*. (2004) reported that posthatchling green turtles were found to feed near the surface on floating *Thalassia* and *Sargassum* (seaweeds/macroalgae) or at shallow depths on ctenephores and unidentified gelatinous eggs but ignored large jellyfish (*Aurelia*) off southeastern Florida. Adult green turtles feed primarily on seagrasses (*e.g.*, turtle grass, manatee grass, shoal grass, and eelgrass), macroalgae, and reef-associated organisms (Burke *et al*., 1992; Bjorndal, 1997). They also consume jellyfish, salps, and sponges (Mortimer, 1995; Bjorndal, 1997).

Green turtles typically make dives shallower than 30 m (Hays *et al*., 1999, 2000; Hochscheid *et al*., 1999; Godley *et al*., 2002; Hatase *et al*., 2006). However, green turtles are also known to forage and also rest at depths of 20 to 50 m (Balazs, 1980; Brill *et al*., 1995).

Status and Management

The green turtle is classified as threatened under the ESA, with the Florida and Mexican Pacific coast nesting populations listed as endangered (NMFS and USFWS, 1991). There is designated critical habitat for this species in the coastal waters around Culebra Island, Puerto Rico (NMFS, 1998). Recent population estimates for green turtles in the western Atlantic area are not available (NMFS, 2006). NMFS and USFWS share jurisdictional responsibility for sea turtles under the ESA. USFWS has responsibility in the terrestrial environment while NMFS has responsibility in the marine environment.

Habitat

Post-hatchling and early juvenile green turtles reside in convergence zones in the open ocean, where they spend an undetermined amount of time in the pelagic environment (Carr, 1987; Witherington and Hirama, 2006). Once green turtles reach a carapace length of 20 to 25 cm (7.9 to 9.8 inches), they migrate to shallow nearshore areas (<50 m deep) where they spend the majority of their lives as late juveniles and adults. The optimal developmental habitats for late juveniles and foraging adults are warm, shallow waters (3 to 5 m in bottom depth), with an abundance of submerged aquatic vegetation, and located proximal to nearshore reefs or rocky areas, used by green turtles for resting (Holloway-Adkins and Provancha, 2005; Witherington *et al*., 2006a).

General Distribution

The green turtle has a circumglobal distribution, occurring throughout tropical and, to a lesser extent, subtropical waters (Seminoff and MTSG, 2004). Green turtles found in U.S. waters come from nesting beaches widely scattered throughout the Atlantic (Witherington *et al*., 2006a). In U.S. Atlantic and Gulf of Mexico waters, green turtles are found around the U.S. Virgin Islands (USVI), Puerto Rico, and along the continental United States from Texas to Massachusetts (NMFS and USFWS, 1991). Juvenile green turtles utilize estuarine waters along the U.S. Atlantic coast as summer developmental habitat, as far north as Long Island Sound, Chesapeake Bay, and North Carolina sounds (Epperly *et al*., 1995b; Epperly *et al*., 1995a; Musick and Limpus, 1997). Limited information is available regarding the occurrence of green turtles in the Chesapeake Bay, although they are presumably present in very low numbers (NMFS, 2006). Nearshore water temperatures play a major role in determining green turtle distribution along the Atlantic and Gulf coasts of the United States (Musick and Limpus, 1997; Witherington *et al*., 2006a). Adults are predominantly tropical and are only occasionally found north of southern Florida. Most sightings of individuals north of Florida occur between late spring and early fall, and are juveniles (Lazell, 1980; CETAP, 1982; Burke *et al*., 1992; Epperly *et al*., 1995a).

Optimal feeding habitats for green turtles in the continental U.S. include waters in Florida and southern Texas such as the Indian River Lagoon, Florida Keys, Florida Bay, Homosassa Springs, Crystal River, Cedar Keys, and Laguna Madre Complex (NMFS and USFWS, 1991; Hirth, 1997). The inshore waters of North Carolina are also an important feeding habitat for juveniles of this species (Epperly *et al*., 1995a).

Green turtles nest on both island and continental beaches between 30ºN and 30ºS (Witherington *et al*., 2006a). Although Florida is near the northern extent of the green turtle's Atlantic nesting range, it hosts a significant proportion of green turtle nesting (Witherington *et al*., 2006a). Green turtle nesting in Florida has occurred in every coastal county except those bordering the Big Bend area (Meylan *et al*., 1995; Witherington *et al*., 2006a). Approximately 99 percent of the green

turtle nesting in Florida occurs on the Atlantic coast, with Brevard through Broward counties hosting the greatest nesting activity (Meylan *et al*., 1995; Witherington *et al*., 2006a). There are scattered nesting records in Georgia, and the Carolinas (Peterson *et al*., 1985; Schwartz, 1989; NMFS and USFWS, 1991).

Green Turtle Occurrence

Green turtles may occur year-round in the JAX Study Area, particularly in waters between the shoreline and the 50 m isobath, where their preferred habitats of seagrass beds and worm-rock reefs are found.

Green Turtle Density

The density estimates for training areas where explosions and/or ordnance use may occur in the JAX Study Area are provided in Table 3.8-1. Seasonal density estimates for the hardshell turtle group in the JAX Study Area, which includes greens, hawksbills, and unidentified hardshell turtles. Methods and results are detailed in the NODE Report (DoN, 2007).

3.8.2.3 Hawksbill Turtle

General Description

The hawksbill turtle is a small to medium-sized sea turtle; adults range between 65 and 90 cm in carapace length and typically weigh around 80 kg (Witzell, 1983; NMFS and USFWS, 1993). Hawksbills are considered to be omnivorous during the later juvenile stage, feeding on encrusting organisms such as sponges, tunicates, bryozoans, algae, mollusks, and a variety of other items such as crustaceans and jellyfish (Bjorndal, 1997). Older juveniles and adults are more specialized feeding primarily on sponges, which comprise as much as 95 percent of their diet in some locations (Witzell, 1983; Meylan, 1988).

Hawksbills may have one of the longest routine dive times of all the sea turtles. Starbird, *et al*. (1999) reported that inter-nesting females at Buck Island, USVI averaged 56.1-minute dives. Average dives during the day ranged from 34 to 65 minutes, while those at night were between 42 and 74 minutes. Data from time-depth recorders indicate that foraging dives of immature hawksbills in Puerto Rico range from 8.6 to 14 minutes in duration, with a mean depth of 4.7 m (Van Dam and Diez, 1996). These individuals were found to be most active during the day. Changes in water temperature have an effect on the behavioral ecology of hawksbill turtles, with an increase in nocturnal dive duration with decreasing water temperatures during the winter (Storch *et al*., 2005).

Status and Management

The hawksbill turtle is listed as endangered under the ESA. This species is second only to the Kemp's ridley in terms of endangerment (NMFS and USFWS, 1993; Bass, 1994) There is designated critical habitat for the species in the Caribbean that includes the waters surrounding Mona and Monito islands, Puerto Rico (NMFS and USFWS, 1998a). NMFS and USFWS share jurisdictional responsibility for sea turtles under the ESA. USFWS has responsibility in the terrestrial environment while NMFS has responsibility in the marine environment.

Habitat

Hawksbill turtles inhabit oceanic waters as post-hatchlings and small juveniles, where they are sometimes associated with driftlines and floating patches of *Sargassum* (Parker, 1995;

Witherington and Hirama, 2006). The developmental habitats for juvenile benthic-stage hawksbills are the same as the primary feeding grounds for adults. They include tropical, nearshore waters associated with coral reefs, hard bottoms, or estuaries with mangroves (Musick and Limpus, 1997). Coral reefs are recognized as optimal hawksbill habitat for juveniles, sub-adults, and adults (NMFS and USFWS, 1993; Diez and Van Dam, 2003). In neritic habitats, resting areas for late juvenile and adult hawksbills are typically located in deeper waters than their foraging areas, such as sandy bottoms at the base of a reef flat (Houghton *et al*., 2003). Late juveniles generally reside on shallow reefs less than 18 m deep. However, as they mature into adults, hawksbills move to deeper habitats and may forage to depths greater than 90 m. Benthic-stage hawksbills are seldom found in waters beyond the continental or insular shelf, unless they are in transit between distant foraging or nesting grounds (NMFS and USFWS, 1993).

General Distribution

Hawksbill turtles are circum-tropical in distribution, generally occurring from 30°N to 30°S within the Atlantic, Pacific, and Indian oceans (Witzell, 1983). The hawksbill turtle has only rarely been recorded away from the tropics. In the Atlantic Ocean, this species is found throughout the Gulf of Mexico, the Greater and Lesser Antilles, and southern Florida, as well as along the mainland of Central America south to Brazil (NMFS and USFWS, 1993). The hawksbill is rare north of Florida (Lee and Palmer, 1981; Keinath *et al*., 1991; Parker, 1995; Plotkin, 1995; USFWS, 2001). Small hawksbills have stranded as far north as Cape Cod, Massachusetts (NMFS, 2006). In 2000 there was one hawksbill stranding in the Chesapeake Bay and one was reported as being taken incidentally in a fishery just south of the Chesapeake Bay (NMFS, 2006). Adult hawksbills are rarely documented in Florida waters, although nesting females occasionally visit beaches along the southeastern coast and the Florida Keys (Meylan and Redlow, 2006).

Major foraging populations in U.S. waters occur in the vicinity of the coral reefs surrounding Mona Island, Puerto Rico and Buck Island, St. Croix, USVI (Starbird *et al*., 1999). Smaller populations of hawksbills reside in the hard bottom habitats that surround the Florida Keys and other small islands in Puerto Rico and the USVI (Witzell, 1983; NMFS and USFWS, 1993). There is designated critical habitat for the species in the Caribbean that includes the waters surrounding Mona and Monito islands, Puerto Rico (NMFS and USFWS, 1998a).

Virtually all nesting is restricted between latitudes 25ºN and 35ºS. Hawksbill nesting in Florida has been reported from Cape Canaveral National Seashore south to Boca Grande Key and the Marquesas Islands and a single locality on the west coast (Longboat Key) (Meylan and Redlow, 2006).

Hawksbill Turtle Occurrence

The hawksbill is rare north of Florida (Lee and Palmer, 1981; Keinath *et al*., 1991; Parker, 1995; Plotkin, 1995; USFWS, 2001). There is sparse sighting, stranding, and by catch data for the Atlantic coast of Florida. Hawksbills may occur rarely in the JAX Study Area.

Hawksbill Turtle Density

The density estimates for training areas where explosions and/or ordnance use may occur in the JAX Study Area are provided in Table 3.8-1. Seasonal density estimates for the hardshell turtle group in the JAX Study Area, include greens, hawksbills, and unidentified hardshell turtles. Methods and results are detailed in the NODE Report (DoN, 2007).

3.8.2.4 Kemp's Ridley Turtle

General Description

The Kemp's ridley is the smallest living sea turtle. This species has a straight carapace length of approximately 60 to 70 cm (with shell length and width being nearly equal) and weigh about 45 kg (USFWS and NMFS, 1992; Gulko and Eckert, 2004). Kemp's ridley turtles feed primarily on portunids (swimming crabs) and other types of crabs, but are also known to prey on mollusks, shrimp, fish, jellyfish, and plant material (Marquez-M., 1994; Frick *et al*., 1999; Lutcavage and Musick, 1985; Keinath *et al*., 1987; Seney and Musick, 2005). Kemp's ridleys may also feed on shrimp fishery by catch (Landry and Costa, 1999).

Few data are available on the maximum dive duration. Satellite-tagged juvenile Kemp's ridley turtles demonstrate different mean surface intervals and dive depths depending on whether the individual is located in shallow coastal areas (short surface intervals) or in deeper, offshore areas (longer surface intervals). Dive times range from a few seconds to a maximum of 167 minutes, with routine dives lasting between 16.7 and 33.8 minutes (Mendonça and Pritchard, 1986; Renaud, 1995). In Cedar Keys, Florida, the average submergence duration was found to be approximately 8.4 minutes (Schmid *et al*., 2002). Renaud and Williams (2005) noted seasonal differences in dive durations, with longer dives (>30 minutes) during the winter and 15 minutes the remainder of the year. Sasso and Witzell (2006) reported longer dives at night than during the day for this species. Over a 12-hour period, Kemp's ridleys spend as long as 96 percent of their time submerged (Byles, 1989; Gitschlag, 1996; Renaud and Williams, 2005; Sasso and Witzell, 2006).

Status and Management

The Kemp's ridley turtle is classified as endangered under the ESA; this is considered the world's most endangered sea turtle species (USFWS and NMFS, 1992). The worldwide population declined from tens of thousands of nesting females in the late 1940s to approximately 300 nesting females in 1985 (TEWG, 2000). From 1985 to 1999, the number of nests at Rancho Nuevo increased at a mean rate of 11.3 percent per year (TEWG, 2000). Positive trends in 2005 were recorded in Rancho Nuevo, Tamaulipas (6,947 nests) on the eastern coast of Mexico, Barra del Tordo (701 nests), and Barra de Tepehuajes (1,610 nests) (USFWS, 2005). Nesting levels at Padre Island National Seashore in Texas, the site of a Kemp's ridley head-starting and imprinting program from 1978 to 1988, have shown a slow but steady rise throughout time (Shaver and Wibbels, 2007). NMFS and USFWS share jurisdictional responsibility for sea turtles under the ESA. USFWS has responsibility in the terrestrial environment while NMFS has responsibility in the marine environment.

Habitat

Kemp's ridley turtles occur in open-ocean and *Sargassum* habitats of the North Atlantic Ocean as post-hatchlings and small juveniles (Manzella *et al*., 1991; Witherington and Hirama, 2006). They move as large juveniles and adults to benthic, nearshore feeding grounds along the U.S. Atlantic and Gulf coasts (Morreale and Standora, 2005). Habitats frequently utilized include warm-temperate to subtropical sounds, bays, estuaries, tidal passes, shipping channels, and beachfront waters where preferred food, including the blue crab, occurs (Lutcavage and Musick, 1985; Landry and Costa, 1999; Seney and Musick, 2005). Models indicate that the most suitable habitats are less than 10 m in bottom depth with sea surface temperatures between 22° and 32°C (Coyne *et al*., 2000). Seagrass beds and mud bottom, as well as live bottom, are important developmental

habitats (Schmid and Barichivich, 2006). Postnesting Kemp's ridleys travel along coastal corridors generally shallower than 50 m in bottom depth (Morreale *et al*., 2007).

General Distribution

Feeding grounds and developmental areas are found on the Atlantic and Gulf coasts of the United States. Henwood and Ogren (1987), and Gitschlag (1996) documented sightings and movements of juveniles within and among preferred habitats along both the Atlantic and Gulf coasts. Some Kemp's ridley juveniles may migrate as far north as New York and New England, arriving in these areas around June (Morreale and Standora, 2005). During the winter, they are prompted by cooler water temperatures to leave northern developmental habitats and migrate south to warmer waters in Florida (Marquez-M., 1994). Migrations tend to take place in nearshore waters along the mid-Atlantic coast (Morreale and Standora, 2005; Morreale *et al*., 2007); juvenile and adults typically travel inshore of the 18 m isobath (Renaud and Williams, 2005). This migratory corridor is a narrow band running within continental shelf waters, possibly spanning the entire length of the U.S. Atlantic coast (Morreale and Standora, 2005; Morreale *et al*., 2007). Next to loggerheads, the Kemp's ridley is the second most abundant sea turtle in mid-Atlantic waters (Keinath *et al*., 1987; Musick and Limpus, 1997). Seasonal movements continue until turtles reach sexual maturity, at which time, they return to breeding grounds in the Gulf of Mexico (Henwood and Ogren, 1987).

The western coast of Florida (particularly the Cedar Keys area), the coast of Alabama, the mouth of the Mississippi River, and the coastal waters off western Louisiana and eastern Texas are identified as important developmental regions for the Kemp's ridley (Márquez-M., 1990; USFWS and NMFS, 1992; Marquez-M., 1994; Schmid *et al*., 2002). The Gulf of Campeche in the southern Gulf of Mexico is also important foraging habitat.

Individuals are known to overwinter in areas south of Cape Hatteras, North Carolina, although the majority of Kemp's ridleys stay in Florida near Cape Canaveral (Henwood and Ogren, 1987). Overwintering individuals may occasionally bury in the mud to hibernate (Schwartz, 1989; Marquez-M., 1994). Individuals that overwinter in southern North Carolina may subsequently move into warmer waters (*e.g.,* Gulf Stream or areas off South Carolina) during the mid-winter (Renaud, 1995; Morreale and Standora, 2005). For example, an individual satellite tagged in Beaufort in 1989 stayed the winter in Onslow Bay, North Carolina during the winter and subsequently moved into the Gulf Stream when temperatures cooled close to shore in January 1990 (Renaud, 1995).

Kemp's Ridley Turtles Occurrence

Kemp's ridleys utilize developmental habitats in North Carolina, South Carolina, and Georgia from April through October (Morreale and Standora, 2005). The majority of Kemp's ridleys overwinter off the coasts of Florida and Georgia (Henwood, 1987). Kemp's ridleys occur within the JAX Study Area year-round. Water temperature is an influential factor in the occurrence and distribution of Kemp's ridleys within the Study Area. Kemp's ridley hatchlings may occur offshore seaward of shelf break near the Gulf Stream in *Sargassum* and older animals, sub-adults and adults, may be found in the warm Gulf Stream waters during the colder months.

Kemps' Ridley Turtle Density

The density estimates for training areas where explosions and/or ordnance use may occur in the JAX Study Area are provided in Table 3.8-1. Methods and results are detailed in the NODE Report (DoN, 2007).

3.8.2.5 Leatherback Turtle

General Description

The leatherback turtle is the largest living sea turtle. Mature males and females can be as long as 2 m curved carapace length (NMFS and USFWS, 1992). Specimens less than 145 cm curved carapace length are considered to be juveniles (NMFS-SEFSC, 2001; Eckert, 2002). Adult leatherbacks weigh between 200 and 700 kg (NMFS and USFWS, 1992), although larger individuals are documented (Eckert and Luginbuhl, 1988). Leatherbacks feed throughout the epipelagic and into the mesopelagic zones of the water column (Davenport, 1988; Eckert *et al*., 1989; Grant and Ferrell, 1993; Salmon *et al*., 2004; James *et al*., 2005b). Prey is predominantly gelatinous zooplankton such as cnidarians (jellyfish and siphonophores) and tunicates (salps and pyrosomas) (NMFS and USFWS, 1992; Grant and Ferrell, 1993; Bjorndal, 1997; James and Herman, 2001; Salmon *et al*., 2004).

The leatherback is the deepest diving sea turtle with a recorded maximum depth of 1,230 m (Hays *et al*., 2004a), though most dives are much shallower than this (usually less than 200 m) (Hays *et al*., 2004a; Sale *et al*., 2006). Leatherbacks spend the majority of their time in the upper 65 m of the water column regardless of their behavior (Jonsen *et al*., 2007). The aerobic dive limit for the leatherback turtle is estimated between 33 and 67 minutes (Southwood *et al*., 1999; Hays *et al*., 2004b; Wallace *et al*., 2005). Tagging data revealed that changes in individual turtle diving activity appear to be related to water temperature, suggesting an influence of seasonal prey availability on their diving behavior (Hays *et al*., 2004b).

Leatherbacks dive deeper and longer in the lower latitudes versus the higher (south versus the north) (James *et al*., 2005b). In northern waters, they are also known to dive to waters with temperatures just above freezing (James *et al*., 2006a; Jonsen *et al*., 2007). James *et al*. (2006b) noted considerable variability in surface time between the northern and southern latitudes. Dives in the north are punctuated by longer surface intervals (equating to much more time spent at the surface per 24-hour period), with individuals spending up to 50 percent of their time at or near the surface in northern foraging areas, perhaps in part to thermoregulate (*i.e.*, bask).

Status and Management

Leatherback turtles are listed as endangered under the ESA. Critical habitat for leatherbacks is designated in the Caribbean at Sandy Point, St. Croix, USVI (NMFS, 1979). NMFS and USFWS share jurisdictional responsibility for sea turtles under the ESA. USFWS has responsibility in the terrestrial environment while NMFS has responsibility in the marine environment.

Habitat

Throughout their lives, leatherbacks are essentially oceanic, yet they enter into coastal waters for foraging and reproduction. There is limited information available regarding the habitats utilized by post-hatchling and early juvenile leatherbacks as these age classes are entirely oceanic (NMFS and USFWS, 1992). These life stages are restricted to waters greater than 26°C and, therefore, spend much time in tropical waters (Eckert, 2002). Late juvenile and adult leatherback turtles are known to range from mid-ocean to continental shelf and nearshore waters (Schroeder and Thompson, 1987; Shoop and Kenney, 1992; Grant and Ferrell, 1993). Juvenile and adult foraging habitats include both coastal feeding areas in temperate waters and offshore feeding areas in tropical waters (Frazier, 2001). Adults may also feed in cold waters at high latitudes (James *et al.*, 2006a). The movements of adult leatherbacks appear to be linked to the seasonal availability of their prey and

the requirements of their reproductive cycle (Collard, 1990; Davenport and Balazs, 1991; Luschi *et al.*, 2006).

General Distribution

The leatherback turtle is distributed circumglobally in tropical, subtropical, and warm-temperate waters throughout the year and into cooler temperate waters during warmer months (NMFS and USFWS, 1992; James *et al*., 2005a) as far north as Nova Scotia, Newfoundland, Labrador, Iceland, the British Isles, and Norway (Bleakney, 1965; Brongersma, 1972; Threlfall, 1978; Goff and Lien, 1988). The leatherback is the most oceanic and wide-ranging of sea turtles, undertaking extensive migrations for hundreds to thousands of kilometers (Morreale *et al*., 1996; Hughes *et al*., 1998). Adult leatherback turtles forage in temperate and subpolar regions in all oceans and migrate to tropical nesting beaches between 30°N and 20°S.

According to aerial survey data, there is a northward movement of individuals along the southeast coast of the United States in the late winter/early spring. In February and March, most leatherbacks along the U.S. Atlantic coast are found in the waters off northeast Florida. By April and May leatherbacks begin to occur in larger numbers off the coasts of Georgia and the Carolinas (NMFS, 1995; 2000). In late spring/early summer, leatherbacks appear off the mid-Atlantic and New England coasts, while by late summer/early fall, many will have traveled as far north as the waters off eastern Canada, remaining in the northeast from approximately May through October (CETAP, 1982; Shoop and Kenney, 1992; Wyneken *et al*., 2005). Leatherback foraging areas in the western Atlantic are located on the continental shelf (30 to 50°N) as well as offshore (42°N, 65°W) (Eckert *et al*., 2006). The location of these foraging areas changes seasonally. From March through November, foraging areas occur on the North American continental shelf yet shift to off-shelf waters from December through February (Eckert *et al*., 2006).

Leatherback nesting occurs on isolated mainland beaches in tropical (mainly Atlantic and Pacific, few in Indian Ocean) and temperate oceans (southwest Indian Ocean) (NMFS and USFWS, 1992) and to a lesser degree on some islands, such as the Greater and Lesser Antilles. In the U.S., the densest nesting is in Florida along the Atlantic coast from Jensen Beach south to Palm Beach (Stewart and Johnson, 2006). Sporadic nesting occurs in Georgia, South Carolina, and as far north as North Carolina (Rabon *et al*., 2003).

Leatherback Turtle Occurrence

Leatherbacks are found year-round in the JAX Study Area in both coastal and deep waters. Leatherback foraging areas in the western Atlantic are located on the continental shelf (30 to 50°N) as well as offshore (42°N, 65°W) (Eckert *et al*., 2006). The location of these foraging areas changes seasonally. From March through November, foraging areas occur on the North American continental shelf yet shift to off-shelf waters from December through February (Eckert *et al*., 2006). Leatherback occurrence is seasonal along the U.S. Atlantic coast, with the number of sightings along the northern area of the coast increasing from winter to summer. Leatherback turtles are generally concentrated off the northeastern Florida coast during the winter beginning in November and December (NMFS, 1995). Leatherbacks may occur year-round in shallow waters over the continental shelf (Lee and Palmer, 1981) as well as offshore waters (Schwartz, 1989).

Leatherback Turtle Density

The density estimates for training areas where explosions and/or ordnance use may occur in the JAX Study Area are provided in Table 3.8-1. Methods and results are detailed in the NODE Report (DoN, 2007).

3.8.2.6 Loggerhead Turtle

General Description

The loggerhead turtle is a large hard-shelled sea turtle named for its disproportionately large head. The average straight carapace length of an adult female loggerhead is between 90 and 95 cm and the average weight is 100 to 150 kg (Dodd, 1988; NMFS and USFWS, 1998b). The diet of the loggerhead turtles progressively changes with age and size (Godley *et al*., 1998). The gut contents of post-hatchlings found in masses of *Sargassum* contained parts of *Sargassum*, zooplankton, jellyfish, larval shrimp and crabs, and gastropods (Carr and Meylan, 1980; Richardson and McGillivary, 1991; Witherington, 1994). Juvenile and subadult loggerhead turtles are omnivorous, foraging on pelagic crabs, mollusks, jellyfish, and vegetation captured at or near the surface (Dodd, 1988; Frick *et al*., 1999). Adult loggerheads are carnivorous, often foraging on fish, in nearshore waters, as well as benthic invertebrates (mollusks, crustaceans, and coelenterates) (Dodd, 1988).

On average, loggerhead turtles spend over 90 percent of their time underwater (Byles, 1988; Renaud and Carpenter, 1994; Narazaki *et al*., 2006). Loggerheads tend to remain at depths shallower than 100 m (Houghton *et al*., 2002; Polovina *et al*., 2003; Hawkes *et al*., 2006; Narazaki *et al*., 2006; McClellan, 2007). Routine dive depths are typically shallower than 30 m (Houghton *et al*., 2002), although dives of up to 233 m were recorded for a post-nesting female loggerhead off Japan (Sakamoto *et al*., 1990). Routine dives typically can last from 4 to 120 minutes (Byles, 1988; Sakamoto *et al*., 1990; Renaud and Carpenter, 1994; Bentivegna *et al*., 2003; Dodd and Byles, 2003).

Status and Management

Loggerhead turtles are listed as threatened under the ESA. The loggerhead is the most abundant sea turtle occurring in U.S. waters. In the continental United States there are four demographically independent loggerhead nesting groups or subpopulations: (1) Northern: North Carolina, South Carolina, Georgia, and northeast Florida; (2) South Florida: occurring from 29°N on the east coast to Sarasota on the west coast; (3) Florida Panhandle: Eglin Air Force Base and the beaches near Panama City, and (4) Dry Tortugas (Witherington *et al*., 2006b). Bowen *et al*. (1995) noted that under a conventional interpretation of the nuclear deoxyribonucleic acid (DNA) data, all breeding populations in the entire southeastern United States would be regarded as a single management unit, yet the mitochondrial DNA data indicate multiple isolated populations, and further suggest this complex population structure mandates a different management strategy at each life stage. The South Florida nesting subpopulation is the largest loggerhead rookery in the Atlantic Ocean (and the second largest in the world), followed by the Northern, Florida Panhandle, and Dry Tortugas subpopulations (Ehrhart *et al*., 2003; Witherington *et al*., 2006b). The south Florida nesting subpopulation produced between 43,500 and 83,400 nests annually over the past decade (USFWS and NMFS, 2003). Nesting trends indicate that the number of nesting females associated with the south Florida subpopulation is increasing (Epperly *et al*., 2001). NMFS and USFWS share

jurisdictional responsibility for sea turtles under the ESA. USFWS has responsibility in the terrestrial environment while NMFS has responsibility in the marine environment.

Habitat

The loggerhead turtle occurs worldwide in habitats ranging from coastal estuaries to waters far beyond the continental shelf (Dodd, 1988). The species may be found hundreds of miles out to sea, as well as in inshore areas such as bays, lagoons, salt marshes, creeks, ship channels, and the mouths of large rivers. Results from tagging data of juvenile loggerheads in both the eastern and western North Atlantic suggest that the location of currents and associated frontal eddies is important to the foraging ecology of the pelagic stage of this species (McClellan, 2007). The neritic juvenile stage and adult foraging stage both occur in the neritic (nearshore) zone. Coral reefs, rocky places, and ship wrecks are often used as feeding areas. The turtles here are active and feed primarily on the bottom (epibenthic/demersal), though prey is also captured throughout the water column (Bjorndal, 2003; Bolten, 2003). The neritic zone not only provides crucial foraging habitat, but can also provide inter-nesting and overwintering habitat. Tagging data revealed that migratory routes may be coastal or may involve crossing deep ocean waters; an oceanic route may be taken even when a coastal route is an option (Schroeder *et al*., 2003).

General Distribution

Loggerhead turtles are widely distributed in subtropical and temperate waters (Dodd, 1988). Loggerhead turtles can be found along the U.S. Atlantic coast from Cape Cod to the Florida Keys during any season. Loggerheads seem generally restricted to waters of the North Atlantic Ocean south of 38°N, with mean sea surface temperatures around 22.2°C. In the Mid-Atlantic Bight, loggerheads concentrate in continental shelf waters but are also commonly sighted in deeper, offshore waters (Shoop and Kenney, 1992). Low water temperatures affect loggerhead turtle activity. Cold-stunned loggerheads have been found in various locales, including off the northeastern United States (Morreale *et al*., 1992). Immature loggerheads inhabiting cool-temperate areas in the western North Atlantic usually migrate seasonally to avoid cold-stunning (lethargy due to cold water temperatures that could lead to death) (Musick and Limpus, 1997). Some loggerheads are believed to escape cold conditions by burying themselves in the bottom sediment and hibernating (Carr *et al*., 1980; Ogren and McVea, 1995; Hochscheid *et al*., 2005). In early spring, juvenile loggerheads over-wintering in southeastern U.S. waters begin to migrate north to developmental feeding habitats (Morreale and Standora, 2005).

The generally accepted life-history model for the species is summarized well by Musick and Limpus (1997), Bolten and Witherington (2003), and Hawkes, *et al*. (2006). Hatchlings travel to oceanic habitats, often occurring in *Sargassum* drift lines (Carr, 1986, 1987; Witherington and Hirama, 2006). When juveniles reach sizes between 40 and 60 cm carapace length (about 14 years old), some individuals begin to recruit to the neritic zone (benthic habitat in shallow coastal waters) close to their natal area, while others remain in the oceanic habitat or move back and forth between the two (Musick and Limpus, 1997; Laurent *et al*., 1998). Turtles either may utilize the same neritic developmental habitat all through maturation, or they may move among different areas and finally settle in an adult foraging habitat. At sexual maturity (about 30 years old), adults switch from subadult to adult neritic foraging habitats (Musick and Limpus, 1997; Godley *et al*., 2003). In direct contrast with the accepted life-history model for this species, Hawkes *et al*. (2006) recently reported that tagging work at the Cape Verde Islands (Africa) revealed two distinct adult foraging strategies that appear to be linked to body size. The larger turtles foraged in coastal waters,

whereas smaller individuals foraged oceanically. Likewise, off Japan, epipelagic foraging has been recorded for adult female loggerheads (Hatase *et al*., 2002). Hawkes *et al*. (2006) also found that movements of adult loggerheads off Cape Verde were in part driven by local surface currents, with active movement by individuals to remain in areas of high productivity.

Loggerhead Turtle Occurrence

The loggerhead turtle is the most abundant sea turtle in the JAX Study Area. Loggerheads are distributed over the continental shelf and slope, with the majority found between the shoreline and the shelf break. Significant populations are known to occur in the following areas: Cape Fear River, North Carolina; Charleston Harbor, South Carolina; Port of Savannah, Georgia; and the Cape Canaveral Ship Channel, Florida. Juveniles and subadults constitute over 80 percent of loggerheads encountered in these areas, from August through March (Henwood, 1987). Nesting occurs along almost the entire coastline adjacent to the Study Area, several of the locations are high density nesting beaches. Loggerheads may occur year-round in the JAX and Charleston OPAREAs, using the waters for overwintering, foraging, migrating, and traveling to nesting beaches.

Loggerhead Turtle Density

The density estimates for training areas where explosions and/or ordnance use may occur in the JAX Study Area are provided in Table 3.8-1. Methods and results are detailed in the NODE Report (DoN, 2007).

3.8.3 Environmental Consequences

3.8.3.1 Explosive Ordnance Exposure Analysis

The exercises that use explosives are BOMBEX (31J), MINEX (North and South UNDET Areas), FIREX (BB,CC), MISSILEX (MLTR) and small arms training (North and South UNDET Areas). Table 2.2-7 summarizes the number of events per year and specific areas where each occurs for each type of explosive ordnance used.

Summary of Thresholds and Criteria for Sea Turtles

Documentation of PTS or TTS in sea turtles is extremely scarce; limited to scattered, solitary records that would be difficult to extrapolate to a population-wide generality. However, it is assumed that acoustic exposure may elicit a physiological or behavioral response (startle) to detonations. Presumably the same broad categories of responses that were examined for marine mammals may also apply here to sea turtles (See Section 3.7.3.1). Few experiments have been conducted to attempt to quantify explosive exposures on turtles; and unfortunately, the methods of these experiments do not allow for their results to be analyzed. Navy analysts have compared the injury levels reported by the best of these experiments to the injury levels that would be predicted using the modified Goertner method (Goertner, 1982). For this assessment, in the absence of criteria specifically set for sea turtles, the criteria for marine mammals, as established in the Churchill FEIS (DON, 2001), are used to estimate potential exposures for turtles. Non-injurious effects are determined by either the dual physiological criteria for single detonations or by the behavioral criterion for multiple detonations. The criterion for behavioral disturbance used in this analysis is based on use of multiple explosives that only take place during a FIREX (w/IMPASS) event or a BOMBEX event where the MK-82 or MK-83 bombs are used. Table 3.8-4 shows the criteria used in the assessment for impulsive sounds for sea turtles. Section 3.7.3.2 provides a more

detailed explanation for each criteria level, metric, and threshold for small explosives and a full explanation of the acoustic affects analysis.

TABLE 3.8-4
EFFECTS, CRITERIA, AND THRESHOLDS FOR IMPULSIVE SOUNDS

Effect	Criteria	Metric	Threshold
Mortality	Onset of Extensive Lung Injury	Goertner modified positive impulse	indexed to 30.5 psi-msec (assumes 100% small animal at 26.9 lbs)
Injurious Physiological	50% Tympanic Membrane Rupture - PTS	Energy flux density	1.17 in-lbs/in^2 (about 205 dB re 1 μPa^2-sec)
Injurious Physiological	Onset Slight Lung Injury	Goertner modified positive impulse	indexed to 13 psi-msec (assumes 100% small animal at 26.9 lbs)
Non-injurious Physiological	TTS	Greatest energy flux density level in any 1/3-octave band (above 100 Hz for toothed whales/sea turtles and above 10 Hz for baleen whales) - for total energy over all exposures	182 dB re 1 μPa^2-sec
Non-injurious Physiological	TTS	Peak pressure for any single exposure	23 psi
Non-injurious Behavioral	Behavioral Disturbance	Greatest energy flux density level in any 1/3-octave (above 100 Hz for sea turtles) - for total energy over all exposures (multiple explosions only)	177 dB re 1 μPa^2-sec

MMPA = Marine Mammal Protection Act
TTS = Temporary Threshold Shift; PTS = Permanent Threshold Shift

Acoustic Effects Analysis

Section 3.7.3.2 for marine mammals outlines the analysis and also applies here to sea turtles. In addition, a more in-depth effects analysis may be found in Appendix J.

3.8.3.2 No Action Alternative

Vessel Movements

Many of the ongoing and proposed operations within the Study Area involve maneuvers by various types of surface ships, boats, and submarines (collectively referred to as vessels). Vessel movements have the potential to affect sea turtles by directly striking or disturbing individual animals. The probability of ship and sea turtle interactions occurring in the Study Area is dependent on several factors including numbers, types, and speeds of vessels; the regularity, duration, and spatial extent of operations; the presence/absence and density of sea turtles; and mitigation measures implemented by the Navy. Currently, the number of Navy ships operating in the Study Area varies based on training schedules and can range from 0 to about 10 ships at any given time. Ship sizes range from 362 feet for an SSN to 1,092 feet for a CVN and speeds range from 10 to 14 knots. Operations involving vessel movements occur intermittently and are short in duration, ranging from a few hours up to a

few weeks. These operations are widely dispersed throughout the Study Area, which is a vast area encompassing 50,090 nm^2. The Navy logs about 1,000 total steaming days within the Study Area during a typical year.

Also, it should be noted that a variety of smaller craft, such as service vessels for routine operations and opposition forces used during training events will be operating within the study area. Small craft types, sizes and speeds vary. The Navy's rigid hull inflatable boat (RHIB) is one representative example of a small craft that may be used during training exercises. By way of example, the Naval Special Warfare RHIB is 35 feet in length and has a speed of 40+ knots. Other small craft, such as those used in maritime security training events, are of similar length and speed to the RHIB and often resemble, and often are, recreational fishing boats (*i.e.*, a 30 - 35 foot center consol boat with twin outboard engines).

During training speeds generally range from 10 to 14 knots; however, it should be expected that ships/craft can and will, on occasion, operate within the entire spectrum of their specific operational capabilities. It may be necessary for vessels/craft to operate at higher speeds for specific events, such as, but not limited to, pursuing and overtaking hostile vessels, evasive maneuvers, and maintenance/performance checks, such as ship trials. In all cases, the vessels/craft will be operated in a safe manner consistent with the local conditions.

Disturbance

The ability of turtles to detect approaching water vessels via auditory and/or visual cues would be expected based on knowledge of their sensory biology (Bartol and Musick, 2003; Levenson *et al*., 2004; Ketten and Bartol, 2006; Moein Bartol and Ketten, 2006). Little information is available on how turtles respond to vessel approaches. Hazel *et al*. (2007) reported that greater vessel speeds increased the probability turtles would fail to flee from an approaching vessel. Turtles fled frequently in encounters with a slow-moving (2.2 knots) vessel, but infrequently in encounters with a moderate-moving (5.9 knots) vessel, and only rarely in encounters with a fast-moving (10.3 knots) vessel. It is difficult to differentiate whether a sea turtle reacts to a vessel due to the produced sound, the presence of the vessel itself, or a combination of both.

Sea turtle hearing sensitivity is not well studied. Several studies using green, loggerhead, and Kemp's ridley turtles suggest that sea turtles are most sensitive to low-frequency sounds, although this sensitivity varies slightly by species and age class (Ridgway *et al*., 1969; Lenhardt *et al*., 1994; Moein Bartol *et al*., 1999; Ketten and Bartol, 2006).

Sea turtles possess an overall hearing range of approximately 100 to 1,000 Hz, with an upper limit of 2,000 Hz (Ridgway *et al*., 1969; Lenhardt *et al*., 1994; Moein Bartol *et al*., 1999; Ketten and Bartol, 2006). Although it is difficult to determine whether sea turtle response to vessel traffic is visual or auditory in nature, it is assumed that sea turtles can hear approaching vessels given their hearing range.

Hazel *et al*. (2007) found that sea turtles reacted to approaching vessels in a variety of ways. Benthic turtles launched upwards at a shallow angle and began swimming. The majority of the turtles swam away from the vessel while some swam along the vessel's track and some crossed in front of the vessel's track before swimming away. Sea turtle reaction time was greatly dependent on the speed of the vessel; sea turtles were able to react faster to slower moving vessels than to faster moving vessels. Sea turtle reactions to vessels elicited short-term responses.

Given the current ambient sound levels in the marine environment, the amount of sound contributed by the use of Navy vessels in the proposed exercises is very low. It is anticipated that any sea turtles exposed would exhibit only short-term reactions and would not suffer and long-term consequences from ship sound.

Human disturbance to wild animals may elicit similar reactions to those caused by natural predators (Gill *et al*., 2001; Beale and Monaghan, 2004). Behavioral responses may also be accompanied by a physiological response (Romero, 2004), although this is very difficult to study in the wild. Immature Kemp's ridley turtles have shown physiological responses to the acute stress of capture and handling through increased levels of corticosterone (Gregory and Schmid, 2001). In the short term exposure to stressors result in changes in immediate behavior (Frid, 2003). For turtles, this can include intense behavioral reactions such as biting and rapid flipper movement (Gregory and Schmid, 2001). Repeated exposure to stressors, including human disturbance such as vessel disturbance and anthropogenic sound, can result in negative consequences to the health and viability of an individual or population (Gregory and Schmid, 2001). Chronic stress can result in decreased reproductive success (Lordi *et al*., 2000; Beale and Monaghan, 2004), decreased energy budget (Frid, 2003), displacement from habitat (Southerland and Crockford, 1993), and lower survival rates of offspring (Lordi *et al*., 2000). At this time, it is unknown what the long-term implications of chronic stress may be on sea turtle species.

Sea turtles may become habituated to sounds, including high levels of ambient noise found in areas of high vessel traffic (Moein *et al*., 1994; Hazel *et al*., 2007). Moein, *et al*. (1994) conducted a study using a fixed sound source to repel sea turtles away from hopper dredges. Three decibel levels (175, 177, and 179 dB re 1 µPa at 1 m) were used for the study. It was found that while sea turtles avoided the sound upon first exposure, they appeared to habituate to the stimuli over a period of time (Lenhardt, 1994; Moein *et al*., 1994). Adult loggerheads have been observed to initially respond (*i.e.*, increase swimming speeds) and avoid air guns when received levels range from 151 to 175 dB re: 1 µPa, but they eventually habituate to these sounds (Lenhardt, 2002). One turtle in the study was reported to exhibit a TTS for up to two weeks after exposure to these levels (Lenhardt, 2002). Viada *et al*. (2008) reported on sea turtle strandings attributed to underwater explosions used in demolishing oil platforms; two juvenile turtles, 100 and 150 feet away from an explosion, were killed.

Sea turtles exposed to the general disturbance associated with a passing Navy vessel could exhibit a short-term behavioral response such as fleeing. Therefore, general vessel disturbance under the No Action Alternative may affect ESA-listed sea turtles. In accordance with NEPA, disturbance from vessels in territorial waters would have no significant impact on sea turtles. Furthermore, disturbance from vessels in non-territorial waters would not cause significant harm to sea turtles in accordance with EO 12114.

Collisions

Vessel strikes are known to affect sea turtles in the Study Area. Turtles swimming or feeding at or just beneath the surface of the water are particularly vulnerable to a vessel strike. According to Florida Fish and Wildlife Conservation Commission (unpublished data) there has been a significantly increasing trend in the percent occurrence of propeller wounds among the loggerheads found dead or debilitated each year in Florida during 1986-2004. In addition, sound from surface vessel traffic may cause behavioral responses of sea turtles.

Accordingly, the Navy has adopted standard operating procedures and mitigation measures to reduce the potential for collisions with surfaced sea turtles (for more details refer to Chapter 5). These mitigation measures include:

- Using lookouts trained to detect all objects on the surface of the water, including sea turtles.
- Implementing reasonable and prudent actions to avoid the close interaction of Navy assets and sea turtles.
- Maneuvering to keep away from any observed sea turtle.

Vessel collisions under the No Action Alternative may affect listed sea turtles. In accordance with NEPA, vessel collisions in territorial waters would have no significant impact on sea turtles. Furthermore, vessel collisions in non-territorial waters would not cause significant harm to sea turtles in accordance with EO 12114.

Aircraft Overflights

Fixed-Wing Aircraft Overflights

The general aircraft overflight exposure information presented for marine mammals in Section 3.7.4.1 is also applicable to sea turtles. As discussed in Section 3.7.4.1, aircraft overflights would produce airborne noise and some of this energy would be transmitted into the water. Sea turtles could be exposed to noise associated with subsonic and supersonic fixed-wing aircraft overflights and helicopter operations while at the surface or while submerged. In addition, low-flying aircraft passing overhead could create a shadow effect that could induce a reaction in sea turtles. It is difficult to differentiate between reactions to the presence of aircraft and reactions to sound. Exposure to elevated noise levels would be brief (seconds) and infrequent based on the transitory and dispersed nature of the overflights. Sound exposure levels would be relatively low because a majority of the overflights would be above 3,000 ft. Fixed-wing aircraft overflights may occur throughout the OPAREAs.

Very little information regarding sea turtle reactions to fixed-wing aircraft overflights is available. Based knowledge of their sensory biology (Bartol and Musick, 2003; Ketten and Bartol, 2006; Lenhardt, 1994; Ridgway *et al*., 1969; Moein Bartol *et al*., 1999), sound from low flying aircraft could be heard by a sea turtle at or near the surface. Turtles might also detect low flying aircraft via visual cues such as the aircraft's shadow. Hazel *et al*. (2007) suggested that green turtles rely more on visual cues than auditory cues when reacting to approaching water vessels. This suggests that sea turtles might not respond to aircraft overflights based on noise alone. As discussed in Section 3.7.4.1, subsonic and supersonic fixed-wing aircraft overflights are not expected to generate underwater sound levels that would result in harm of sea turtles (Eller and Cavanagh, 2000; Laney and Cavanagh, 2000).

Sea turtles exposed to aircraft overflights may exhibit no response or behavioral reactions such as quick diving. Any behavioral avoidance reaction would be short-term and would not permanently displace animals or result in physical harm. Fixed-wing aircraft overflights are not expected to result in chronic stress because it is extremely unlikely that individual animals would be repeatedly exposed to low altitude overflights.

Fixed-wing aircraft overflights under the No Action Alternative may affect sea turtles, but the effects would be insignificant. In accordance with NEPA, fixed-wing aircraft overflights over territorial waters would have no significant impact on sea turtles. Furthermore, fixed-wing aircraft

overflights over non-territorial waters would not cause significant harm to sea turtles in accordance with EO 12114.

Helicopter Overflights

Helicopters overflights occur in conjunction with several different exercises, totaling 734 helicopter sorties annually, throughout the OPAREAs. Animals would only be exposed to the sound and water disturbance if they are at or near the water surface. The sound exposure levels would be relatively low to sea turtles since they spend the majority or their time underwater. Unlike fixed-wing aircraft, helicopter training operations often occur at low altitudes (75 to 100 feet), which increases the likelihood that sea turtles would respond to helicopter overflights.

Based on results of a comprehensive literature review, no information regarding sea turtle reactions to helicopter overflights is available. However, based on knowledge of the auditory capabilities of turtles (Bartol and Musick, 2003; Levenson *et al*., 2004; Ketten and Bartol, 2006; Moein Bartol and Ketten, 2006), as well as their response to visual cues (Hazel *et al*., 2007) discussed in the fixed-wing aircraft overflights section, it is reasonable to assume that if exposed, sea turtles may react to helicopter overflights. In addition to the auditory and visual cues, animals may react to the disturbance of the water by the downdraft. Helicopter overflights are not expected to result in chronic stress because it is extremely unlikely that individual animals would be repeatedly exposed. Helicopter overflights under the No Action Alternative may affect sea turtles, but the effects would be insignificant. In accordance with NEPA, helicopter overflights over territorial waters would have no significant impact on sea turtles. Furthermore, helicopter overflights over non-territorial waters would not cause significant harm to sea turtles in accordance with EO 12114.

Towed Mine Warfare Devices

As described in Chapter 2 and Appendix D, MIW exercises conducted in the Study Area include the use of the AN/AQS 20, MK 103, MK 105, AQS 14A, AQS 24A, and OASIS mine detection systems that are towed through the water by helicopters flying approximately 75 feet above the water at low airspeeds. Approximately 78 towed MIW device sorties would occur under the No Action Alternative in the JAX Study Area (see Figure 2.2-1). All five species of sea turtles may occur in areas where towed MIW devices would be used.

While the potential exists for sea turtles to be struck by a towed MIW device, there are no documented instances of this occurring. Helicopter crew members monitor the water's surface during training to identify and avoid any objects that might damage the equipment. Based on the low flight altitudes and relatively slow air speeds, it is likely that crew members would be able see turtles at or near the surface and avoid them. Sea turtles at or near the surface may see or hear the oncoming helicopter or feel the downdraft, which could initiate avoidance behavior. The water column disturbance and sound created by the towed MIW device would likely elicit short-term behavioral responses similar to those discussed for vessel movements and aircraft overflights.

The use of towed MIW devices under the No Action Alternative may affect sea turtles, but the effects of collisions would be discountable because they are extremely unlikely to occur. In accordance with NEPA, the use of towed MIW devices in territorial waters would have no significant impact on sea turtles. Furthermore, towed MIW device use non-territorial waters would not cause significant harm to sea turtles in accordance with EO 12114.

Non-Explosive Practice Munitions

Strikes

Current Navy training operations in the JAX Study Area include firing a variety of weapons and employing a variety of NEPM and explosive rounds, including bombs, missiles, naval gun shells, cannon shells, small caliber ammunition, and grenades. The majority of ordnance fired in the JAX Study Area consists of NEPM (Table 2.2-6). The analysis presented in this section focuses on NEPM, while potential effects of explosive rounds are analyzed below in the explosions section. Training exercises that involve weapons firing and ordnance use take place in several training areas (see Table 2.2-6 for a summary of ordnance use by training area).

Direct ordnance strikes and disturbance associated with sound from firing weapons are potential stressors to sea turtles. Ingestion of expended ordnance is also a potential concern for some sea turtles and is analyzed below under MEM. The primary concern is potential exposure of sea turtles at or near the water's surface, which could result in injury or mortality.

The potential for sea turtles to be struck by fired ordnance was evaluated using statistical probability modeling as described in Appendix I. Model input values include ordnance use data (frequency and type) and sea turtle density data for each season and training area where ordnance use occurs. The model first calculates the probability of a turtle being struck and then calculates the number of exposures (sea turtle/ordnance strikes) for the given season and training area. The model outputs for sea turtle/ordnance strikes are biased by the following assumptions and data/model limitations:

- The model is two-dimensional and assumes that all sea turtles would be at or near the surface 100 percent of the time, when in fact, sea turtles spend the majority of their time under water - up to 96 percent (Lutcavage and Lutz, 1997).
- The model does not take into account standard mitigation measures used by the Navy to avoid and minimize sea turtle/ordnance strikes.
- The model assumes the animal is stationary and does not account for any movement of the sea turtle or any potential avoidance of the training.

The ordnance strike model is not expected to produce false negatives because the assumptions will more than likely produce an overestimate of impacts. A model output of less than one exposure provides a high level of certainty that sea turtles would not be struck and that ordnance strikes would have no effect on ESA-listed sea turtles.

Appendix I provides a breakdown of the model input/output values for each group of turtles by training area where ordnance is fired or released. All model output values are substantially less than one (Appendix I), indicating that sea turtle/ordnance strikes are extremely unlikely to occur. The probability of a direct ordnance strike is further reduced by Navy mitigation measures (see Chapter 5).

The use of NEPM would have no effect on sea turtles. Therefore, in accordance with NEPA, use of NEPM in territorial waters would have no significant impact on sea turtles. Furthermore, use of NEPM in non-territorial waters would not cause significant harm to sea turtles in accordance with EO 12114.

Disturbance

Transmitted Gunnery Sound

A gun fired from a ship on the surface of the water propagates a blast wave away from the gun muzzle. This spherical blast wave reflects off and diffracts around objects in its path. As the blast wave hits the water, it reflects back into the air, transmitting a sound pulse back into the water in proportions related to the angle at which it hits the water.

Propagating energy is transmitted into the water in a finite region below the gun. A critical angle (about 13°, as measured from the vertical) can be calculated to determine the region of transmission in relation to a ship and gun (DoN, 2006).

The largest proposed shell size for these operations is a 5-inch shell. This would produce the highest pressure, and all analysis would be done using this as a conservative measurement of produced and transmitted pressure, assuming that all other smaller ammunition sizes would fall under these levels.

Aboard the USS Cole in June 2000, a series of pressure measurements were taken during the firing of a five-inch gun. Average pressure measured approximately 200 dB with reference pressure of 1 µPa at the point of the air and water interface. Based on the USS Cole data, down-range peak pressure levels were calculated to be less than 186 dB re: 1 µPa at 100 m (DoN, 2000) and as the distance increases, the pressure would decrease.

In reference to the EFD harassment criteria, the EFD levels (greatest in any 1/3 octave band above 10 Hz) of a 5-inch gun muzzle blast were calculated to be 190 dB with reference pressure of one micropascal squared in one second (dB re: 1 μPa^2-sec) directly below the gun muzzle decreasing to 170 dB re: 1 μPa^2-sec at 100 m (328 feet) into the water (DoN, 2006). The rapid dissipation of the sound pressure wave, coupled with the mitigation measures implemented by the Navy (see Chapter 5 for details) to detect sea turtles in the area prior to conducting operations, would result in a blast from a gun muzzle having no effect on sea turtle species.

Sound Transmitted Through Ship Hull

A gun blast will also transmit sound waves through the structure of the ship which can propagate into the water. The 2000 study aboard the USS Cole also examined the rate of sound pressure propagation through the hull of a ship (DoN, 2000). The structurally borne component of the sound consisted of low-level oscillations on the pressure time histories that preceded the main pulse, due to the air blast impinging on the water (DoN, 2006).

The structural component for a standard round was calculated to be 6.19 percent of the air blast (DoN, 2006d). Given that this component of a gun blast was a small portion of the sound propagated into the water from a gun blast, and far less than the sound from the gun muzzle itself, the transmission of sound from a gun blast through the ship's hull would have no effect on listed sea turtles.

Therefore, in accordance with NEPA, use of NEPM in territorial waters would have no significant impact on sea turtles. Furthermore, use of NEPM in non-territorial waters would not cause significant harm to sea turtles in accordance with EO 12114.

Underwater Detonations and HE Explosive Ordnance

Explosions that occur in the JAX Study Area are associated with training exercises that use explosive ordnance, including bombs (BOMBEX), missiles (MISSILEX), and naval gun shells (FIREX with IMPASS, 5-inch HE rounds), and anti-swimmer grenades (Small Arms Training), as well as UNDETs associated with Mine Neutralization training (MINEX). Explosive ordnance use and UNDET is limited to a few specific training areas (see Table 2.2-7 for a summary of explosions by training area).

An explosive analysis was conducted to estimate the number of sea turtles that could be exposed to impacts from the use of explosives. Appendix J contains a technical report describing the scientific basis, methods, assumptions, and all results of the explosive analysis. Tables 3.8-5 and 3.8-6 provide a summary of the explosive analysis for the No Action Alternative, which indicates that all species of sea turtles could be exposed to impacts from explosions. For each species, in order to determine the total non-injurious potential exposures for all operations, the two columns for non-injurious exposures (182 dB criteria for TTS and 177 dB criteria for behavioral disruption) need to be added together between the two tables (Tables 3.8-5 and 3.8-6). For each species, the total for injurious potential exposures can be determined by adding the 205 dB re 1 mPa2-s/13 psi columns together between the two tables. For each species, the total mortality potential exposures can be determined by adding the 30.5 psi columns together between the two tables.

TABLE 3.8-5
SUMMARY OF POTENTIAL EXPOSURES FROM SINGLE DETONATION EXPLOSIVE ORDNANCE (PER YEAR) FOR SEA TURTLES IN THE JAX STUDY AREA—NO ACTION ALTERNATIVE

Species/Training Operation	Potential Exposures @ 182 dB re μPa^2-s or 23 psi (peak)	Potential Exposures @ 205 dB re μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Hardshell turtles			
BOMBEX training	2	0	0
MISSILEX training	2	0	0
MINEX training	0	0	0
Total Exposures	4	0	0
Kemp's Ridley turtle			
BOMBEX training	0	0	0
MISSILEX training	1	0	0
MINEX training	0	0	0
Total Exposures	1	0	0
Leatherback turtle			
BOMBEX training	3	0	0
MISSILEX training	1	0	0
MINEX training	0	0	0
Total Exposures	4	0	0

TABLE 3.8-5 (Continued)
SUMMARY OF POTENTIAL EXPOSURES FROM SINGLE DETONATION EXPLOSIVE ORDNANCE (PER YEAR) FOR SEA TURTLES IN THE JAX STUDY AREA—NO ACTION ALTERNATIVE

Species/Training Operation	Potential Exposures @ 182 dB re μPa²-s or 23 psi (peak)	Potential Exposures @ 205 dB re μPa²-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Loggerhead turtle			
BOMBEX training	3	0	0
MISSILEX training	3	0	0
MINEX training	1	0	0
Total Exposures	7	0	0

TABLE 3.8-6
SUMMARY OF POTENTIAL EXPOSURES FROM MULTIPLE DETONATION EXPLOSIVE ORDNANCE (PER YEAR) FOR SEA TURTLES IN THE JAX STUDY AREA—NO ACTION ALTERNATIVE

Species/Training Operation	Potential Exposures @ 177 dB r μPa²-s (multiple detonations only)	Potential Exposures @ 205 dB r μPa²-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Hardshell turtles			
BOMBEX (MK-82/83)	90	2	0
FIREX training	4	0	0
Small Arms (grenades)	0	0	0
Total Exposures	94	2	0
Kemp's Ridley turtle			
BOMBEX (MK-82/83)	12	0	0
FIREX training	1	0	0
Small Arms (grenades)	0	0	0
Total Exposures	13	0	0
Leatherback turtle			
BOMBEX (MK-82/83)	142	3	0
FIREX training	8	0	0
Small Arms (grenades)	0	0	0
Total Exposures	150	3	0
Loggerhead turtle			
BOMBEX (MK-82/83)	163	4	0
FIREX training	8	0	0
Small Arms (grenades)	2	0	0
Total Exposures	173	4	0

The modeling results indicate that Kemp's ridley, leatherback, loggerhead, and hardshell (which includes green, hawksbill, and unidentified hardshell turtles) sea turtles may be exposed to levels that could result in non-injurious (physiological and behavioral) affects. The modeling results indicate that leatherback, loggerhead, and hardshell (which includes green, hawksbill, and unidentified hardshell turtles) sea turtles may be exposed to levels that could result in injurious (physiological) effects. No sea turtles are expected to be exposed to levels that would result in mortality.

Underwater detonations and explosive ordnance use under the No Action Alternative may affect ESA listed green, hawksbill, leatherback, Kemp's ridley, and loggerhead sea turtles. In summary, the analysis presented above indicates that underwater detonations and HE ordnance use under the No Action Alternative would affect individual sea turtles, but any effects observed at the population or species level would be negligible. Therefore, in accordance with NEPA, there would be no significant impact to sea turtle populations from explosive ordnance use during training exercises within territorial waters. In accordance with EO 12114, there would be no significant harm to sea turtle populations resulting from explosive ordnance use during training exercises in non-territorial waters.

Military Expended Material

Overview

The Navy uses a variety of MEM during training exercises conducted in the JAX Study Area. The types and quantities of expended material used and information regarding fate and transport of this material within the marine environment are discussed in Section 3.2. The analyses presented in Sections 3.2, 3.3, and 3.6 predict that the majority of the expended material would rapidly sink to the sea floor, become encrusted by natural processes, and incorporated into the sea floor, with no significant accumulations in any particular area and no significant negative effects to water quality or marine benthic communities. Nonetheless, sea turtles could be exposed to a variety of expended material via contact and ingestion.

Sea turtles of all sizes and species are known to ingest a wide variety of marine debris, which might be mistaken for prey. Plastic bags and plastic sheeting are most commonly ingested by sea turtles but balloons, Styrofoam beads, monofilament fishing line, and tar are also known to be ingested (NRC, 1990; Lutz, 1990; Bjorndal, 1994; Tomas *et al.*, 2002). Marine debris could pass through the digestive tract and be voided naturally without causing harm, or it could cause sublethal effects or lethal effects (Balazs, 1985). Sublethal effects may have a greater influence on populations than lethal effects through nutrient dilution. Nutrient dilution occurs when non-nutritive debris displaces nutritious food in the gut leading to decreased nutrient gain and ultimately slowing somatic growth or reducing reproductive output (McCauley and Bjorndal, 1999). Lutz (1990) found that hungry sea turtles actively seek and consume marine debris if other food is not available. In most cases, this debris passes through the gut within a few days, but latex was found to take up to four months to clear the intestinal system. While ingestion of marine debris has been linked to sea turtle mortalities, sublethal effects are more common (NRC, 1990; Bjorndal, 1994; Tomas *et al.*, 2002; McCauley and Bjorndal 1999).

Ordnance-Related Material

Ordnance-related material includes various sizes of non-explosive training rounds and shrapnel from explosive rounds (Tables 2.2-5 and 2.2-6). The solid metal material would quickly move

through the water column and settle to the sea floor where it could be available for ingestion by benthic foraging sea turtles. Ingestion of expended ordnance is not expected to occur in the water column because ordnance quickly sinks.

The probability of sea turtles ingesting expended ordnance would depend on factors such as the size of the material, the likelihood the material would be mistaken for prey, and the level benthic foraging that occurs in the impact area (which is a function of benthic habitat quality), prey availability, and species-specific foraging strategies. Some material, such as an intact non-explosive training bomb, would be too large to be ingested by a sea turtle, but other material such as cannon shells, small caliber ammunition, and shrapnel, are small enough to be ingested. While the literature indicates that commonly ingested items such as drifting balloons or plastic bags might be mistaken as jellyfish or other prey, there are cases of animals ingesting items such as plastic caps that do not resemble prey (Barreiros, 2001). It is possible that expended ordnance colonized by epibenthic fauna could be mistaken for prey or that expended ordnance could be incidentally ingested while foraging on natural prey items.

Water depth in areas where ordnance is fired ranges from about 65 feet to well over 650 feet in areas more than 3 nm offshore. While some benthic foraging could occur in these offshore areas, a majority of benthic foraging by green, hawksbill, Kemp's ridley, and loggerhead turtles occurs in nearshore (*e.g*. less than 65 feet) areas (Lutcavage *et al*., 1997). Consequently, ingestion of expended ordnance by these species could occur, but would be considered unlikely. Leatherbacks feed throughout the epipelagic and into the mesopelagic zones of the water column (Davenport, 1988; Eckert *et al*., 1989; Grant and Ferrell, 1993; Salmon *et al*., 2004; James *et al.*, 2005a). Prey is predominantly gelatinous zooplankton such as cnidarians (jellyfish and siphonophores) and tunicates (salps and pyrosomas) (NMFS and USFWS 1992; Grant and Ferrell, 1993; Bjorndal, 1997; James and Herman, 2001; Salmon *et al*., 2004). Leatherbacks would not ingest expended ordnance because they are not expected to feed in the benthic environment.

Ingestion of ordnance under the No Action Alternative would have no effect on leatherback turtles, but may affect other sea turtle species. In accordance with NEPA, ordnance-related material would have no significant impact on sea turtles in territorial waters. Furthermore, ordnance-related material would not cause significant harm to sea turtles in non-territorial waters in accordance with EO 12114.

Target-Related Material

A variety of at-sea targets are used in the JAX Study Area, ranging from high-tech remotely operated airborne and surface targets (*e.g.*, airborne drones and Seaborne Powered Targets) to low-tech floating at-sea targets (*e.g.*, inflatable targets, 55-gallon metal drums) and towed banners. Many of the targets are designed to be recovered for reuse and are not destroyed during training because ordnance is set to detonate before impacting the target. The only expendable airborne targets used in the JAX Study Area are Tactical Air-Launched Decoys, which are non-powered, constructed of extruded aluminum, weigh about 400 lbs, and are about 7 feet long. Expendable targets such as floating at-sea inflatable targets are recovered after use and properly disposed of onshore. Some targets such as 55-gallon metal drums cannot be recovered and sink to the sea floor after use. Unrecoverable floating material generated by target use is expected to be minimal. Descriptions of the targets used in the JAX Study Area and information on fate and transport are provided in Section 3.2.

As discussed above for ordnance-related material, turtles that feed on or near the bottom may encounter an expended target while feeding; however, the size of the target would prohibit any listed species from ingesting it. Therefore, the use of targets under the No Action Alternative would have no effect on sea turtles. In accordance with NEPA, target-related material would have no significant impact on sea turtles in territorial waters. Furthermore, target-related material would not cause significant harm to sea turtles in non-territorial waters in accordance with EO 12114.

Chaff Fibers, End Caps, and Pistons

The background information and general exposure analysis presented in Section 3.7.4.1 for marine mammals and chaff is also applicable to sea turtles and is not repeated here. Similar to marine mammals, sea turtles could be exposed to chaff through direct body contact, inhalation, and ingestion. Sea turtles are not expected to respond to direct contact with chaff or inhalation of chaff. In addition, any changes in water quality from chaff use would be negligible and would not be expected to affect sea turtles.

Based on the small size of chaff fibers, sea turtles would not confuse the fibers with prey items or purposefully feed on them. However, sea turtles could occasionally ingest chaff incidentally while feeding on prey items on the surface, in the water column, or on the bottom. While no studies have been conducted to evaluate the effects of chaff ingestion on sea turtles or other reptiles, the effects are expected to be negligible based the low concentrations that could reasonably be ingested, the small size of chaff fibers, and available data on the toxicity of chaff and aluminum (as described in Section 3.7.4.1). A young sea turtle weighing 113 kg would need to ingest more than 83,000 chaff fibers per day to receive a daily aluminum dose equal to 1,000 mg/kg (based on chaff consisting of 40% aluminum by weight and a 150-g chaff canister containing 5 million fibers). An adult loggerhead turtle weighing 113 kg or more would need to ingest more than 9 million chaff fibers per day to receive a daily aluminum dose equal to 1,000 mg/kg. It is highly unlikely that a sea turtle would ingest a toxic dose of chaff based on the anticipated environmental concentration of chaff (1.8 fibers/ft^2 for a worst-case scenario of 360 chaff cartridges simultaneously released at a single drop point).

Silicon dioxide, also known as silica, is an abundant compound in nature that is prevalent in soils, rocks, and sand (USAF, 1997). Silicon is the second most abundant element in the earth's crust, making up approximately 28.2 percent by weight (Jefferson Lab, 2007). As such, the diet of benthic foraging marine animals that routinely ingest sediment while feeding likely contains relatively high concentrations of silicon dioxide. Silicon dioxide is chemically unreactive in the environment (USEPA, 1991) and the acute and chronic oral toxicity of silicon dioxide is low. No significant toxicity or mortality has been reported in animals given doses of up to 3,000 mg/kg of body weight per day (EVM, 2003). No observed adverse effect levels of 2,500 and 7,500 mg/kg of body weight per day were obtained for mice and rats, respectively in long-term studies (up to 24 months) (Takizawa *et al.*, 1988).

The potential also exists for sea turtles to ingest chaff end caps and pistons. However, the probability of sea turtles ingesting plastic end caps and pistons is low because this material sinks in saltwater (Spargo, 2007) and the environmental concentration would be low (approximately 2.4 pieces/nm^2/year). A majority of the end caps and pistons are expected to sink in offshore, deepwater areas and ultimately become incorporated into bottom sediments where minimal turtle foraging occurs. A very small percentage of the end caps and pistons released could land on *Sargassum* mats or be transported by currents to benthic foraging areas, where the probability of

ingestion would be higher. Since young pelagic turtles feed indiscriminately within *Sargassum* mats and are known to ingest anthropogenic debris (McCauley and Bjorndal, 1999), it is possible that sea turtles would be exposed to and ingest end caps and pistons. However, the overall probability of turtles ingesting an end cap or piston appears to be extremely low.

If ingested, it is likely the small (1.3-inch diameter, 0.13-inch thick) round end cap or piston would pass through the digestive tract of adult turtles without causing harm, as with other instances of debris ingestion (Balazs, 1985). Although ingestion of anthropogenic debris can result in serious injury or death, sea turtles are known to ingest small plastic items without noticeable negative consequence to health and viability (Barreiros, 2001; Mascarenhas, 2004). Based on their smaller size, subadult and juvenile turtles would be more susceptible to digestive tract blockage if they ingested this material.

Should a sea turtle encounter and ingest a discarded piston or end-cap, the animal could experience effects ranging from sublethal effects such as nutritional dilution (McCauley and Bjorndal, 1999) to mortality (NRC, 1990; Bjorndal, 1994; Tomas *et al.*, 2002). However, these effects are not expected because ingestion of end caps and pistons would be extremely unlikely due to the low concentration of approximately 2.4 pieces/nm^2/year. Chaff use under the No Action Alternative may affect sea turtles, but the effects would be discountable and/or insignificant. In accordance with NEPA, chaff use would have no significant impact on sea turtles in territorial waters. Furthermore, chaff use would not cause significant harm to sea turtles in non-territorial waters in accordance with EO 12114.

Self-Protection Flares

Self-protection flares consist of a magnesium/Teflon formulation that, when ignited and released from an aircraft, burn for a short period of time (less than 10 seconds) at very high temperatures. Flares release heat and light to disrupt tracking of Navy aircraft by enemy infrared tracking devices or weapons. Flares are designed to burn completely, thus reducing the amount of material that falls to the sea surface. Under normal operations, the only material that would enter the water would be a small, round plastic end cap (approximately 1.4 inch diameter). About 1,740 self-protection flares would be used per year under the No Action Alternative.

An extensive literature review and controlled experiments conducted by the Air Force revealed that self-protection flare use poses little risk to the environment or animals (USAF, 1997). Nonetheless, sea turtles within the JAX Study Area could be exposed to light generated by the flares and flare plastic end caps. The light generated by flares would have no effect on sea turtles based on short burn time, relatively high altitudes where they are used, and the widely dispersed and infrequent use. Similar to chaff end caps and pistons, sea turtles could potentially ingest flare end caps. Ingestion of flare end caps under the No Action Alternative may affect sea turtles, but the effects would be considered discountable because ingestion is extremely unlikely to occur based on the low number of end caps (1,740 per year). In accordance with NEPA, flares would have no significant impact on sea turtles in territorial waters. Furthermore, flares would not cause significant harm to sea turtles in non-territorial waters in accordance with EO 12114.

Marine Markers

The MK-25 and MK-58 marine markers produce chemical flames and regions of surface smoke and are used in various training exercises to mark a surface position to simulate divers, ships, and points of contact on the surface of the ocean. When the accompanying cartridge is broken, an area of smoke

is released. The smoke dissipates in the air having little effect on the marine environment. The marker burns similar to a flare, producing a flame until all burn components have been used. While the light generated from the marker is bright enough to be seen up to three miles away in ideal conditions, the resulting light would either be reflected off the water's surface or would enter the water and attenuate in brightness over depth. The point source of the light would be focused and be less intense than if an animal were to look to the surface and encounter the direct path of the sun. The MK-25 is composed of aluminum and contains either one or two seawater-activated batteries (depending on the model) and a red phosphorus pyrotechnic composition. The MK-25 marine marker is 18.5 inches long and 2.9 inches in diameter. It produces yellow flame and white smoke for 10 to 20 minutes (The Ordnance Shop, 2007). The MK-58 is composed of tin and contains two red phosphorus pyrotechnic candles and a seawater-activated battery. The MK-58 marine marker is 21.78 inches long and 5.03 inches in diameter, weighs 12.8 lbs, and produces a yellow flame and white smoke for a minimum of 40 minutes and a maximum of 60 minutes (The Ordnance Shop, 2007). The marker itself is not designed to be recovered and would eventually sink to the bottom and become encrusted and/or incorporated into the sediments. Approximately 300 marine markers would be used in the Study Area under the No Action Alternative.

Expended marine markers are a potential ingestion hazard for sea turtles while they are floating or after they sink to the bottom. However, the probability of ingestion is extremely low based on the low number of marine markers expended per year (300) and the low concentration ($0.006/nm^2$/year). Marine marker ingestion under the No Action Alternative may affect sea turtles, but the effects would be considered discountable because ingestion is extremely unlikely to occur. In accordance with NEPA, marine markers would have no significant impact on sea turtles in territorial waters. Furthermore, marine markers would not cause significant harm to sea turtles in non-territorial waters in accordance with EO 12114.

3.8.3.3 Alternative 1

Vessels Movements

The number of operations involving vessel movements would increase in the JAX Study Area under Alternative 1 with a total of 1,050 steaming days per year; an increase of five percent over the No Action Alternative. These changes would result in increased potential for short-term behavioral reactions to vessels. Potential for collision would increase slightly compared to the No Action Alternative; however, Navy mitigation measures (see Chapter 5) would reduce the probability.

Vessel movements under Alternative 1 may affect sea turtles. In accordance with NEPA, vessel movements in territorial waters would have no significant impact on sea turtles. Furthermore, vessel movements in non-territorial waters would not cause significant harm to sea turtles in accordance with EO 12114.

Aircraft Overflights

The number of operations involving fixed-wing aircraft overflights would increase eight percent to 1,773 per year in the JAX Study Area under Alternative 1. These changes would result in increased exposures of sea turtles to fixed-wing overflights. Elevated numbers of overflights would increase the potential for behavioral disturbance from sound and shadow-effects. Operations involving helicopter overflights would increase twenty-five percent to 916 per year.

Behavioral reactions to fixed-wing and helicopter overflights would be the same as discussed under the No Action Alternative.

Aircraft overflights under Alternative 1 may affect sea turtles, but the effects are expected to be insignificant. In accordance with NEPA, aircraft overflights over territorial waters would have no significant impact on sea turtles. Furthermore, aircraft overflights over non-territorial waters would not cause significant harm to sea turtles in accordance with EO 12114.

Towed MIW devices

Towed MIW device activities would increase 92 percent under Alternative 1 from 78 to 150 per year. The use of towed MIW devices under Alternative 1 may affect sea turtles, but the effects of collisions would be discountable because they are extremely unlikely to occur and the effects of disturbance would be insignificant. In accordance with NEPA, the use of towed MIW devices in territorial waters would have no significant impact on sea turtles. Furthermore, towed MIW device use non-territorial waters would not cause significant harm to sea turtles in accordance with EO 12114.

Non-Explosive Practice Munitions

Strikes

The number of NEPM used in the JAX Study Area would not change under Alternative 1 (Table 2.2-5 and 2.2-6). There would be no increased potential exposure for sea turtle ordnance strikes compared to baseline conditions. Ordnance strike modeling predicts that substantially less than one sea turtle would be exposed to direct ordnance strikes under Alternative 1 (see Appendix I). Additionally, Navy mitigation measures further reduce the probability of ordnance-related exposure. The use of non-explosive ordnance under Alternative 1 would have no effect on sea turtles.

Disturbance

The number of shells and small caliber firings in the JAX Study Area would increase 4 to 10 percent under Alternative 1. As presented in the discussion under the No Action Alternative above, firing of weapons would not result in an exposure of sea turtles; therefore weapon firings would have no effect on sea turtles.

Therefore, in accordance with NEPA, the use of NEPM in territorial waters would have no significant impact on sea turtles. Furthermore, use of NEPM in non-territorial waters would not cause significant harm to sea turtles in accordance with EO 12114.

Underwater Detonations and High Explosive Ordnance

The number and location of explosions occurring in the JAX Study Area would not change under Alternative 1, with the exception of the number of missiles and 20-lbs NEW underwater detonation charges (Tables 2.2-5 and 2.2-7). Forty additional Hellfire missile explosions would occur in MLTR and one additional AIM missile explosion would occur in W-158. The number of 20-lbs NEW underwater detonation charges in the North and South UNDET boxes would decrease from 18 to 12 per year.

As discussed for the No Action Alternative, an explosive analysis was conducted to estimate the number of sea turtles that could be exposed to impacts from explosions. Tables 3.8-7 and 3.8-8 provide a summary of the explosive analysis results for Alternative 1. For each species, in order to

TABLE 3.8-7
SUMMARY OF POTENTIAL EXPOSURES FROM SINGLE DETONATION EXPLOSIVE ORDNANCE (PER YEAR) FOR SEA TURTLES IN THE JAX STUDY AREA—ALTERNATIVE 1

Species/Training Operation	Potential Exposures @ 182 dB re μPa²-s or 23 psi (peak)	Potential Exposures @ 205 dB re μPa²-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Hardshell turtles			
BOMBEX training	2	0	0
MISSILEX training	4	0	0
MINEX training	0	0	0
Total Exposures	6	0	0
Kemp's ridley turtle			
BOMBEX training	0	0	0
MISSILEX training	1	0	0
MINEX training	0	0	0
Total Exposures	1	0	0
Leatherback turtle			
BOMBEX training	3	0	0
MISSILEX training	3	0	0
MINEX training	0	0	0
Total Exposures	6	0	0
Loggerhead turtle			
BOMBEX training	3	0	0
MISSILEX training	6	0	0
MINEX training	1	0	0
Total Exposures	10	0	0

TABLE 3.8-8
SUMMARY OF POTENTIAL EXPOSURES FROM MULTIPLE DETONATION EXPLOSIVE ORDNANCE (PER YEAR) FOR SEA TURTLES IN THE JAX STUDY AREA—ALTERNATIVE 1

Species/Training Operation	Potential Exposures @ 177 dB r μPa²-s (multiple detonations only)	Potential Exposures @ 205 dB r μPa²-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Hardshell turtles			
BOMBEX training	90	2	0
FIREX training	4	0	0
Small Arms (grenades)	0	0	0
Total Exposures	94	2	0
Kemp's ridley turtle			
BOMBEX training	12	0	0
FIREX training	1	0	0
Small Arms (grenades)	0	0	0
Total Exposures	13	0	0
Leatherback turtle			
BOMBEX training	142	3	0
FIREX training	8	0	0
Small Arms (grenades)	0	0	0
Total Exposures	150	3	0
Loggerhead turtle			
BOMBEX training	163	4	0
FIREX training	8	0	0
Small Arms (grenades)	2	0	0
Total Exposures	173	4	0

determine the total non-injurious potential exposures for all operations, the two columns for non-injurious exposures (182 dB criteria for TTS and 177 dB criteria for behavioral disruption) need to be added together between the two tables (Tables 3.8-7 and 3.8-8). For each species, the total for injurious potential exposures can be determined by adding the 205 dB re 1 mPa2-s/13 psi columns together between the two tables. For each species, the total mortality potential exposures can be determined by adding the 30.5 psi columns together between the two tables.

Appendix J contains a technical report describing the scientific basis, methods and assumptions of the explosive analysis. The modeling results indicate that Kemp's ridley, leatherback, loggerhead, and hardshell (which includes green, hawksbill, and unidentified hardshell turtles) sea turtles would be exposed to levels that may result in non-injurious (physiological and behavioral) effects. The modeling results indicate that leatherback, loggerhead, and hardshell (which includes green, hawksbill, and unidentified hardshell turtles) sea turtles may be exposed to levels that could result in injurious (physiological) effects. No sea turtles are expected to be exposed to levels that would result in mortality.

Underwater detonations and explosive ordnance use under Alternative 1 may affect ESA listed green, hawksbill, leatherback, Kemp's ridley, and loggerhead sea turtles. In summary, the analysis

indicates that underwater detonations and HE ordnance use under Alternative 1 would affect individual sea turtles, but any effects observed at the population or species level would be negligible. Therefore, in accordance with NEPA, there would be no significant impact to sea turtle populations from explosive ordnance use during training exercises within territorial waters. In accordance with EO 12114, there would be no significant harm to sea turtle populations resulting from explosive ordnance use during training exercises in non-territorial waters..

Military Expended Material

Ordnance-Related Material

The amount of ordnance fired would increase 4 percent in the JAX Study Area under Alternative 1 (Table 2.2-5 and 2.2-6). Similar to the No Action Alternative, green, hawksbill, Kemp's ridley, and loggerhead turtles would potentially be exposed to expended ordnance via ingestion from foraging off the bottom. Leatherback turtles would not ingest expended ordnance because they do not feed on the bottom. Therefore, ingestion of ordnance would have no effect on leatherback turtles under Alternative 1. The probability of a benthic foraging sea turtle to ingest ordnance would continue to be low under Alternative 1. Ingestion of ordnance under Alternative 1 may affect green, hawksbill, Kemp's ridley, and loggerhead turtles. In accordance with NEPA, ordnance-related material would have no significant impact on sea turtles in territorial waters. Furthermore, ordnance-related material would not cause significant harm to sea turtles in non-territorial waters in accordance with EO 12114.

Target-Related Material

The number of expendable targets used in the JAX Study Area would increase from 40 to 44 per year (10%) under Alternative 1 (Table 2.2-5). Analysis of both remotely operated and floating at-sea targets under the No Action Alternative indicates that the use of targets would have no effect on listed sea turtles due to the large size of the target which would prohibit any sea turtle from ingesting it. Increased numbers of these targets under Alternative 1 would also have no effect on listed sea turtles. In accordance with NEPA, ordnance-related material would have no significant impact on sea turtles in territorial waters. Furthermore, ordnance-related material would not cause significant harm to sea turtles in non-territorial waters in accordance with EO 12114.

Chaff Fibers, End Caps, and Pistons

The amount of chaff used in the OPAREAs would increase by about 10 percent per year under Alternative 1 (Tables 2.2-5 and 3.7-8). This increase in chaff use would result in negligible increases in relative environmental concentrations of chaff fibers, end caps, and pistons (Table 3.7-8). Similar to the No Action Alternative, effects of direct body contact, inhalation, and any changes to water or sediment quality would continue to be insignificant. The potential for sea turtles to ingest chaff fibers would increase under Alternative 1, but ingestion of a toxic dose (greater than 1,000 mg/kg) would continue to be highly unlikely based on the anticipated low environmental concentration (1.8 fibers/ft2). Sea turtles could ingest chaff end caps and pistons under Alternative 1, but the likelihood of ingestion remains extremely low based on the low environmental concentration (2.7 pieces/nm^2).

Chaff use under Alternative 1 may affect sea turtles; however, the effects are expected to be insignificant or discountable. In accordance with NEPA, chaff use would have no significant impact on sea turtles in territorial waters. Furthermore, chaff use would not cause significant harm to sea turtles in non-territorial waters in accordance with EO 12114.

Self-Protection Flares

The number of self-protection flares used in the JAX Study Area would increase under Alternative 1 from 1,740 to 2,470 per year (10%). Similar to the No Action Alternative, ingestion of flare end caps under Alternative 1 may affect sea turtles, but the effects would be considered discountable because ingestion is extremely unlikely to occur. In accordance with NEPA, flare use would have no significant impact on sea turtles in territorial waters. Furthermore, flare use would not cause significant harm to sea turtles in non-territorial waters in accordance with EO 12114.

Marine Markers

The number of marine markers used in the JAX Study Area would stay the same under Alternative 1; therefore the effects would be the same as the No Action Alternative. Marine marker ingestion under Alternative 1 may affect sea turtles, but the effects would be considered discountable because ingestion is extremely unlikely to occur. In accordance with NEPA, marine markers would have no significant impact on sea turtles in territorial waters. Furthermore, marine markers would not cause significant harm to sea turtles in non-territorial waters in accordance with EO 12114.

3.8.3.4 Alternative 2

All Stressors

As detailed in Chapter 2 and Table 2.2-5, Alternative 2 would include all the activities proposed under Alternative 1 except for the elimination of BOMBEX with live ordnance and the establishment of Mine Warfare Training Areas in the north and south UNDET boxes. Other operational parameters would not change under Alternative 2. Therefore, the Alternative 1 analyses are applicable to Alternative 2. The analysis for Alternative 2 focuses on the establishment of the Mine Warfare Training Areas (non-explosive mine shape deployment/recovery) and the explosives analysis.

Mine Warfare Training (Non-explosive Mine Shape Deployment/Recovery)

As discussed in Section 2.2.5, new Mine Warfare Training Areas would be designated in the north and south UNDET boxes. This section addresses potential effects on sea turtles associated with establishing and maintaining these training areas (*i.e.*, non-explosive mine shape deployment/recovery). The effects of conducting training exercises in these areas are analyzed under aircraft overflights, towed MIW devices, and explosions.

The non-explosive mine shape deployment and recovery process would have no effect on sea turtles. The effects of mine warfare training area establishment would be limited to short-term and localized disturbances of the water column and benthic habitat associated with deployment and recovery of non-explosive mineshapes. In some cases (in shallow waters) the entire assembly (mine shape, mooring line, and anchor) would be deployed concurrently from a boat and recovered immediately following the exercise. The mooring lines would not present an entanglement risk for sea turtles because they would be held taut by the anchor and mine shape. Mooring lines would only be left in place for as long as the mine shape is in the water. The establishment of mine warfare training areas would not be expected to result in Level A or Level B harassment as defined by the MMPA. In accordance with NEPA, the establishment of mine warfare training areas would have no significant impact on sea turtles in territorial waters. Furthermore, the establishment of

mine warfare training areas would not cause significant harm to sea turtles in non-territorial waters in accordance with EO 12114.

Non-Explosive Practice Munitions

Strikes

The number of NEPM used would increase 67 percent in the JAX Study Area under Alternative 2 (Table 2.2-5 and 2.2-6). These changes would result in increased potential exposure for sea turtle ordnance strikes compared to baseline conditions. However, ordnance strike modeling predicts that substantially less than one sea turtle would be exposed to direct ordnance strikes under Alternative 2 (see Appendix I). Additionally, Navy mitigation measures further reduce the probability of ordnance-related exposure. The use of non-explosive ordnance under Alternative 2 would have no effect on sea turtles.

Weapons Firing Disturbance

The number of shells and small caliber firings in the JAX Study Area would increase 4 to 10 percent under Alternative 2. As presented in the discussion under the No Action Alternative above, firing of weapons would not result in an exposure of sea turtles; therefore weapon firings would have no effect on sea turtles.

Underwater Detonations and High Explosive Ordnance

Explosive ordnance associated with BOMBEX exercises would no longer occur under Alternative 2. As such, explosive ordnance associated with BOMBEX exercises would have no impact on any sea turtles under Alternative 2.

Forty additional Hellfire missile explosions would occur in MLTR. IMPASS events would not change under Alternative 2. The number of 20 lbs NEW underwater detonation charges in the north and south UNDET boxes would decrease from 18 to 12 per year.

As described under the No Action and Alternative 1, an explosive analysis was conducted to estimate the number of sea turtles that could be exposed to impacts from explosions. Appendix J contains a technical report describing the scientific basis, methods and assumptions of the explosive analysis. Tables 3.8-9 and 3.8-10 provide a summary of the explosive analysis for Alternative 2. For each species, in order to determine the total non-injurious potential exposures for all operations, the two columns for non-injurious exposures (182 dB criteria for TTS and 177 dB criteria for behavioral disruption) need to be added together between the two tables (Tables 3.8-9 and 3.8-10). For each species, the total for injurious potential exposures can be determined by adding the 205 dB re 1 mPa2-s/13 psi columns together between the two tables. For each species, the total mortality potential exposures can be determined by adding the 30.5 psi columns together between the two tables.

The modeling results indicate that Kemp's ridley, leatherback, loggerhead, and hardshell (which includes green, hawksbill, and unidentified hardshell turtles) sea turtles would be exposed to levels that could result in non-injurious (physiological and behavioral) effects. No sea turtles are expected to be exposed to levels that would result in injurious (physiological) effects or mortality under Alternative 2.

TABLE 3.8-9
SUMMARY OF POTENTIAL EXPOSURES FROM SINGLE DETONATION EXPLOSIVE ORDNANCE (PER YEAR) FOR SEA TURTLES IN THE JAX STUDY AREA—ALTERNATIVE 2

Species/Training Operation	Potential Exposures @ 182 dB re μPa²-s or 23 psi (peak)	Potential Exposures @ 205 dB re μPa²-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Hardshell turtles			
MISSILEX training	4	0	0
MINEX training	0	0	0
Total Exposures	4	0	0
Kemp's ridley turtle			
MISSILEX training	1	0	0
MINEX training	0	0	0
Total Exposures	1	0	0
Leatherback turtle			
MISSILEX training	3	0	0
MINEX training	0	0	0
Total Exposures	3	0	0
Loggerhead turtle			
MISSILEX training	6	0	0
MINEX training	1	0	0
Total Exposures	7	0	0

TABLE 3.8-10
SUMMARY OF POTENTIAL EXPOSURES FROM MULTIPLE DETONATION EXPLOSIVE ORDNANCE (PER YEAR) FOR SEA TURTLES IN THE JAX STUDY AREA—ALTERNATIVE 2

Species/Training Operation	Potential Exposures @ 177 dB r μPa²-s (multiple detonations only)	Potential Exposures @ 205 dB r μPa²-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Hardshell turtles			
FIREX training	4	0	0
Small Arms (grenades)	0	0	0
Total Exposures	4	0	0
Kemp's ridley turtle			
FIREX training	1	0	0
Small Arms (grenades)	0	0	0
Total Exposures	1	0	0

TABLE 3.8-10 (Continued)
SUMMARY OF POTENTIAL EXPOSURES FROM MULTIPLE DETONATION EXPLOSIVE ORDNANCE (PER YEAR) FOR SEA TURTLES IN THE JAX STUDY AREA—ALTERNATIVE 2

Species/Training Operation	Potential Exposures @ 177 dB r μPa^2-s (multiple detonations only)	Potential Exposures @ 205 dB r μPa^2-s or 13 psi-ms	Potential Exposures @ 30.5 psi-ms
Leatherback turtle			
FIREX training	8	0	0
Small Arms (grenades)	0	0	0
Total Exposures	8	0	0
Loggerhead turtle			
FIREX training	8	0	0
Small Arms (grenades)	2	0	0
Total Exposures	10	0	0

Underwater detonations and explosive ordnance use under Alternative 2 may affect ESA-listed green, hawksbill, leatherback, Kemp's ridley, and loggerhead sea turtles. In summary, the analysis presented above indicates that underwater detonations and HE ordnance use under Alternative 2 would affect individual sea turtles, but any effects observed at the population or species level would be negligible. Therefore, in accordance with NEPA, there would be no significant impact to sea turtle populations from explosive ordnance use during training exercises within territorial waters. In accordance with EO 12114, there would be no significant harm to sea turtle populations resulting from explosive ordnance use during training exercises in non-territorial waters.

3.8.4 Unavoidable Significant Environmental Effects

The Navy is working with the NMFS through the ESA Section 7 consultation process to ensure that unavoidable significant effects to sea turtles do not result from implementation of the proposed action.

3.8.5 Summary of Environmental Effects

3.8.5.1 Endangered Species Act

Table 3.8-11 provides a summary of the Navy's determination of effect for Alternative 2 (the Preferred Alternative) and federally listed sea turtles that occur in the Study Area. Alternative 2 may affect green, hawksbill, Kemp's ridley, leatherback, and loggerhead turtles. The Navy is consulting with NMFS regarding its determination of effect for federally listed sea turtles.

TABLE 3.8-11
SUMMARY OF THE NAVY'S DETERMINATION OF EFFECT FOR FEDERALLY LISTED SEA TURTLES IN THE JAX STUDY AREA FOR ALTERNATIVE 2

Stressor	Green Turtle	Hawksbill Turtle	Kemp's ridley Turtle	Leatherback Turtle	Loggerhead Turtle
Vessel Movements					
Disturbance	May Affect	May Affect	May Affect	May Affect	May Affect
Collisions	May Affect	May Affect	May Affect	May Affect	May Affect
Aircraft Overflights					
Disturbance	May Affect	May Affect	May Affect	May Affect	May Affect
Towed MIW Devices					
Strikes	May Affect	May Affect	May Affect	May Affect	May Affect
Mine Warfare Training					
Inert Mine Shape Deployment/Recovery	No Effect	No Effect	No Effect	No Effect	No Effect
Non-Explosive Practice Munitions					
Weapons Firing Disturbance	No Effect	No Effect	No Effect	No Effect	No Effect
Ordnance Strikes	No Effect	No Effect	No Effect	No Effect	No Effect
Underwater Detonations and High Explosive Ordnance					
HE Ordnance	May Affect	May Affect	May Affect	May Affect	May Affect
UNDETs	May Affect	May Affect	May Affect	May Affect	May Affect
MK3A2 grenades	May Affect	May Affect	May Affect	May Affect	May Affect
Military Expended Materials					
Ordnance-Related Material	May Affect	May Affect	May Affect	No Effect	May Affect
Target-Related Material	No Effect	No Effect	No Effect	No Effect	No Effect
Chaff	May Affect	May Affect	May Affect	May Affect	May Affect
Self Protection Flares	May Affect	May Affect	May Affect	May Affect	May Affect
Marine Markers	May Affect	May Affect	May Affect	May Affect	May Affect

3.8.5.2 National Environmental Policy Act and Executive Order 12114

Based on best available science, Navy concludes that takes due to explosive ordnance and underwater detonations would result in only short-term effects to most individuals exposed and would likely not affect annual rates of recruitment or survival of the species. The mitigation measures presented in Ch. 5 would further reduce the potential for exposures, and there would be no mortality of sea turtles from the proposed training activities.

As summarized in Table 3.8-12, the No Action Alternative, Alternative 1, and Alternative 2 would have no significant impact on sea turtles in territorial waters in accordance with NEPA. Furthermore, in accordance with EO 12114 the No Action Alternative, Alternative 1, and Alternative 2 would not cause significant harm to sea turtles in non-territorial waters.

TABLE 3.8-12
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON SEA TURTLES IN THE JAX STUDY AREA

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	NEPA (U.S. Territory)	EO 12114 (Non-Territorial Waters, >12 nm)
No Action		
Vessel Movements	Short-term behavioral responses from general vessel disturbance. Potential for injury or mortality from vessel collisions.	Short-term behavioral responses from general vessel disturbance. Potential for injury or mortality from vessel collisions.
Aircraft Overflights	Potential for short-term behavioral responses to overflights. No long-term population-level effects.	Potential for short-term behavioral responses to overflights. No long-term population-level effects.
Towed MIW Devices	Low potential for towed MIW device strikes. No long-term population-level effects.	Low potential for towed MIW device strikes. No long-term population-level effects.
MIW Training	No effect.	No effect.
NEPM	No effect based on extremely low probability of direct strikes.	No effect based on extremely low probability of direct strikes.
UNDET and HE Ordnance	Potential for short-term behavioral responses. Potential for injury or mortality within limited ZOI.	Potential for short-term behavioral responses. Potential for injury or mortality within limited ZOI.
MEM	Low potential for ingestion of chaff and/or flare plastic end caps and pistons.	Low potential for ingestion of chaff and/or flare plastic end caps and pistons.
Conclusion	No significant impact to sea turtles.	No significant harm to sea turtles.
Alternative 1		
Vessel Movements	Short-term behavioral responses from general vessel disturbance. Potential for injury or mortality from vessel collisions. Slight increase compared to No Action.	Short-term behavioral responses from general vessel disturbance. Potential for injury or mortality from vessel collisions. Slight increase compared to No Action.
Aircraft Overflights	Potential for short-term behavioral responses to overflights. Slight increase compared to No Action. No long-term population-level effects.	Potential for short-term behavioral responses to overflights. Slight increase compared to No Action. No long-term population-level effects.
Towed MIW Devices	Low potential for towed MIW device strikes. Slight increase compared to No Action. No long-term population-level effects.	Low potential for towed MIW device strikes. Slight increase compared to No Action. No long-term population-level effects.
MIW Training	No effect.	No effect.
NEPM	No effect based on extremely low probability of direct strikes.	No effect based on extremely low probability of direct strikes.
UNDETs and HE Ordnance	Potential for short-term behavioral responses. Potential for injury or mortality within limited ZOI. Slight increase compared to No Action.	Potential for short-term behavioral responses. Potential for injury or mortality within limited ZOI. Slight increase compared to No Action.
MEM	Low potential for ingestion of chaff and/or flare plastic end caps and pistons. Slight increase compared to No Action.	Low potential for ingestion of chaff and/or flare plastic end caps and pistons. Slight increase compared to No Action.
Conclusion	No significant impact to sea turtles.	No significant harm to sea turtles.

TABLE 3.8-12 (Continued)
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON SEA TURTLES IN THE JAX STUDY AREA

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	NEPA (U.S. Territory)	EO 12114 (Non-Territorial Waters, >12 nm)
Alternative 2		
Vessel Movements	Short-term behavioral responses from general vessel disturbance. Potential for injury or mortality from vessel collisions. Slight increase compared to No Action.	Short-term behavioral responses from general vessel disturbance. Potential for injury or mortality from vessel collisions. Slight increase compared to No Action.
Aircraft Overflights	Potential for short-term behavioral responses to overflights. Slight increase compared to No Action. No long-term population-level effects.	Potential for short-term behavioral responses to overflights. Slight increase compared to No Action. No long-term population-level effects.
Towed MIW Devices	Low potential for towed MIW device strikes. Slight increase compared to No Action. No long-term population-level effects.	Low potential for towed MIW device strikes. Slight increase compared to No Action. No long-term population-level effects.
MIW Training	No effect.	No effect.
NEPM	No effect based on extremely low probability of direct strikes.	No effect based on extremely low probability of direct strikes.
UNDETs and HE Ordnance	Potential for short-term behavioral responses. Potential for injury or mortality within limited ZOI. Slight increase compared to No Action.	Potential for short-term behavioral responses. Potential for injury or mortality within limited ZOI. Slight increase compared to No Action.
MEM	Low potential for ingestion of chaff and/or flare plastic end caps and pistons. Slight increase compared to No Action.	Low potential for ingestion of chaff and/or flare plastic end caps and pistons. Slight increase compared to No Action.
Conclusion	No significant impact to sea turtles.	No significant harm to sea turtles.

3.9 FISH AND ESSENTIAL FISH HABITAT

3.9.1 Introduction and Methods

3.9.1.1 Regulatory Framework

The primary laws that make up the regulatory framework for fish and essential fish habitat (EFH) are described in Appendix K and include the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), the Sustainable Fisheries Act (SFA), and the ESA.

One of the most significant mandates in the SFA is the EFH provision, which provides the means to conserve fish habitat. The SFA requires that regional Fishery Management Councils (FMC) identify EFH for federally managed species (*i.e.*, species covered under fishery management plans [FMP]). The SFA requires federal agencies to consult with the NMFS on activities that may adversely affect EFH, or when the NMFS independently learns of a federal activity that may adversely affect EFH. An adverse effect is defined as "any impact which reduces quality and/or quantity of EFH [and] may include direct (*e.g.,* contamination or physical disruption), indirect (*e.g.,* loss of prey or reduction in species' fecundity), site-specific or habitat wide impacts, including individual, cumulative, or synergistic consequences of actions" (50 CFR 600.810). As discussed in Section 3.9.2 - Affected Environment, EFH has been designated in the JAX Study Area.

This section of the EIS/OEIS includes the Navy's EFH Assessment for the JAX Range Complex. An EFH Assessment is a critical review of the proposed project and its potential impacts to EFH. As set forth in 50 CFR 600.920[e][3], EFH Assessments must include (1) a description of the proposed action (see Chapters 1 and 2); (2) an analysis of the effects of the action on EFH and managed species; (3) the federal agency's conclusions regarding the effects of the action on EFH; and (4) proposed mitigation (see Chapter 5), if applicable. Once NMFS learns of a federal or state activity that may have adverse effects on designated EFH, NMFS is required to develop EFH conservation recommendations for the activity. These recommendations may include measures to avoid, minimize, mitigate, or otherwise offset adverse effects on EFH (NMFS 2004a,b).

As discussed in Appendix K, the ESA established protection over and conservation of threatened and endangered species. Portions of the Study Area are within the current or historic ranges of the shortnose sturgeon and smalltooth sawfish, which are federally listed as endangered. Therefore, the ESA requirements discussed in Appendix K are applicable to the analysis for the shortnose sturgeon and smalltooth sawfish. The Navy has consulted with the NMFS in accordance with Section 7 of the ESA. Critical habitat for listed fish species has not been designated under the ESA in the Study Area.

3.9.1.2 Assessment Methods and Data Used

General Approach to Analysis

The general approach to analysis for fish and EFH is the same as the approach described for marine mammals in Section 3.7.1.2.

Study Area

The Study Area for fish and EFH is described in Section 1.5 and is shown in Figure 1.5-1, and includes waters of the Atlantic Ocean. Inland ranges (Rodman Range and Lake George Range) are

not part of the Study Area for this section of the EIS/OEIS. Potential affects of the alternatives on fish and fish habitat at the Lake George Range are addressed in Section 3.11.

Data Sources

A comprehensive and systematic review of relevant literature and data has been conducted in order to complete the EFH Assessment and this analysis for fish and EFH, and to ensure that best available information has been used. Of the available scientific literature (both published and unpublished), the following types of documents were utilized in the assessment: journals, books, periodicals, bulletins, Department of Defense operations reports, Environmental Impact Statements, and other technical reports published by government agencies, private businesses, consulting firms, or non-governmental conservation organizations. The scientific literature was also consulted during the search for geographic location data on the occurrence of resources within the Study Area. The primary source of information used to describe the affected environment for fish and EFH were in the Navy's Marine Resources Assessment (MRA) report for Charleston/Jacksonville Operating Area (DoN, 2008). The MRA report provides a compilation of the most recent data and information on the occurrence of marine resources in the Study Area. Descriptions of literature and data searches conducted during preparation of the MRA report are described in detail in that document.

Factors Used to Assess Effects

This EIS/OEIS analyzes potential effects to fish and EFH in the context of the MSFCMA (federally managed species and EFH), ESA (species listed under the ESA only), NEPA, and EO 12114. The factors used to assess the significance of effects vary under these Acts. Pursuant to 50 CFR 600.910(a), an "adverse effect" on EFH is defined as any impact that reduces the quality and/or quantity of EFH. To help identify Navy activities falling within the adverse effect definition, the Navy has determined that temporary or minimal impacts are not considered to "adversely affect" EFH. 50 CFR 600.815(a)(2)(ii) and the EFH Final Rule (67 Fed. Reg. 2354) were used as guidance for this determination, as they highlight activities with impacts that are more than minimal and not temporary in nature, as opposed to those activities resulting in inconsequential changes to habitat. Temporary effects are those that are limited in duration and allow the particular environment to recover without measurable impact (NMFS, 2002). Minimal effects are those that may result in relatively small changes in the affected environment and insignificant changes in ecological functions (NMFS, 2002). Whether an impact is minimal will depend on a number of factors:

- The intensity of the impact at the specific site being affected.
- The spatial extent of the impact relative to the availability of the habitat type affected.
- The sensitivity/vulnerability of the habitat to the impact.
- The habitat functions that may be altered by the impact (*e.g.*, shelter from predators).
- The timing of the impact relative to when the species or life stage needs the habitat.

The factors outlined above were also considered in determining the significance of effects under NEPA and EO 12114. For purposes of ESA compliance, effects of the action were analyzed to make the Navy's determination of effect for listed species. The definitions used in making the determination of effect under Section 7 of the ESA are based on the USFWS and NMFS *Endangered Species Consultation Handbook* (USFWS and NMFS, 1998) and are provided in Section 3.7.1.1.

3.9.1.3 Warfare Areas and Associated Environmental Stressors

The Navy used a screening process to identify aspects of the proposed action that could act as stressors to fish and EFH. Navy subject matter experts de-constructed the warfare areas and operations included in the proposed action to identify specific activities that could act as stressors. Public and agency scoping comments, previous environmental analyses, previous agency consultations, laws, regulations, Executive Orders, and resource-specific information were also evaluated. This process was used to focus the information presented and analyzed in the affected environment and environmental consequences sections of this EIS/OEIS. As summarized in Table 3.9-1, potential stressors to fish and EFH include vessel movements (disturbance and collisions), aircraft overflights (disturbance), towed MIW devices (strikes), MIW training, non-explosive practice munitions (disturbance and strikes), UNDETs and HE ordnance, and MEM (ordnance-related material, targets, chaff, self-protection flares, and marine markers). The potential effects of these stressors on fish and EFH are analyzed in detail in Section 3.9.3.

TABLE 3.9-1
SUMMARY OF POTENTIAL STRESSORS TO FISH AND ESSENTIAL FISH HABITAT

Warfare Area and Operation	Training Areas	Vessel Movements (Disturbance)	Vessel Movements (Collisions)	Aircraft Overflights (Disturbance)	Aircraft Overflights (Strikes)	Towed Mine Warfare Devices	Mine Warfare Deployment/Recovery	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Material
Mine Warfare (MIW)										
Mine Laying	Lake George Range									
MCM	Carrier Operating Areas	✓	✓	✓		✓	✓			
Mine Neutralization	Charleston OPAREA (North and South UNDET Boxes)	✓	✓	✓			✓	✓	✓	✓
Surface Warfare (SUW)										
MISSILEX (A-S)	W-157A (Area 4X) and W-159A (Area 5X)			✓				✓	✓	✓
GUNEX (A-S)	W-132, W-133, W-134, W-157, W-158			✓				✓		✓
GUNEX (S-S) Boat	Charleston OPAREA (Areas 11J)	✓	✓					✓		✓

TABLE 3.9-1 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO FISH AND ESSENTIAL FISH HABITAT

Warfare Area and Operation	Training Areas	Vessel Movements (Disturbance)	Vessel Movements (Collisions)	Aircraft Overflights (Disturbance)	Aircraft Overflights (Strikes)	Towed Mine Warfare Devices	Mine Warfare Deployment/Recovery	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Material
GUNEX (S-S) Ship	JAX OPAREA (AA, BB, and CC)	✓	✓					✓		✓
BOMBEX (A-S) (at sea)	HE, W-158 (31J) NEPM, W157A/B and W-158 A/B			✓				✓	✓	✓
Laser Targeting	W-132, W-133, W-134, W-157, W-158			✓						
GUNEX (S-S) (FAC/FIAC)	Amber Strait: Charleston OPAREA (Boxes Q-9&10, R-9&10)	✓	✓							
VBSS/MIO-Ship	JAX and Charleston OPAREAs	✓	✓							
VBSS/MIO-Helicopter	W-157A (Area 4X) and W-159A (Area 5X)			✓						
Air Warfare (AW)										
ACM	W-157A (Areas 3X & 4X)			✓						✓
Air Intercept Control	JAX and Charleston OPAREAs			✓						
ACM Chaff Exercise	W-157A (Areas 3X & 4X)			✓						✓
ACM Flare Exercise	W-157A (Areas 3X & 4X)			✓						✓
MISSILEX (A-A)	W-132, W-133, W-134, W-157, W-158			✓				✓	✓[1]	✓

TABLE 3.9-1 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO FISH AND ESSENTIAL FISH HABITAT

Warfare Area and Operation	Training Areas	Vessel Movements (Disturbance)	Vessel Movements (Collisions)	Aircraft Overflights (Disturbance)	Aircraft Overflights (Strikes)	Towed Mine Warfare Devices	Mine Warfare Deployment/Recovery	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Material
MISSILEX (S-A)	JAX and Charleston OPAREAs									✓
Detect-to-Engage	W-132, W-133, W-134, W-157, W-158	✓	✓	✓						
GUNEX (S-A)	JAX OPAREA (AA, BB, and CC)	✓	✓	✓				✓		✓
GUNEX (A-A)	W-157A/W-133 (Area 2X)									✓
Amphibious Warfare (AMW)										
FIREX (S-S) with IMPASS	JAX OPAREA (BB and CC)	✓	✓					✓	✓	✓
Strike Warfare (STW)										
BOMBEX (A-G)	Rodman Range									
CSAR and Convoy Operations	Rodman Range									
Electronic Combat (EC)										
EC Operations - Aircraft	W-132, W-133, W-134, W-157, W-158			✓						
EC Operations - Surface Ships	JAX and Charleston OPAREAs	✓	✓							
Chaff Exercise	JAX and Charleston OPAREAs	✓	✓	✓						✓
Flare Exercise - Helicopter	Lake George Range									

TABLE 3.9-1 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO FISH AND ESSENTIAL FISH HABITAT

Warfare Area and Operation	Training Areas	Vessel Movements (Disturbance)	Vessel Movements (Collisions)	Aircraft Overflights (Disturbance)	Aircraft Overflights (Strikes)	Towed Mine Warfare Devices	Mine Warfare Deployment/Recovery	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Material
Other Training										
SESEF Utilization	5-15 nm east of Mayport	✓	✓							
Precision Anchoring	NS Mayport	✓								
Small Arms with anti-swimmer grenades (MK3A2)	Charleston OPAREA (Area 10L, 12I)	✓	✓						✓	✓

[1] Missile explodes in air, no explosive sound in the water.

As discussed in Section 3.3 – Water Resources and Section 3.4 – Air Quality, some water and air pollutants would be released into the environment as a result of the proposed action. The analyses presented in Sections 3.3 and 3.4 indicate that any increases in water or air pollutant concentrations resulting from Navy training in the Study Area would be negligible and localized, and impacts to water and air quality would not be significant. Based on the analyses presented in Sections 3.3 and 3.4, water and air quality changes would have no effect or negligible effects on fish and any effects to EFH would be temporary and/or minimal. Accordingly, the effects of water and air quality changes on fish and EFH are not addressed further in this EIS/OEIS.

3.9.2 Affected Environment

3.9.2.1 Regional Overview

The zoogeography of marine fish is closely tied to oceanographic processes and their position to continents (Moyle and Cech, 1988). Fish residing on continental shelves are affected by the topography of the continental shelf, water temperatures, and currents (Moyle and Cech, 1988). Climates throughout the world, along with topographic features, divide the continental shelves into five categories: tropical regions, north temperate regions, south temperate regions, arctic regions, and Antarctic regions (Moyle and Cech, 1988). In addition to continental shelf regions, there are also pelagic and deep sea regions that support various fish species. Fish distributions in these regions, such as the mesopelagic zone (200 to 1,000 m) and the offshore area of the epipelagic zone (0 to 200 m), are not confined to specific geographic locations (Moyle and Cech, 1988). In addition, the distributions of marine invertebrates, like those of marine fish, are also subjected to currents, ocean temperatures, and topographic features but are largely dependent upon the composition (firmness, texture, and stability) of the substrate they reside upon (Sumich, 1988). Their larval stage allows extensive distributions by drifting along stretches of open water and miles of coastline (Jackson *et al.*, 2002).

The Study Area is located within the South Atlantic Bight (SAB). The topography in this region is divided into four distinct habitats: coastal habitats (1 to 18 m), open-shelf habitat (18 to 55 m), shelfedge habitat (55 to 110 m), and lower-shelf habitat (110 to 182 m) (Struhsaker, 1969). The Study Area extends from southern North Carolina to northern Florida and includes various physiographic structures (*i.e.*, Charleston Bump and Blake Plateau) that attract commercial and recreational fish species. Two main currents converge off of North Carolina: the Labrador Current flowing down from the north and the Gulf Stream Current traveling up from the south. The dynamic interplay of these currents has a profound effect on the fish fauna of the Study Area. The northern region (North Carolina) of the Study Area is considered temperate whereas the southern region (*i.e.*, Florida) is considered subtropical-tropical (Moyle and Cech, 1988). Fish species move in and out of the Study Area depending upon their thermal tolerances, prey availability, and other environmental/ecological variables. Ecological groups of fish that occur in the SAB include the estuarine-dependent community, the reef associated community, and the pelagic associated community (Schwartz, 1989). As a result, fishes that are more typical of regions to the north (*i.e.*, more temperate species) or south (*i.e.*, more tropical species) of the Study Area may be well represented at different times of the year (Vernberg and Vernberg, 1970; Bumpus 1973; and Briggs 1974).

The northern portion (inner shelf, North Carolina) of the Study Area has a narrowing shelf with fair amounts of hardbottom to support coastal migratory pelagic fish species (*e.g.*, king mackerel [*Scomberomorus cavalla*], Spanish mackerel [*S. maculatus*], and cero mackerel [*S. regalis*]) (NAS, 1990). The fish in this area are subjected to cold water temperatures in the winter (4° to 10°C) and fairly mild temperatures in the summer (22° to 25°C) (Huntsman and Manooch, 1978). The offshore reef fish of the Study Area inhabit deeper water that does not fluctuate in temperature as much as the nearshore. The fish residing in the offshore shelf waters of the Study Area are considered tropical and subtropical (*i.e.*, porgies [Sparidae], snappers [*Lutjanus* sp.], groupers [*Epinephelus* sp.], grunts [Haemulidae], and black sea bass [*Centropristis striatus*]) (Huntsman and Manooch, 1978; NAS, 1990; Miller and Richards, 1980). The offshore reef fish reside wherever there is sufficient hardbottom. The central and southern portions of the Study Area, from South Carolina to northern Florida, has considerable hardbottom and topographic features (*e.g.*, Gray's Reef, Charleston Bump, and Savannah Scarp) that supports many species of reef fish on the Florida-Hatteras shelf and slope (Sedberry *et al*., 2001). There are also a number of artificial habitats, both shipwrecks and constructed artificial reefs, which are found throughout the Study Area that support a diversity of fish (Figure 3.6-4). Reef fish partition their environment by depth, bottom topography, and temperature, allowing for high diversity (Miller and Richards, 1980; Grimes *et al*., 1982). The combination of habitat complexity, warm water from the Gulf Stream, and pelagic larvae of coral-associated fish (Leis, 1991) results in significant assemblages of invertebrates (*i.e.*, sponges) and reef fish (over 300 species) such as the redfin parrotfish (*Sparisoma rubripinne*), creole wrasse (*Clepticus parrai*), puddingwife (*Halichoeres radiatus*), and white grunt (*Haemulon plumieri*) inhabiting the inner, mid and outer shelf (Struhsaker, 1969; Parker *et al*., 1983; Parker and Mays, 1998). Common coastal fish species in the Study Area are bluefish (*Pomatomus saltatrix*), jacks (Carangidae), winter flounder (*Pseudpoleuronectes americanus*), red drum (*Sciaenops ocellatus*), sheepshead (*Archosargus probatocephalus*), Atlantic spadefish (*Chaetodipterus faber*), spotted sea trout (*Cynoscion nebulosus*), and weakfish (*C. regalis*) (NAS, 1990; SCDNR, 2006).

Billfish (Istiophoridae), swordfish (*Xiphias gladius*), tuna (*Thunnus* sp.), and many shark species are classified as highly migratory fishes and are distributed from coastal waters seaward into the open ocean. These species are capable of moving great distances seasonally (north to south or inshore to

offshore) as well as vertically in the water column. In contrast to temperate and subtropical fish, highly migratory species (HMS) are not correlated with areas or features that typify most fish habitat (bottom substrate or submerged vegetation) but are instead associated with physiographic and hydrographic features such as ocean fronts, current boundaries, the continental shelf margin, or sea mounts (NMFS, 1999).

Although the Study Area does not include any estuarine areas, their importance as nursery and maturation areas for various fish species cannot be minimized (Schwartz, 1989; NERR, 2006). Coastal habitat is part of the Study Area and many fish residing in these areas (*i.e.*, Onslow Bay, North Carolina) move through the offshore area seasonally to the outer shelf as the coastal waters become too cold (Schwartz, 1989; NOAA, 2005). Many of the common fish to the Study Area, such as snapper (*Lutjanus* sp.) and grouper (*Epinephelus* sp.) species are developmentally linked to estuaries (NAS, 1990; SAFMC, 1998). Estuaries are also important in the life history of commercially valuable invertebrates, such as crabs and shrimp (Schwartz, 1989).

3.9.2.2 Essential Fish Habitat

The EFH that occurs in the Study Area generally includes (DoN, 2005; NEFMC, 2007; GMFMC, 2007; MAFMC, 2007; NMFS, 2007a; SAFMC, 2007a):

- Benthic Habitat - rocks, gravel, cobble, pebbles, sand, clay, mud, silt, shell fragments, and hard bottom as well as the water-sediment interface used by many invertebrates and a variety of species for spawning/nesting, development, dispersal, and feeding.
- Structured Habitat - including artificial reefs (and wrecks), and biogenic habitat created by living organisms such as sponges, mussels, hydroids, amphipod tubes, red algae, bryozoans, coral, and deepwater non-reef forming (ahermatypic) corals, including proposed deepwater coral Habitat Areas of Particular Concern (HAPC) (see Figure 3.6-3).
- *Sargassum* Habitat - mats of *Sargassum natans* and *S. fluitans* which provide important habitat for numerous fish, especially their larval stages;
- Gulf Stream Habitat - a diverse and productive pelagic habitat enhancing the dispersal of larvae of many fish species; and
- Marine Water Column - extending from the ocean surface to the ocean floor. Depending upon species, habitat may only include a part of the water column (*e.g.*, surface waters).

The FMCs classify EFH for temperate and subtropical-tropical managed species in terms of five basic life stages: (1) eggs, (2) larvae, (3) juveniles, (4) adult, and (5) spawning adult. Eggs are those individuals that have been spawned but not hatched and are completely dependent on the egg's yolk for nutrition. Larvae are individuals that have hatched and can capture prey, while juveniles are those individuals that are not sexually mature but possess fully formed organ systems that are similar to adults. Adults are sexually mature individuals that are not necessarily in spawning condition. Finally, spawning adults are those individuals capable of spawning.

Although the individual life stage terms and definitions are the same as those defined by the FMCs, NMFS categorizes the life stages of managed tuna, swordfish, and billfish somewhat differently, resulting in three categories that are based on common habitat usage by all life stages in each group: (1) spawning adults, eggs, and larvae; (2) juveniles and subadult; and (3) adult. Subadults are those individuals just reaching sexual maturity. The category of spawning adult, eggs, and larvae is associated with spawning location and the circulation patterns that control the distribution of the eggs and larvae.

NMFS uses a different life stage classification system for sharks; the system bases the life stage combinations on the general habitat shifts that accompany each developmental stage. The three resulting categories are: (1) neonate and early juvenile (including newborns and pups less than one year old), (2) late juvenile and subadult (age one to adult), and (3) adult (sexually mature sharks). In Amendment 1 to the Fisheries Management Plan for the Atlantic Tunas, Swordfish, and Sharks, the first two life stages were modified as follows: the neonate and early juvenile category was renamed "neonate," which primarily includes neonates and small young-of-the-year sharks; and the late juveniles and subadults category was renamed "juveniles," which includes all immature sharks from young to late juveniles.

Detailed descriptions of individual species, their life-histories, distribution, and maps of species designated EFH-HAPC are contained in the *Marine Resource Assessment for the Charleston/Jacksonville Operating Area* (DoN, 2008) and the *Essential Fish Habitat Study for the Southeast Operating Areas: Virginia Capes, Cherry Point, and Charleston/Jacksonville* (DoN, 2005). Section 3.6 – Marine Communities also provides descriptions of benthic habitats and maps for benthic communities (Figure 3.6-1); coral, coral reefs, live, or hard bottom EFH (Figure 3.6-2); existing coral, coral reefs, live, or hard bottom HAPC (Figure 3.6-3); proposed deepwater coral HAPC (Figure 3.6-3); designated deepwater snapper grouper marine protected areas (Figure 3.6-3); and artificial habitats (Figure 3.6-4).

Table 3.9-2 lists the 126 species with designated EFH for at least one life stage occurring within the JAX Range Complex. These include fish, invertebrate, and macroalgal species. These species can be grouped as temperate, subtropical/tropical, and highly migratory:

- Temperate Water/Northeast Fish and Invertebrate Species (T) - Temperate water fish that have EFH in the JAX Range Complex, include the black sea bass, bluefish, spiny dogfish, and summer flounder. The black sea bass is divided into two stocks, the northern and the southern, with only the southern stock, which ranges from Cape Hatteras, North Carolina to Cape Canaveral, Florida, having EFH in the area.
- Subtropical/Tropical Fish and Invertebrate Species (ST/T) - Subtropical/tropical EFH species in the OPAREAs include 84 fish, eight invertebrates, and multiple coral groupings. These include snapper-grouper complex, coastal migratory pelagic species complex, red drum, dolphin/wahoo complex, calico scallop, spiny lobster, penaeid and deepwater shrimps, coral, coral reefs, and live/hardbottom habitat; and golden crab.
- Highly Migratory Species (HMS) - Twenty-nine HMS have designated EFH in the JAX Range Complex, including billfish, swordfish, tunas, and many shark species. EFH for HMS is wide-ranging because these species generally occur in the open ocean but may also frequent nearshore waters. HMS are usually associated with physiographic and hydrographic features, such as ocean fronts, current boundaries, the continental shelf margin, or sea mounts (DoN, 2008). As of September 2008, the draft version of Amendment 1 to the Consolidated Atlantic Highly Migratory Species Fishery Management Plan Essential Fish Habitat has been released by NMFS for public comment.

TABLE 3.9-2
REPRESENTATIVE SPECIES WITH ESSENTIAL FISH HABITAT THAT ARE EXPECTED TO OCCUR IN THE JAX RANGE COMPLEX

Species	Group[1]	Jurisdiction[2]
Almaco jack (*Seriola rivoliana*)	ST/T	3
Atlantic yellowfin tuna (*Thunnus albacares*)	HM	5
Atlantic sharpnose shark (*Rhizoprionodon terraenovae*)	HM	5
Banded rudderfish (*Seriola zonata*)	ST/T	3,4
Bank sea bass (*Centropristis ocyurus*)	ST/T	3
Bar jack (*Caranax rubber*)	ST/T	3
Bignose shark (*Carcharhinus altimus*)	HM	5
Black grouper (*Mycteroperca bonaci)*	ST/T	3,4
Black margate (*Anisotremus surinamensis*)	ST/T	3
Black sea bass (*Centropristis striata*)	T	3
Black snapper (*Apsilus dentatus*)	ST/T	3
Blackfin snapper (*Lutjanus buccanella*)	ST/T	3,4
Blacknose shark (*Carcharhinus acronotus*)	HM	5
Blacktip shark (*Carcharhinus limbatus*)	HM	5
Blue marlin (*Makaira nigricans*)	HM	5
Blue runner (*Caranx crysos*)	ST/T	3
Blue stripe grunt (*Haemulon sciurus*)	ST/T	3
Bluefin tuna (*Thunnus thynnus*)	HM	5
Bluefish (*Pomatous saltatrix*)	T	2
Blueline tilefish (*Caulolatilus microps*)	ST/T	3,4
Bonnethead shark (*Sphyrna tiburo*)	HM	5
Brown shrimp (*Penaeus aztecus)*	ST/T	3,4
Bull shark (*Carcharhinus leucas*)	HM	5
Calico scallop (*Argopecten gibbus*)	ST/T	3
Cero (Scomberomorus regalis)	ST/T	3,4
Cobia (Rachycentron canadum)	ST/T	3,4
Coney (Epinephelus fulvus)	ST/T	3
Corals: stony corals, octocorals, and black corals	ST/T	3,4
Cottonwick (Haemulon melanurum)	ST/T	3
Crevalle jack (Caranx hippos)	ST/T	3
Cubera snapper (Lutjanus cyanopterus)	ST/T	3,4

TABLE 3.9-2 (Continued)
REPRESENTATIVE SPECIES WITH ESSENTIAL FISH HABITAT THAT ARE EXPECTED TO OCCUR IN THE JAX RANGE COMPLEX

Species	Group[1]	Jurisdiction[2]
Dog snapper (*Lutjanus jocu*)	ST/T	3,4
Dolphin, common (*Coryphaena hippurus)*	ST/T	3,4
Dolphin, Pompano (*Coryphaena equiselis)*	ST/T	3,4
Dusky shark (*Carcharhinus obscurus*)	HM	5
Finetooth shark (*Carcharhinus isodon*)	HM	5
French grunt (*Haemulon flavolineaum*)	ST/T	3
Gag (*Mycteroperca microlepis*)	ST/T	3,4
Golden crab (*Chaceon fenneri*)	ST/T	3
Golden tilefish *(Lopholatilus chamaeleonticeps)*	ST/T	2,3,4
Goliath grouper (*Epinephelus itajara*)	ST/T	3,4
Goosefish (monkfish) (*Lophius americanuse*)	ST/T	3,4
Grass porgy (*Calamus arctifrons*)	ST/T	3
Gray snapper (*Lutjanus griseus*)	ST/T	3,4
Gray triggerfish (*Balistes capriscus*)	ST/T	3,4
Graysby (*Epinephelus cruentatus*)	ST/T	3
Great hammerhead shark (*Sphyrna mokarran*)	HM	5
Greater amberjack (*Seriola dumerili*)	ST/T	3,4
Hogfish (*Lachnolaimus maximus*)	ST/T	3,4
Jolthead porgy (*Calamus bajonado*)	ST/T	3
King mackerel (*Scomberomorus cavalla*)	ST/T	3,4
Knobbed porgy (*Calamus nodosus*)	ST/T	3
Lane snapper (*Lutjanus synagris*)	ST/T	3,4
Lemon shark (*Negaprion brevirostris*)	HM	5
Lesser amberjack *(Seriola fasciata)*	ST/T	3,4
Little tunny (*Euthynnus alletteratus)*	ST/T	3,4
Longbill spearfish (*Tetrapturus pfluegeri*)	HM	5
Longfin mako shark (*Isurus paucus*)	HM	5
Longspine porgy (*Stenotomus caprinus*)	ST/T	3
Mahogany snapper (*Lutjanus mahogoni*)	ST/T	3,4
Margate (*Haemulon album*)	ST/T	3
Misty grouper (*Epinephelus mystacinus*)	ST/T	3,4
Mutton snapper (*Lutjanus analis*)	ST/T	3,4
Nassau grouper (*Epinephelus striatus*)	ST/T	3,4

TABLE 3.9-2 (Continued)
REPRESENTATIVE SPECIES WITH ESSENTIAL FISH HABITAT THAT ARE EXPECTED TO OCCUR IN THE JAX RANGE COMPLEX

Species	Group[(1)]	Jurisdiction[(2)]
Night shark (*Carcharhinus signatus*)	HM	5
Nurse shark (*Ginglymostoma cirratum*)	HM	5
Ocean triggerfish (*Canthidermis sufflamen*)	ST/T	3
Oceanic whitetip shark (*Carcharhinus longimarus*)	HM	5
Pink shrimp (*Penaeus duorarum)*	ST/T	3,4
Pompano dolphin (*Coryphaena equiselis*)	ST/T	3
Porkfish (*Anisotremus virginicus*)	ST/T	3
Puddingwife (*Halichoeres radiatus*)	ST/T	3
Queen snapper (*Etelis oculatus*)	ST/T	3,4
Queen triggerfish (*Balistes vetula*)	ST/T	3
Red drum (*Sciaenops ocellatus*)	ST/T	3,4
Red grouper (*Epinephelus morio*)	ST/T	3,4
Red hind (*Epinephelus guttatus*)	ST/T	3,4
Red porgy (*Pagrus pagrus*)	ST/T	3
Red snapper (*Lutjanus campechanus*)	ST/T	3,4
Rock hind (*Epinephelus adscensionis*)	ST/T	3,4
Rock sea bass (*Centropristis philadelphica*)	ST/T	3
Rock shrimp (*Sicyonia brevirostris*)	ST/T	3
Royal red shrimp (*Pleoticus robustus*)	ST/T	3,4
Sailfish (*Istiophorus platypterus*)	HM	5
Sailors choice (*Haemulon parrai*)	ST/T	3
Sand tiger shark (*Odontaspis taurus*)	HM	5
Sand tilefish (*Malacanthus plumieri)*	ST/T	3
Sandbar shark (*Carcharhinus plumbeus*)	HM	5
Saucereye porgy (*Calamus calamus*)	ST/T	3
Scalloped hammerhead (*Sphyrna lewini*)	HM	5
Scamp (*Mycteroperca phenax*)	ST/T	3,4
Schoolmaster (*Lutjanus apodus*)	ST/T	3,4
Seabob shrimp (*Xiphopenaeus kroyers*)	ST/T	3,4
Sheepshead (*Archosargus probatocephalus*)	ST/T	3
Silk snapper (*Lutjanus vivanus*)	ST/T	3,4
Silky shark (*Carcharhinus falciformis)*	HM	5
Smallmouth grunt (*Haemulon chrysargyreum*)	ST/T	3
Snowy grouper (*Epinephelus niveatus*)	ST/T	3,4

TABLE 3.9-2 (Continued)
REPRESENTATIVE SPECIES WITH ESSENTIAL FISH HABITAT THAT ARE EXPECTED TO OCCUR IN THE JAX RANGE COMPLEX

Species	Group[(1)]	Jurisdiction[(2)]
Spadefish (*Chaetodipterus faber*)	ST/T	3
Spanish grunt (*Haemulon macrostomun*)	ST/T	3
Spanish mackerel (*Scomberomorus maculatus*)	ST/T	3,4
Speckled hind (*Epinephelus drummondhayi)*	ST/T	3,4
Spinner shark (*Carcharhinus brevipinna*)	HM	5
Spiny dogfish (*Squalus acanthias*)	T	2
Spiny lobster (*Panulirus argus*)	ST/T	3,4
Summer flounder (*Paralichtys dentatus*)	T	2
Swordfish (*Xiphias gladius*)	HM	5
Tiger grouper (*Mycteroperca tigris*)	ST/T	3
Tiger shark (*Galeocerdo cuvier)*	HM	5
Tilefish (*Lopholatilus chamaeleonticeps*)	T	2
Tomtate (*Haemulon aurolineatum*)	ST/T	3
Vermilion snapper (*Rhomboplites aurorubens*)	ST/T	3,4
Wahoo (*Acanthocybium solanderi*)	ST/T	3
Warsaw grouper (*Epinephelus nigritus)*	ST/T	3,4
White grunt (*Haemulon plumieri*)	ST/T	3
White marlin (*Tetrapturus albidus*)	HM	5
White shark (*Carcharodon carcharias*)	HM	5
White shrimp (*Penaeus setiferus*)	ST/T	3,4
Whitebone porgy (*Calamus leucosteus*)	ST/T	3
Wreckfish (*Polyprion americanus*)	ST/T	3
Yellow jack (*Caranx bartholomaei)*	ST/T	3
Yellowedge grouper (*Epinephelus flavolimbatus*)	ST/T	3
Yellowfin grouper (*Mycteroperca venenosa*)	ST/T	3,4
Yellowfin tuna (*Thunnus albacares*)	HM	5
Yellowmouth grouper (*Mycteroperca interstitialis*)	ST/T	3,4
Yellowtail snapper (*Ocyurus chrysurus*)	ST/T	3,4

[(1)] Group: T=temperate; ST/T=subtropical/tropical; HM= highly migratory.
[(2)] Jurisdictions: 1=New England Fishery Management Council (NEFMC); 2=Mid-Atlantic Fishery Management Council (MAFMC); 3= South Atlantic Fishery Management Council (SAFMC); 4=Gulf of Mexico Fishery Management Council (GMFMC); 5=NMFS. Sources: NEFMC, 2007; GMFMC, 2007; MAFMC, 2007; NMFS, 2006a, 2007a; SAFMC, 2007a.

The South Atlantic Fishery Management Council (SAFMC) is adopting an ecosystem approach to fisheries management with development of a Fishery Ecosystem Plan to amend the Council's

fishery management and habitat plans (SAFMC, 2007b). The transition from single species management to ecosystem management would help define the complex relationships among humans, harvested fish, and prey in the South Atlantic Ecosystem. This effort would improve the understanding of the social and economic impacts of management and ecological consequences of conservation management (SAFMC, 2007b). It would also likely result in additional EFH areas and likely broaden areas currently designated as EFH.

3.9.2.3 Fishery Management Plans and Managed Species

Table 3.9-3 provides an overview of fishery management plans for federal waters in the JAX Range Complex. Species within federal waters of the Study Area fall primarily under the jurisdiction of two fishery management councils and one federal agency: SAFMC (jurisdiction is federal waters from North Carolina to eastern Florida at Key West), the Mid-Atlantic Fishery Management Council (MAFMC; jurisdiction is federal waters from New York to North Carolina), and NMFS (jurisdiction limited to HMS in federal waters off the U.S. Atlantic and the Gulf of Mexico). As noted in Table 3.9-3, many species are co-managed by more than one FMC and/or commission. The Atlantic States Marine Fisheries Commission (ASMFC), a consortium of the 15 coastal states from Florida through Maine, manages some species in state waters and works cooperatively with FMCs on management of some species in federal waters.

TABLE 3.9-3
FISHERY MANAGEMENT PLANS FOR FEDERAL WATERS AND MANAGED SPECIES IN THE JAX RANGE COMPLEX

Agency and Fishery Management Plan	Representative Species Expected to Occur in JAX Range Complex	Reference
National Marine Fisheries Service		
Consolidated Atlantic Highly Migratory Species FMP	**Billfish Management Unit** Blue marlin, longbill spearfish, sailfish, and white marlin **Tuna Management Unit** Bluefin tuna and yellowfin tuna **Swordfish Management Unit** Swordfish **Large Coastal Shark Management Unit** Blacktip, bull, great hammerhead, lemon, nurse, sandbar, scalloped hammerhead, silky, spinner, and tiger sharks **Small Coastal Shark Management Unit** Atlantic sharpnose, blacknose, bonnethead, and finetooth sharks **Pelagic Management Unit** Oceanic whitetip and sand tiger sharks **Prohibited Species Management Unit** Bignose, dusky, longfin mako, night, and white sharks	NMFS, 2007a

TABLE 3.9-3 (Continued)
FISHERY MANAGEMENT PLANS FOR FEDERAL WATERS AND MANAGED SPECIES IN THE JAX RANGE COMPLEX

Agency and Fishery Management Plan	Representative Species Expected to Occur in JAX Range Complex	Reference
Mid-Atlantic Fishery Management Council		
Bluefish FMP(1)	Bluefish	MAFMC, 2007
Spiny Dogfish FMP(2)	Spiny dogfish	MAFMC, 2007
Summer flounder, Scup and Black Sea Bass FMP(3)	Summer flounder	MAFMC, 2007
Tilefish FMP	Tilefish	MAFMC, 2007
South Atlantic Fishery Management Council		
Coastal Migratory Pelagics FMP(3)	King mackerel, Spanish mackerel, cero mackerel, cobia, and little tunny	SAFMC, 2007a
Coral and Live Bottom Habitat FMP	Coral belonging to the Class Hydrozoa (fire corals and hydrocorals); coral belonging to the Class Anthozoa, Subclass Hexacorallia, Orders Scleractinia (stony corals) and Antipatharia (black corals); seafans, *Gorgonia flabellum* or *G. ventalina*; coral in a coral reef, except for allowable octocoral; coral in an HAPC, including allowable octocoral; live rock – living marine organisms, or an assemblage thereof, attached to a hard substrate, including dead coral or rock (excluding individual mollusk shells)	SAFMC, 2007c
Dolphin and Wahoo FMP	Common dolphin, pompano dolphin, and wahoo	SAFMC, 2007d
Golden Crab FMP	Golden crab	SAFMC, 2007e
Red Drum FMP(4)	Red drum	SAFMC, 2007f
Shrimp FMP	White, pink, brown, royal red, and brown rock shrimp	SAFMC, 2007g
Snapper/Grouper Complex FMP	Includes 73 species consisting of snappers, groupers, porgys, triggerfish, jacks, tilefish, grunts, spadefish, wrasses, and sea basses	SAFMC, 2007h
Spiny lobster(3)	Spiny lobster and ridged slipper lobster	SAFMC, 2007
Calico Scallop FMP	Calico scallop	FFWCC, 2007
Sargassum FMP	*Sargassum natans* and *Sargassum fluitans*	SAFMC, 2007i

(1)Jointly managed by MAFMC and ASMFC.
(2)Jointly managed by the MAFMC (lead) and the NEFMC.
(3)Jointly managed by the SAFMC (lead) and the GMFMC.
(4)Jointly managed by the SAFMC and the ASMFC.

3.9.2.4 Habitat Areas of Particular Concern

Habitat Areas of Particular Concern (HAPC) are discrete subsets of EFH that provide extremely important ecological functions or are especially vulnerable to degradation. Regional FMCs may designate a specific habitat area as an HAPC based on one or more of the following reasons: (1) importance of the ecological function provided by the habitat, (2) the extent to which the habitat is sensitive to human-induced environmental degradation, (3) whether, and to what extent, development activities are, or will be, stressing the habitat type, and (4) rarity of the habitat type (NMFS, 2002). The HAPC designation does not confer additional protection or restrictions upon an area, but can help prioritize conservation efforts.

Table 3.9-4 summarizes existing HAPC in the JAX Range Complex. Coral, coral reef, and live/hardbottom HAPCs are shown in Figure 3.6-3. Mapping for other HAPCs are provided in the *Marine Resources Assessment for the Charleston and Jacksonville Operating Areas* (DoN, 2008). In response to research revealing the distribution, importance, and uniqueness of deepwater coral habitats in the South Atlantic, SAFMC has proposed establishment of four new deepwater coral HAPCs (Figure 3.6-3) (SAFMC, 2008). Portions of the largest proposed deepwater coral HAPC (Stetson Reef/Savannah and East Florida Lithoherms/Miami Terrace) are located within the JAX and Charleston OPAREAs. This proposed HAPC encompasses about 12,490 nm^2 within the JAX and Charleston OPAREAs west of the shelf break, in waters ranging from 300 to 1,100 m deep. Action to establish the new deepwater coral HAPCs will be taken through the Comprehensive Fishery Ecosystem Plan Amendment, which was under development as of October 2008 (SAFMC, 2008).

TABLE 3.9-4
SPECIES GROUPS WITH DESIGNATED
HABITAT AREAS OF PARTICULAR CONCERN IN THE STUDY AREA

Species Group	Essential Fish Habitat-Habitat Area of Particular Concern
Sargassum	The distribution of pelagic *Sargassum* in all U.S. state and federal waters within the EEZ under the jurisdiction of the SAFMC (includes entire water column).
Dolphin and wahoo, all lifestages	Charleston Bump (South Carolina) and Georgetown Hole (South Carolina) are designated HAPC in the OPAREAs. **Additional designated HAPC, which are not located in the OPAREAs are**: The Point (North Carolina); Ten Fathom Ledge (North Carolina); Big Rock (North Carolina); Amberjack Lump (Florida); the Hump off Islamorada (Florida); Marathon Hump (Florida); and the "Wall" off the Florida Keys.
Snapper-grouper MU (18 species), all lifestages	Medium to high profile, offshore, hard bottom habitat where spawning normally occurs (areas of known spawning aggregation); pelagic and benthic *Sargassum*; all hermatypic coral habitats and reefs; manganese outcroppings on the Blake Plateau; FMC-designated artificial reef Special management Zones; areas with fishing gear restrictions or harvest regulations; Charleston Bump (South Carolina); and Hoyt Hills for wreckfish are designated HAPC within the OPAREAs. **Additional designated HAPC, which are not located in the OPAREAs are**: seagrass habitat, mangrove habitat, oyster/shell habitat, all coastal inlets, all state-designated nursery habitats, nearshore hard bottom habitat (<4 m), the Point (NC); Ten Fathom Ledge (NC); Big Rock (NC), and the *Oculina* Bank HAPC.

TABLE 3.9-4 (Continued)
SPECIES GROUPS WITH DESIGNATED HABITAT AREAS OF PARTICULAR CONCERN IN THE STUDY AREA

Species Group	Essential Fish Habitat-Habitat Area of Particular Concern
Coastal migratory pelagic MU (cobia, king mackerel, and Spanish mackerel), all lifestages	Sandy shoals associated with Cape Fear, North Carolina from shore to the ends of the respective shoals but shoreward of the Gulf Stream; Charleston Bump (South Carolina); Hurl Rocks (South Carolina); and pelagic *Sargassum* have been designated as HAPC in the OPAREAs. **Additional designated HAPC, which are not located in the OPAREAs are**: sandy shoals associated with Cape Lookout and Cape Hatteras, North Carolina; the Point (North Carolina); Ten Fathom Ledge (North Carolina); Big Rock (North Carolina); the Point off Jupiter Inlet (Florida); *Phragmatopoma* (worm) reefs (central east-coast of Florida); nearshore hard bottom (<4 m) south of Cape Canaveral, Florida; the Hump off Islamorada, Florida; the Marathon Hump (Florida); the "Wall" off the Florida Keys; and Atlantic coast estuaries with high numbers of Spanish mackerel (Bogue Sound and New River, NC) and Cobia (Broad River, SC).
Coral, coral reef and live/hard bottom habitat	Areas designated as HAPC in the OPAREAs include the Charleston Bump (South Carolina), Hurl Rocks (South Carolina), and Gray's National Marine Sanctuary (Georgia) (see Figure 3.6-3). In addition, portions of the largest of the proposed deep-sea coral HAPC are located within the OPAREAs (see Figure 3.6-3). **Additional designated HAPC, which are not located in the OPAREAs are**: Ten Fathom Ledge (North Carolina), Big Rock (North Carolina), the Point (North Carolina), Oculina Bank, *Phragmatopoma* (worm) reefs (central east coast of Florida; south of OPAREA); nearshore hard bottom (<4 m) from Cape Canaveral, Florida to Broward County, Florida; offshore (5 to 30 m) hard bottom from Palm Beach County, Florida to Fowey Rocks, Florida; Biscayne Bay, Florida; Biscayne National Park, Florida; and the Florida Keys National Marine Sanctuary.
Note: The penaid shrimp MU, red drum, and spiny lobster have designated HAPC, however these are not located within the boundaries of the Study Area.	

SAFMC has also designated a series of eight deepwater marine protected areas in the South Atlantic region. The marine protected areas are designed to protect a portion of the long-lived, deepwater snapper grouper species and their habitat from directed fishing pressure (NMFS, 2008). Juvenile and adults of most snapper grouper species are demersal and associate with live/hard bottom that has moderate to high relief (*e.g.*, coral reef systems, artificial reef structures, rocky hard bottom substrates, and limestone outcroppings) (SAFMC and NMFS, 2006). Therefore, the proposed marine protected areas represent areas of important live/hard bottom habitat. Five of the proposed marine protected areas (from north to south; Northern South Carolina, Edisto, Charleston Deep Artificial Reef, Georgia, and North Florida) are located within the JAX and Charleston OPAREAs (Figure 3.6-3).

3.9.2.5 Endangered Species Act-Listed Fish Species

Shortnose Sturgeon

Status **-** The shortnose sturgeon was originally listed as an endangered species throughout its range under the Endangered Species Preservation Act of 1966 and remained on the endangered species list with the enactment of the ESA in 1973 (NMFS, 1998). Historically, the range of the shortnose sturgeon extended along the Atlantic coast from Saint John River, New Brunswick, Canada to Indian River, Florida (Gruchy and Parker, 1980). Currently, NMFS recognizes 19 distinct population segments of shortnose sturgeons inhabiting 25 river systems from Saint John River, New Brunswick, Canada, to St. Johns River, Florida. All populations from the Chesapeake Bay north are considered "northeast" while those south of the Chesapeake Bay are considered "southeast" population segments (NMFS, 1998). Distinct population segments in the vicinity of the Study Area include:

- Cape Fear – Cape Fear River, North Carolina.
- Winyah Bay - Waccamaw, Pee Dee, and Black Rivers, North and South Carolina.
- Santee – Santee River, South Carolina.
- Cooper – Cooper River, South Carolina.
- "ACE" Basin - Ashepoo, Combahee, and Edisto Rivers, South Carolina.
- Savannah - Savannah River, South Carolina and Georgia, and hatchery stocks.
- Ogeechee – Ogeechee River, Georgia.
- Altamaha – Altamaha River, Georgia.
- Satilla – Satilla River, Georgia.
- St. Mary's – St. Mary's River, Florida.
- St. Johns – St Johns River, Florida.

The Hudson River in New York supports the largest population of shortnose sturgeon, with an estimated population of 56,708 for 1994-1996 (Bain *et al*., 2000). The Savannah and Altamaha populations segments have large (greater than or equal to 1,000 fish) and improved populations, while the remaining southeast population segments are considered small (less than 100 fish) or very small (less than 100 fish), with unknown population trends (Center for Biological Diversity, 2007).

Habitat Preferences **-** Shortnose sturgeons inhabit rivers and estuaries, occasionally moving short distances to the mouths of estuaries and nearby coastal waters, with populations confined mostly to natal rivers and estuarine habitats. The species appears to be estuarine anadromous in the southern part of its range, but in some northern rivers it is "freshwater amphidromous" (adults spawn in freshwater but regularly enter saltwater habitats during their life) (NMFS, 1998). In estuarine systems, the shortnose sturgeon occurs in areas with little or no current over a bottom composed primarily of mud and sand. Sturgeons prefer freshwater swamps or areas with fast flows and gravel cobble bottoms in the riverine areas (Gilbert, 1992). Adults are found in deep water (10 to 30 m) in winter and in shallow water (2 to 10 m) in summer. Juveniles are nonmigratory, typically inhabiting deep channels of swiftly flowing river above the salt wedge (Burkhead and Jenkins, 1991). Shortnose sturgeons are not known to participate in coastal migrations (NMFS, 1998).

Occurrence in the JAX Study Area **-** Based on information presented above, the shortnose sturgeon is not expected to occur in the Atlantic Ocean portion of the JAX Study Area.

Information regarding occurrence of the shortnose sturgeon in the St. John River system and Lake George is provided in Section 3.11.

Smalltooth Sawfish

The smalltooth sawfish is an elasmobranch species (cartilaginous skeleton; sharks, skates, rays) that gets its name from its long, flat snout or rostrum (~25% of body length) edged with 24 to 34 sharp teeth. It has a brownish flattened body and wing-like pectoral fins. This species typically is 5.5 m in length but has been recorded to reach up to 7.6 m in length (Passarelli and Curtis, 1999; Simpfendorfer, 2002, 2005). The smalltooth sawfish uses its saw for obtaining prey, either by stirring up the substrate to expose benthic crustaceans or by stunning and slashing schooling fishes (*e.g.*, mullet and herring) (SSSRT, 2000; Schultz, 2004).

Status **-** The distinct population segment of smalltooth sawfish in the United States was designated as endangered by the NMFS on April 1, 2003 and by the USFWS on November 16, 2005 from Florida to Cape Hatteras, North Carolina (NMFS, 2003; USFWS, 2005). It is the first elasmobranch species to have this status. Critical habitat has not yet been designated for the smalltooth sawfish. However, NMFS anticipates proposing critical habitat for this species by March 2009 and designating critical habitat by September 2009 (Norton, 2008). Proposed critical habitat for the smalltooth sawfish is expected to be limited to portions of Florida that are outside of the Study Area. Habitat degradation and loss, such as loss of wetlands, eutrophication, point and non-point pollution, increased sedimentation and turbidity, and hydrologic modifications, are considered the primary factors contributing to the endangered status of this species. Entanglements in commercial and recreational fishing gear, incidental take as by catch in various fisheries (especially gill nets), low productivity (*i.e.*, low fecundity and long maturation rate), and the market for rostral saws sold as curios or in Asian markets for medicinal purposes have also contributed to this species' decline (Musick *et al*., 2000; Seitz and Poulakis, 2006). It is believed that the current population is less than five percent of its historical size (Simpfendorfer and Wiley, 2006).

Habitat Preferences **-** The smalltooth sawfish commonly inhabits shallow subtropical-tropical estuarine and marine waters but can also be found utilizing freshwater habitats in large rivers (*e.g.*, Mississippi and St. Johns River) (Simfendorfer, 2002; Schultz, 2004). It prefers remaining close to the bottom in deep holes of sand or muddy sand and has also been reported utilizing habitats consisting of limestone hard bottom, coral reefs, and sponge bottoms (Poulakis and Seitz, 2004; Schultz, 2004). There is a correlation between the distance from shore and depth with the size for this species, with smaller individuals typically utilizing habitats close to shore (water <1 m deep) in areas with inshore bars, mangroves, and seagrass beds possibly to avoid predation by sharks, while larger individuals inhabit deeper waters commonly greater than 70 m but up to 122 m deep (Poulakis and Seitz, 2004; NMFS, 2003; Simpfendorfer, 2005, 2006; Simpfendorfer and Wiley, 2005a, 2005b, 2006). However, recent tagging studies indicate that adults (*i.e.*, larger individuals) spend more time in shallow water than previously suspected and are only occasionally found in deeper waters (Simpfendorfer and Wiley, 2005a). This species also associates with sea fans, artificial reefs, and oil rigs (Poulakis and Seitz, 2004). Nursery areas are located in shallow nearshore regions and estuaries, especially in areas with mangroves (Seitz and Poulakis, 2002; NMFS, 2003, 2006; Simpfendorfer and Wiley, 2005b).

Distribution **-** This species, historically, has ranged throughout the Pacific, Indian, and Atlantic oceans, including the Mediterranean Sea, the Caribbean Sea, Bermuda, and the Gulf of Mexico (Passarelli and Curtis, 1999). In the western Atlantic, it was distributed from New York to Brazil.

It was considered a year-round resident off Florida and only found in higher latitudes seasonally (Schultz, 2004). Historic records indicate that this species use to undertake seasonal migrations northward along the Atlantic coast during the summer months. However, due to the lack of encounters north of Florida, it is believed that migration is no longer occurring (Simpfendorfer and Wiley, 2006). Currently, the only remaining population in U.S. waters exists off southern Florida with the center of distribution being the Everglades National Park, including Florida Bay. The smalltooth sawfish population in U.S. waters is considered isolated from other populations making it a distinct population segment (NMFS, 2003).

Occurrence in the JAX Study Area - The current smalltooth sawfish population extends from St. Johns County on the east coast of Florida through the Florida Keys and northward to Pinellas County on the western coast of Florida, north of Tampa Bay. Though, there have been a few encounters north of this region. The Mote Marine Laboratory Sawfish Encounter Database, as of April 2005, had 593 verified smalltooth sawfish encounters (MML, 2005; Simpfendorfer and Wiley, 2005a). Only two encounters have been recorded within the boundaries of the JAX and Charleston OPAREAs (*i.e.*, off Georgia [along Georgia/South Carolina border] and south of Daytona Beach, Florida) and four within the vicinity of JAX OPAREA (*i.e.*, Florida state waters) (MML, 2005; Simpfendorfer and Wiley, 2005a). The individual recorded off Georgia was an adult (~ 4.0 m length) caught by a bottom longline vessel in greater than 60 m depth (Simpfendorfer and Wiley, 2006; NMFS, 2006b). This individual was encountered in 2002 (NMFS, 2006b). Most of the Florida's east coast encounters occur south of 27.2°N outside the JAX OPAREA. Within the OPAREAs and vicinity, sightings range from Charleston, South Carolina to just north of Cape Canaveral, Florida primarily in state waters off Florida (Simpfendorfer and Wiley, 2005b). It is considered rare that the smalltooth sawfish could be found within the boundaries of the OPAREAs, while it is more likely that an encounter would occur in Florida state waters adjacent to the JAX OPAREA's western boundary (MML, 2005; Simpfendorfer, 2006) (Figure 3.9-1).

Candidate Species

"Candidate species" refers to (1) species that are the subject of a petition to list under the ESA and for which NMFS determined that listing may be warranted, and (2) species that are not the subject of a petition but for which NMFS has announced the initiation of a status review in the *Federal Register*. In other words, any species undergoing a status review announced by the NMFS in a *Federal Register* notice will be considered a candidate species. Initiation of a status review does not mean an ESA listing is imminent. Even after a status review has been conducted, it is possible the available information would be insufficient to make a determination on the status of the species or that the information would indicate an ESA listing is not warranted. Candidate species do not carry any procedural or substantive protections under the ESA and Section 7 consultation requirements do not apply. One candidate species, the Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) may occur in the Study Area.

The Atlantic sturgeon is found along the Atlantic coast from Labrador, Canada, to the St Johns River, Florida. It is anadromous (migrates from the ocean into coastal estuaries and rivers to spawn), lives approximately 60 years, and reaches sexual maturity between years five and 34 years (NMFS, 2007b). Atlantic sturgeon feed on benthic invertebrates, mussels, worms, and shrimp. First identified as a species of concern in 1988, its status was reviewed in 1998 and found not to

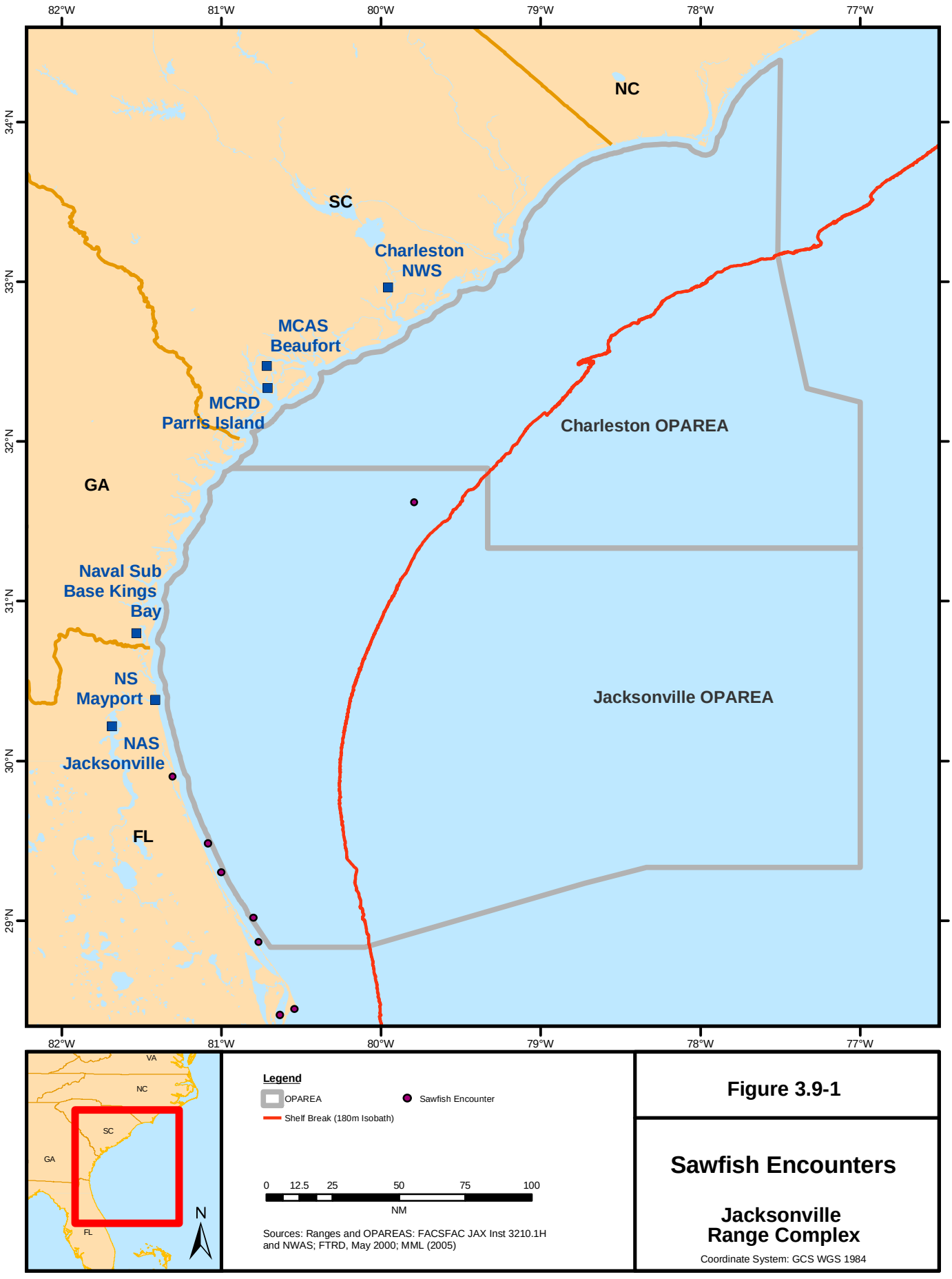


Figure 3.9-1

Sawfish Encounters

Jacksonville Range Complex

Coordinate System: GCS WGS 1984

warrant listing at that time; although, a country-wide moratorium on fishing was ordered by the federal government in 1998. Reasons for its decline are fishing (harvesting for flesh and eggs [caviar]), estuarine and freshwater habitat degradation, and locks and dams. The Atlantic sturgeon is managed under the ASMFC Fishery Management Plan, and rebuilding of stock is estimated to take 20 to 40 years (ASMFC, 2007). A second review is currently underway to consider ESA listing (NMFS, 2007b).

Species of Concern

"Species of concern" are those species about which NMFS has concern regarding status and threats, but for which insufficient information is available to indicate a need to list the species under ESA. Species of concern do not carry any procedural or substantive protections under the

ESA and Section 7 consultation requirements do not apply. Species of concern status serves to promote conservation and research efforts for these species. The following species of concern potentially occur in the Study Area: barndoor skate (*Dipturus laevis*), blueback herring (*Alosa aestivalis*), dusky shark (*Carcharhinus obscurus*), mangrove rivulus (*Rivulus marmoratus*), Nassau grouper (*Epinephelus striatus*), night shark (*Carcharinus signatus*), opossum pipefish (*Microphis brachyurus lineatus*), sand tiger shark (*Carcharias taurus*), speckled hind (*Epinephelus drummondhayi*), striped croaker (*Bairdiella sanctaeluciae*), thorny skate (*Amblyraja radiata*), and Warsaw grouper (*Epinephelus nigritus*) (NMFS, 2007c).

3.9.3 Environmental Consequences

3.9.3.1 No Action Alternative

Vessel Movements

Effects on Essential Fish Habitat

Ongoing and proposed operations within the Study Area involve maneuvers by various types of surface ships, boats, and submarines. The number of Navy ships operating in the Study Area varies based on training schedules and can range up to 10 ships. Operations involving vessel movements occur intermittently and are short in duration, ranging from a few hours up to a few weeks. These operations are widely dispersed throughout the 50,090 nm^2 Study Area. The Navy would log about 1,000 total steaming days within the Study Area during a typical year under the No Action Alternative.

Vessel movements would have no effect on benthic or artificial habitats because Navy vessels are operated in relatively deep waters and have navigational capabilities to avoid contact with these habitats. Vessel movements would result in short-term, localized disturbances to water column and *Sargassum* habitats. Impacts to *Sargassum* habitats would be avoided and minimized by mitigation measures (Chapter 5). Impacts to EFH would be temporary and minimal. Vessel movements would not reduce the quality and/or quantity of EFH in the Study Area.

Disturbance to Fish

Studies documenting behavioral responses of fish to vessels show that fish may exhibit avoidance responses to engine sound, sonar, depth finders, and fish finders (Jorgensen *et al.,* 2004; Acoustic Ecology, 2007). Avoidance reactions are quite variable depending on the type of fish, its life history stage, behavior, time of day, and, the sound propagation characteristics of the water (Schwartz, 1985). Misund (1997) found that fish ahead of a ship, that showed avoidance reactions,

did so at ranges of 160 to 490 ft. When the vessel passed over them, some species of fish responded with sudden escape responses that included lateral avoidance and/or downward compression of the school.

The low frequency sounds of large vessels or accelerating small vessels caused avoidance responses among herring (Chapman and Hawkins, 1973). Avoidance ended within 10 seconds after the vessel departed. Twenty five percent of the fish groups habituated to the sound of the large vessel and 75 percent of the responsive fish groups habituated to the sound of small boats.

Vessel movements under the No Action Alternative would expose fish to general disturbance, which could result in short-term behavioral and/or physiological responses (*e.g.,* swimming away and increased heart rate). Such responses would not be expected to compromise the general health or condition of individual fish.

Collisions with Fish

The probability of collisions between vessels and adult or juvenile fish, which could result in injury or mortality, would be extremely low because these life stages are highly mobile and Navy vessel density in the Study Area is low. Ichthyoplankton (fish eggs and larvae) in the upper portions of the water column could be displaced, injured, or killed by vessel and propeller movements. However, no measurable effects on fish recruitment would occur because the number of eggs and larvae exposed to vessel movements would be low relative to total ichthyoplankton biomass. Navy mitigation measures (see Chapter 5), which include avoidance of large *Sargassum* mats where some fish species tend to concentrate, further reduce the probability of injury or mortality.

In accordance with NEPA, vessel movements in territorial waters under the No Action Alternative would have no significant impact on fish populations or habitat. Furthermore, vessel movements in non-territorial waters would not cause significant harm to fish populations or habitat in accordance with EO 12114.

Aircraft Overflights

Effects on Essential Fish Habitat

As discussed in Section 3.7.3.3, aircraft overflights in the Study Area would produce intermittent airborne noise and some of this sound energy would be transmitted into the water. Based on the analysis presented in Section 3.7.3.3, aircraft overflights could increase ambient sound levels in the water column and possibly in shallow water benthic habitats. However, most fixed-wing overflights occur at 5,000 to 30,000 ft and low-altitude flights are infrequent. Furthermore, any increased sound levels in the water column would be short-term (a few seconds as the aircraft passes) and localized (a narrow cone under the aircraft). The downdraft from low altitude helicopter overflights could also result in short-term, localized disturbance to the water surface. Impacts from aircraft overflights to EFH would be temporary and minimal. Aircraft overflights would not reduce the quality and/or quantity of EFH in the Study Area.

Effects on Fish

Some species of fish could respond to noise associated with low-altitude aircraft overflights or to the surface disturbance created by downdrafts from helicopters. However, studies indicate that hearing specializations in marine fish are quite rare and that most marine fish are considered hearing generalists (Popper, 2008; Popper, 2003; Amoser and Ladich, 2005). Generalists are limited to detection of the particle motion component of low frequency sounds at relatively high

sound intensities (Amoser and Ladich, 2005). As such, it is possible that many species of fish would not hear or respond to noise associated with most aircraft overflights. If fish were to respond to aircraft overflights, only short-term behavioral and/or physiological reactions (*e.g.*, swimming away and increased heart rate) would be expected. Such responses would not compromise the general health or condition of individual fish. In accordance with NEPA, aircraft overflights over territorial waters under the No Action Alternative would have no significant impact on fish populations or habitat. Furthermore, aircraft overflights over non-territorial waters would not cause significant harm to fish populations or habitat in accordance with EO 12114.

Towed Mine Warfare Devices

Effects on Essential Fish Habitat

As described in Chapter 2 and Appendix D, Mine Warfare Exercises conducted in the Study Area include the use of various underwater mine detection and countermeasures systems that are towed through the water by helicopters flying approximately 75 ft above the water at low airspeeds. Seventy-eight towed Mine Warfare device sorties would be conducted in Amber Strait and Kaiser Carrier Operating Area (Figure 2.2-1) under the No Action Alternative.

The use of towed Mine Warfare devices would result in short-term and localized disturbance to the water column, but benthic habitats would not be affected because these devices are not towed on the bottom and the training areas are located in deep waters (about 30 to 800 m). *Sargassum* mats are likely to occur in the training areas based on their proximity to the Gulf Stream and the western frontal boundary of the Gulf Stream. While towed Mine Warfare devices could result in short-term and localized disturbances to *Sargassum* habitats, Navy mitigation measures specify that the crew monitor for *Sargassum* rafts prior to and during the exercise. Visible *Sargassum* would be avoided to prevent fouling of the towed devices. Air crews operating the helicopters are expected to be able to see and avoid most *Sargassum* mats based on the relatively low flight altitude and low airspeeds. Therefore, any disturbance to *Sargassum* would be limited to very small patches that are not visible to the air crew. Impacts to EFH would be temporary and minimal. Use of towed Mine Warfare devices would not reduce the quality and/or quantity of EFH in the Study Area.

Effects on Fish

The probability of collisions between towed Mine Warfare devices and adult or juvenile fish, which could result in injury or mortality, would be extremely low because these life stages are highly mobile. Ichthyoplankton (fish eggs and larvae) in the upper portions of the water column could be displaced, injured, or killed by towed Mine Warfare devices. However, no measurable effects on fish recruitment would occur because the number of eggs and larvae exposed to towed Mine Warfare devices would be low relative to total ichthyoplankton biomass. In accordance with EO 12114, towed Mine Warfare device use in non-territorial waters under the No Action Alternative would not cause significant harm to fish populations or habitat. Towed Mine Warfare devices would not be used in territorial waters under the No Action Alternative.

Mine Warfare Training

The No Action Alternative does not include establishment of Mine Warfare Training Areas.

Non-Explosive Practice Munitions

Effects on Essential Fish Habitat

Current Navy operations in the Study Area include firing a variety of weapons and employ a variety of NEPM, including bombs, missiles, naval gun shells, cannon shells, and small caliber ammunition. NEPM use occurs in several training areas, but it is not used in state waters (0 to 3 nm from shore) (see Table 2.2-6 for a summary of ordnance use by training area).

Disturbances to water column habitats from NEPM strikes would be short-term and localized. Navy mitigation measures require avoidance of *Sargassum*; therefore impacts to these habitats would be minimal. The potential for NEPM strikes to adversely affect benthic communities depends on several factors, including the size and speed of the ordnance, water depth, the number of rounds delivered, the frequency of training, and the presence/absence of sensitive benthic communities. As described in Section 3.6.2.2, both soft bottom and hard bottom communities occur in the Study Area. While a broad area of soft and hard bottom benthic habitat could be exposed to direct ordnance strikes, the training exercises are intermittent and widely dispersed, which decreases the likelihood that a given area would be subjected to repeated exposure. Most ordnance firing occurs in areas greater than 12 nm offshore in waters ranging from about 15 m deep to over 900 m deep. NEPM velocity would rapidly decrease upon contact with the water and as it travels through the water column. Consequently, NEPM strikes would cause little or no physical damage to soft bottom benthic habitat and any damage would be localized.

Live hard bottom habitats would be vulnerable to damage from NEPM strikes. This is particularly true for areas that support coral because coral is fragile and could be easily broken by contact with larger objects such as non-explosive practice bombs. Repopulation and recovery of damaged hard bottom habitats would be relatively slow (*e.g.*, years to a decade or more) compared to soft bottom areas (*e.g.*, less than one year) (NRC, 2002).

Large, heavy items such as non-explosive practice bombs, missiles, and naval gun shells (Table 3.9-5) could cause damage if they struck sensitive hard bottom habitat. Small caliber ammunition has little potential to disturb the bottom because these materials are relatively small and light, and their velocity would decrease through the water column. A total of 360 non-explosive practice bombs would be dropped per year under the No Action Alternative; 180 per year in W-157A/B (10,423 nm^2) and 180 per year in W-158A/B (8,597 nm^2). Assuming an even distribution within each area, the relative concentration of non-explosive practice bombs would be 1.7 per 100 nm^2/year in W-157A/B and 2.1 per 100 nm^2/year in W-158A/B. Actual concentrations would vary based on specific training scenarios, but would nonetheless be extremely low. Non-explosive practice missiles use (14 per year for No Action Alternative) would be widely dispersed in W-132, w-133, W-134, W-157, and W-158A total of 14 non-explosive practice. A total of 2,174 non-explosive naval gun shells (5 in and 76 mm) would be fired per year in under the No Action Alternative in Surface Gunnery Areas AA, BB, and CC.

The maximum area of benthic habitat affected by non-explosive practice bomb, missile, and naval gun shell strikes would be approximately 7,151 ft^2 (0.00019 nm^2) per year or 71,510 ft^2 (0.00195 nm^2) over a ten-year period for the No Action Alternative, assuming that the area affected by a single NEPM would be two time its footprint (Table 3.9-6).

TABLE 3.9-5
SIZE OF NON-EXPLOSIVE PRACTICE BOMBS, MISSILES, AND NAVAL GUN SHELLS USED IN THE OPAREAS

NEPM Type	Weight (pounds)	Length (inches)	Diameter (inches)	Footprint (ft^2)[1]
BDU-45	500	66	11	5.0
MK-76	25	25	4	0.7
MK-20 Rockeye Cluster (each dispenses 247 bomblets)	1.32 (per bomblet)	6.5 (per bomblet)	2 (per bomblet)	22.3 (total per bomb)
MK-83(I)[1]	1,000	119	14	11.6
AIM-7	500	144	8	8
AIM-9	190	113	5	3.9
AIM-120	350	144	7	7
5 in	70	26	5	0.9
76 mm	14	14	3	0.3

[1]Footprint = length x diameter.

TABLE 3.9-6
ESTIMATES OF MARINE BENTHIC HABITAT THAT WOULD BE AFFECTED BY NON-EXPLOSIVE PRACTICE BOMBS, MISSILES, AND NAVAL GUN SHELLS IN THE OPAREAS

NEPM Type	No Action Alternative		Alternative 1		Alternative 2	
	#/Yr	Area Affected/Yr (ft^2)[1]	#/Yr	Area Affected/Yr (ft^2)[1]	#/Yr	Area Affected/Yr (ft^2)[1]
Non-Explosive Practice Bombs – W-157A/B and W-158A/B						
BDU-45	180	1,822	180	1,822	360	3,643
MK-76	129	179	129	179	129	179
MK-20	51	2,274	51	2,274	51	2,274
MK-83(I)	0	0	0	0	12	278
Subtotal =	360	4,275	360	4,275	552	6,374
Non-Explosive Practice Missiles (Air-to-Air) – W-132, W-133, W-134, W-157, and W-158						
AIM-7	5	80	5	80	5	80
AIM-9	4	31	5	39	5	39
AIM-120	5	70	5	70	5	70
Subtotal =	14	181	15	189	15	189
Non-Explosive Practice Naval Gun Shells – Surface Gunnery Areas AA, BB, and CC						
5 in	1,135	2,049	1,220	2,203	1,220	2,203
76 mm	1,039	646	1,152	716	1,152	716
Subtotal =	2,174	2,695	2,372	2,919	2,372	2,919
Total =		7,151		7,383		9,482

[1]Assumed that the area of marine benthic habitat affected per year = footprint x 2 x #/yr.

As shown in Figures 3.6-1 through 3.6-4, live hard bottom and artificial habitats are found in portions of the areas where non-explosive practice bombs, missiles, and naval gun shells would be used, including hard bottom EFH, a proposed deepwater coral HAPC, and a designated deepwater snapper grouper marine protected area. The probability of non-explosive practice bombs, missiles, and naval gun shells striking artificial habitats would be low because these resources occupy a relatively small area and most are located relatively close to shore, outside of the training areas

where these munitions are used. The probability of a strike in the designated snapper grouper marine protected area would also be low because it covers a relatively small area within W-157A.

Based on the distribution of hard bottom EFH (Figure 3.6-2) and proposed deepwater coral HAPC (Figure 3.6-3), it is expected that some non-explosive practice bombs, missiles, and naval gun shells would strike in these areas. The potential for strikes to adversely affect benthic communities in these areas would depend on the substrate and community types found at the point of physical impact. Given the dispersed nature of the training activities, often patchy distribution of community types, and relatively limited bottom mapping data, it is not possible to accurately determine the number of non-explosive practice bombs, missiles, and naval gun shells that would strike soft bottom habitats versus more sensitive areas such as live hard bottom or coral mounds. Nonetheless, the total area of benthic habitat affected by non-explosive practice bomb, missile, and naval gun shell strikes would be small (about 7,151 ft^2 per year) and only a percentage (less than 7,151 ft^2 per year) of the total area affected would be sensitive benthic habitat such as live hard bottom or coral mounds. Based on geographic information system data obtained through SAFMC, the Study Area contains about 18,919 nm^2 of live hard bottom EFH. The total benthic habitat affected represents less than 0.000001 percent of the total live hard bottom EFH in the Study Area.

Non-explosive practice bomb, missile, and naval gun shell strikes could result in long-term, minor effects to benthic EFH, but the effects would be localized and no long-term changes to community structure or function would be expected. Impacts to benthic EFH would be minimal based on the relatively small area affected by non-explosive practice bombs, missile, and naval gun shell. Given the small area affected, NEPM use under the No Action Alternative would not reduce the quality and/or quantity of EFH in the Study Area.

Effects on Fish

NEPM and associated shrapnel have the potential to directly strike fish as it travels through the water column. NEPM could also generate physical shock entering the water, but would not explode. Shock waves could cause behavioral reactions or physical injury. Fish at the surface would be most susceptible to injury from strikes because NEPM velocity would rapidly decrease upon contact with the water and as it travels through the water column. Navy mitigation measures, which include avoidance of large *Sargassum* mats where some fish tend to concentrate, further reduce the probability of NEPM-related injury or mortality. As discussed in Section 3.7.3 and 3.8.3, statistical modeling conducted for the JAX Study Area indicates that the probability of NEPM striking marine mammals and sea turtles is extremely low. Statistical modeling could not be conducted to estimate the probability of NEPM/fish strikes because fish density data are not available. A possibility exists that a small number of fish at or near the surface may be directly impacted if they are in the target area and near the point of physical impact at the time of NEPM delivery, but population-level effects would not occur.

Weapons firing could have acoustic effects from: 1) sound generated by firing the gun (muzzle blast), 2) vibration from the blast propagating through the ship's hull, and 3) sonic-booms generated by the shell flying through the air.

Firing a deck gun produces a shock wave in air that propagates away from the muzzle in all directions, including toward the air/water surface. Direct measurements of shock wave pressures transferred through the air/water interface from the muzzle blast of a 5-inch gun are well below levels known to be harmful at shallow depths (DoN, 2000a; Yagla and Stiegler, 2003). Sound

produced during gunfire may disturb fish in the vicinity of the ship. Because the sound is brief, no extended disruption of fish behavior is expected.

Gun fire sends energy through the ship structure, into the water, and away from the ship. This effect was also investigated in conjunction with the measurement of 5-inch gun blasts described above (DoN, 2000a; Yagla and Stiegler, 2003). The energy transmitted through the ship to the water for a typical round was found to be about 6 percent of that from the air blast impinging on the water. Therefore, sound transmitted from the gun, through the hull into the water should have negligible impact on marine life.

The sound generated by a shell in its flight at supersonic speeds above the water is transmitted into the water in much the same way as a muzzle blast (Pater, 1981). The region of underwater sound influence from a single traveling shell is relatively small, diminishes quickly as the shell gains altitude, and is of short duration. The penetration of sound through the air\water interface is relatively limited (Miller, 1991; Yagla and Stiegler, 2003). Studies reviewed in DoN (2007) indicate only a small number of submerged species would be exposed to the pressure waves from sonic booms from 5-inch shells fired during routine training exercises. The potential exists for energy from multiple sonic booms to accumulate over time from multiple, possibly rapid firings of a gun. However, because the area directly below the shells' path, where the conditions are correct for energy to enter the ocean is small, it is highly unlikely that the energy from more than two or three shells would be additive.

In accordance with NEPA, NEPM use in territorial waters under the No Action Alternative would have no significant impact on fish populations or habitat. Furthermore, NEPM use in non-territorial waters would not cause significant harm to fish populations or habitat in accordance with EO 12114.

Underwater Detonations and High Explosive Ordnance

Overview

Explosions that occur in the OPAREAs are associated with training exercises that use HE ordnance, including bombs (BOMBEX), missiles (MISSILEX), and naval gun shells (FIREX with IMPASS, 5-inch HE rounds), and Small Arms (anti-swimmer grenades, 8 oz HE), as well as underwater detonations associated with Mine Neutralization training (MINEX). Underwater detonation and HE ordnance use is limited to specific training areas (see Table 2.2-7 for a summary of explosions by training area) and does not occur in state waters (0 to 3 nm from shore). Potential effects to fish and EFH from underwater explosions include: habitat disturbance; disturbance, injury, or death from the shock (pressure) wave; acoustic effects; and indirect effects including those on prey species and other components of the food web.

Habitat Disturbance and Essential Fish Habitat

The underwater detonation of explosives can result in physical alteration of fish habitats (Wright and Hopky, 1998). As discussed above in Section 3.9.2, EFH has been designated for various federally managed species in training areas where underwater detonations and HE ordnance use occurs. All underwater detonations and HE ordnance use would result in disturbance to water column habitats, some of which could be designated as EFH for spawning adults. However, water column disturbances would be short-term and localized, and associated effects to EFH would be considered temporary and minimal.

A primary concern is the potential for explosions to affect live hard bottom, coral reefs, artificial reefs, and shipwrecks, because these resources provide shelter and habitat for a wide variety of marine life and dense aggregations of fish (Cahoon *et al.,* 1990; Thompson *et al.,* 1999). Mine Neutralization exercises conducted under the No Action Alternative in the North and South UNDET Boxes would include underwater detonations set on or near the sea floor, as well as in the water column. The amount of known hard bottom habitat in the UNDET Boxes is limited (Figure 3.6-1) and occurrence of artificial habitats is limited to the outer edge of the UNDET Boxes (Figure 3.6-3). The Navy does not set underwater explosive charges associated with Mine Neutralization exercises within 1,000 ft of known live/hard bottom, artificial reefs, and shipwrecks (see Section 5.7.13 for detailed description of Navy mitigation measures involving underwater detonations). Therefore, only unconsolidated, soft bottom and water column habitats would be exposed to impacts from underwater detonations associated with Mine Neutralization exercises.

Cratering of soft bottom habitats would result from Mine Neutralization charges set on or near the bottom. For a specific size of explosive charge, crater depths and widths would vary depending on depth of the charge and sediment type, but crater dimensions generally decrease as bottom depth increases. A 20-lb NEW charge detonated on the bottom can create depressions in the substrate up to 4 to 5 feet in diameter (12.6 to 19.6 ft^2) and 1 foot deep (DoN, 2000b). Assuming a worst –case scenario where all 18 20-lb charges were detonated directly on the bottom, up to 227 to 253 ft^2 of soft bottom benthic habitat could be disturbed by underwater detonations per year under the No Action Alternative. Crater effects are usually temporary in sand and mud bottoms. Short-term (a few hours) increases in turbidity, resuspension of bottom sediments, and localized mortality of benthic organisms and plankton would be expected. Repopulation of displaced sediments should be relatively rapid (less than one year) compared to hard bottom areas (years to decades or more) (NRC, 2002). The effects to EFH from Mine Neutralization underwater detonations would be considered minimal based on the relatively small area affected. The effects would also be considered temporary based on the relatively rapid (less than one year)recovery of soft bottom habitats and associated benthic communities.

Explosions associated with BOMBEX, MISSILEX, FIREX with IMPASS, and Small Arms (anti-swimmer grenades) occur at or near the water's surface in areas where depths range from 20 m to over 900 m. Of the ordnance types used during these exercises under the No Action Alternative, the MK-84 HE bomb has the highest net explosive weight (NEW) (944.7 lbs). Using the equation presented in Swisdak (1978), the maximum radius of the gas bubble produced by a MK-84 HE bomb explosion would be about 11.9 m (39 ft). The gas bubble would not extend to the sea floor based on the minimum water depth (20 m) and a detonation depth of 1 m below the surface. Likewise, the gas bubbles produced by other ordnance types used in BOMBEX, MISSILEX, FIREX with IMPASS, and Small Arms would not extend to the bottom because they have smaller NEWs. Therefore, explosions during these exercises are not expected to result in disturbance to benthic or artificial habitats because detonations would occur near the surface in deep waters. Effects of explosions on *Sargassum* habitats would be minimal because Navy mitigation measures specify that HE ordnance is not targeted to impact near observed *Sargassum* mats.

In summary, underwater detonations and HE ordnance use under the No Action Alternative would result in short-term and localized disturbances to water column habitats, some of which could be designated as EFH for spawning adults. Underwater detonations associated with Mine Neutralization training would disturb soft bottom benthic habitats, but the effects would be minimal and temporary. Underwater detonations and HE ordnance use are not expected to have

adverse effects on, coral, coral reefs, live, or hard bottom EFH or HAPC; proposed deepwater coral HAPC; designated deepwater snapper grouper marine protected areas; or artificial habitats. Navy mitigation measures further reduce the potential for these resources and *Sargassum* habitats to be affected by explosions. Impacts to EFH from underwater detonations and HE ordnance would be temporary and/or minimal. Underwater detonations and HE ordnance use under the No Action Alternative would not reduce the quantity or quality of EFH in the Study Area. In accordance with NEPA, underwater detonations and HE ordnance use in territorial waters under the No Action Alternative would not result in significant impacts to fish habitat. In accordance with EO 12114, underwater detonations and HE ordnance use in non-territorial waters would not cause significant harm to fish habitat.

Pressure Effects and Acoustic Effects

An underwater explosion generates a shock wave that produces a sudden, intense change in local pressure as it passes through the water (DoN, 1998, 2001). Pressure waves extend to a greater distance than other forms of energy produced by the explosion (*i.e.*, heat and light) and are therefore the most likely source of negative effects to marine life from underwater explosions (Craig, 2001; SIO, 2005; DoN, 2006).

The shock wave from an underwater explosion is lethal to fish at close range, causing massive organ and tissue damage and internal bleeding (Keevin and Hempen, 1997). At greater distance from the detonation point, the extent of mortality or injury depends on a number of factors including fish size, body shape, orientation, and species (Wright, 1982; Keevin and Hempen, 1997). At the same distance from the source, larger fish are generally less susceptible to death or injury, elongated forms that are round in cross-section are less at risk than deep-bodied forms, and fish oriented sideways to the blast suffer the greatest impact (Yelverton *et al.,* 1975; Wiley *et al.,* 1981; O'Keefe and Young, 1984a,b; Edds-Walton and Finneran, 2006). Species with gas-filled organs have higher mortality than those without them (Goertner *et al.,* 1994; CSA, 2004).

Two aspects of the shock wave appear most responsible for injury and death to fish: the received peak pressure and the time required for the pressure to rise and decay (Dzwilewski and Fenton, 2003). Higher peak pressure and abrupt rise and decay times are more likely to cause acute pathological effects (Wright and Hopky, 1998). Rapidly oscillating pressure waves might rupture the kidney, liver, spleen, and sinus and cause venous hemorrhaging (Keevin and Hempen, 1997). They can also generate bubbles in blood and other tissues, possibly causing embolism damage (Ketten, 1998). Oscillating pressure waves might also burst gas-containing organs. The swim bladder, the gas-filled organ used by many pelagic fish to control buoyancy, is the primary site of damage from explosives (Yelverton *et al.,* 1975; Wright, 1982). Gas-filled fish swim bladders resonate at different frequencies than surrounding tissue and can be torn by rapid oscillation between high- and low-pressure waves. Swim bladders are a characteristic of bony fishes and are not present in sharks and rays. However, hemorrhaging of the liver in sharks exposed to the shock waves from explosives could have deleterious effects on the buoyancy function provided by the livers of these species (Edds-Walton and Finneran, 2006). Delayed lethality could result from the accumulation of sub-lethal injuries (DoN, 2001).

Studies that have documented fish killed during planned underwater explosions indicate that most fish that die do so within one to four hours, and almost all die within a day (Hubbs and Rechnizer, 1952; Yelverton *et al.,* 1975). Fitch and Young (1948) found that the type of fish killed changed when blasting was repeated at the same marine location within 24 hours of previous blasting. They

observed that most fish killed on the second day were scavengers, presumably attracted by the victims of the previous day's blasts. However, fishes collected during these types of studies have mostly been recovered floating on the waters surface. Gitschlag *et al.* (2000) collected both floating fish and those that were sinking or lying on the bottom after explosive removal of nine oil platforms in the northern Gulf of Mexico. They found that 3 to 87 percent (46% average) of the specimens killed during a blast might float to the surface. Other impediments to accurately characterizing the magnitude of fish mortality included currents and winds that transported floating fishes out of the sampling area and predation by seabirds or other fishes.

There have been few studies of the impact of underwater explosions on early life stages of fishes (eggs, larvae, juveniles). Fitch and Young (1948) reported the demise of larval anchovies exposed to underwater blasts off California, and Nix and Chapman (1985) found that anchovy and smelt larvae died following the detonation of buried charges. Similar to adult fishes, the presence of a swim bladder contributes to shock wave-induced internal damage in larval and juvenile fishes (Settle *et al.,* 2002). Shock wave trauma to internal organs of larval pinfish and spot from shock waves was documented by Govoni *et al.* (2003). These were laboratory studies, however, and have not been verified in the field.

Fish not killed or driven from a location by an explosion might change their behavior, feeding pattern, or distribution. Changes in behavior of fish have been observed as a result of sound produced by explosives, with effect intensified in areas of hard substrate (Wright, 1982). Fish which ascend too quickly, a typical response to fear or to avoid negative stimuli, might experience an increase in the volume of gas-filled organs due to the reduction in ambient pressure. The resulting inflation might render the fish unable to immediately return to its normal habitat depth because the expanded organs make the buoyancy of the fish too great to overcome by swimming downward. Stunning from pressure waves could also temporarily immobilize fish, making them more susceptible to predation.

The variety of environmental parameters and biological features that can modify the impact of underwater explosions complicates the effort to predict lethal effect ranges in the field (Wright, 1982; Keevin and Hempen, 1997). Predictive models have, however, been developed over the past three decades (Wiley *et al.,* 1981; Goertner, 1982; Young, 1991). These are based on measurements of the pressure produced by underwater explosions at increasing distance from the detonation point (O'Keefe and Young, 1984a,b; Wright and Hopky, 1998; Dzwilewski and Fenton, 2003). Different types of explosive materials are normalized in effect range models by establishing an equivalent weight of TNT known as NEW.

Young (1991) provides equations that allow estimation of the potential effect on fish possessing swim bladders using a damage prediction method developed by Goertner (1982). Young's parameters include the size of the fish and its location relative to the explosive source, but are independent of environmental conditions (*e.g.*, depth of fish and explosive shot frequency). An example of such model predictions is shown in Table 3.9-7 which lists estimated explosive-effects ranges using Young's (1991) method for fish possessing swim bladders exposed to explosions that would occur under the No Action Alternative and Alternatives 1 and 2. The 10 percent mortality range is the distance beyond which 90 percent of the fish present would be expected to survive. It is difficult to predict the range of more subtle effects causing injury but not mortality (CSA, 2004).

TABLE 3.9-7
ESTIMATED EXPLOSIVE EFFECTS RANGES FOR FISH WITH SWIM BLADDERS

Training Operation and Type of Ordnance	NEW (lb)	Depth of Explosion (ft)	10% Mortality Range (ft)		
			1-oz Fish	1-lb Fish	30-lb Fish
Mine Neutralization					
20-lb NEW UNDET Charge	20	30	666	464	299
Missile Exercise					
AGM-114 Hellfire	8	3.3	317	221	142
AGM-65 Maverick	80	3.3	604	421	271
Firing Exercise with IMPASS					
HE Naval Gun Shell, 5-inch	8	1	244	170	109
Small Arms					
Anti-Swimmer Grenade	0.5	1	186	130	83
Bombing Exercise					
MK-20(1)	98.5	3.3	660	460	296
MK-82(1)	192.2	3.3	772	539	346
MK-83(1)	415.8	3.3	959	668	430
MK-84(1)	944.7	3.3	1,206	841	541

(1) No Action Alternative and Alternative 1 only.

Fish located outside the lethal effects range of an underwater explosion could also experience adverse effects from the blast's acoustical signature. Sound is the only form of energy that propagates well underwater and is used by many aquatic animals for imaging, navigations, and communication. Fish have evolved two main sensory organs for detecting sound: the inner ear, located in the skull, and the lateral line system along the flanks and on the head (Ladich and Popper, 2004). The perception of sound pressure is restricted to fish species with gas-filled swim bladders. Due to the higher compressibility of gas than water, the swim bladder responds effectively to sound pressure fluctuations. In some species of fish, a series of modified vertebra connect the inner ear to the swim bladder acting as a transducer that converts sound pressure waves into particle motion which stimulates the otoliths. Species with no swim bladder (for example, mackerel, tuna, sharks) or a much-reduced one (many benthic species, including flatfish) tend to have relatively low auditory sensitivity.

Broadly, fish can be categorized as either hearing specialists or hearing generalists. Fish in the hearing specialist category have a broad frequency range with a low auditory threshold due to a mechanical connection between an air filled cavity, such as a swim bladder, and the inner ear. Specialists detect both the particle motion and pressure components of sound and can hear at levels above 1 kHz. Generalists are limited to detection of the particle motion component of low frequency sounds at relatively high sound intensities (Amoser and Ladich, 2005). Although hearing capability data only exists for 100 of the 27,000 fish species (Hastings and Popper, 2005), it is thought that most species of fish detect sounds from 0.05 to 1.0 kHz (NRC, 2003). Studies indicate that hearing specializations in marine species are quite rare and that most marine fish are considered hearing generalists (Popper, 2008; Popper, 2003; Amoser and Ladich, 2005). Studies have shown different hearing abilities for species within the same family (Amoser and Ladich, 2005). It has also been shown that susceptibility to the effects of anthropogenic sound can be influenced by developmental and genetic differences in the same species of fish (Popper *et al.*, 2007). Therefore, generalizations about fish hearing abilities must be made with caution.

The potential acoustic effects of underwater explosions may be considered in four categories:

- Masking – interference with the ability to hear biologically important sounds.
- Stress – physiological responses including elevated heart rate and release of hormones.
- Behavior – disruption of natural activities like swimming, schooling, feeding, breeding, and migration.
- Hearing – permanent hearing loss from high intensity/long duration sounds or temporary hearing loss from less intense sounds.

If an individual fish were repeatedly exposed to sounds from underwater explosions, the acoustic effects outlined above could lead to long-term consequences such as reduced survival, growth, or reproductive capacity. However, the time scale of individual explosions is very limited, and training exercises involving explosions are dispersed in space and time. Consequently, repeated exposure of individual fish to sounds from underwater explosions is not likely and most acoustic effects are expected to be short-term and localized. Sound from a single explosion could also effect fish recruitment if it occurred in the vicinity of a spawning event. The sound from the explosion could alter the behavior of the fish and disrupt, delay, or prevent the spawning event from occurring. Given the spatial and temporal dispersion of training activities and spawning events, the probability of an explosion disrupting spawning is expected to be low. If a spawning event were disrupted, the effects would be localized and a measureable reduction in fish recruitment would not be expected.

The number of fish affected by an underwater explosion would depend on the population density in the vicinity of the blast, as well as factors discussed above such as NEW, depth of the explosion, and fish size. For example, if an explosion occurred in the middle of a dense school of menhaden, herring, or other schooling fish, a large number of fish could be killed. This would not, however, represent significant mortality in terms of the total population of such fish in the Study Area. Furthermore, the probability of this occurring is low based on the patchy distribution of dense schooling fish. Fish density in a given area is inherently dynamic and varies seasonally, daily, and over shorter time frames. Consequently, fish density data are not available for the Study Area and the number of fish affected by underwater detonations and HE ordnance cannot be accurately quantified.

Fish density is influenced by numerous environmental conditions including habitat and productivity. Figure 3.6-1 through 3.6-4 show training areas where explosions would occur in relationship to habitat features such as live hard bottom and artificial habitats that often support dense aggregations of fish. Navy mitigation measures reduce the possibility that large numbers of fish would be affected. Nonetheless, the training areas where explosions would take place do contain designated EFH and do support many important species of fish.

To summarize, a limited number of fish would be killed in the immediate proximity of underwater explosions. Additional fish would be injured and could subsequently die or suffer greater rates of predation. Beyond the range of lethal or injurious effects, there could be short-term effects such as masking, stress, behavioral changes, and hearing threshold shifts. However, given the relatively small area that would be affected, and the abundance and distribution of the species concerned, no population-level effects would be expected. When exercises are completed, the fish stock should repopulate the area. The regional abundance and diversity of fish are unlikely to measurably decrease. While these conclusions are primarily based on qualitative judgments, they are supported by the best scientific information currently available. Quantitative predictions of population-level

effects are simply beyond the capacity of contemporary ocean science. In accordance with NEPA, underwater detonations and HE ordnance use in territorial waters under the No Action Alternative would not result in significant impacts to fish populations. In accordance with EO 12114, underwater detonations and HE ordnance use in non-territorial waters would not cause significant harm to fish populations.

Indirect Effects

In addition to directly affecting fish and fish habitat, underwater explosions could affect other species in the food web including plankton and other prey species. The effects of underwater explosions would differ depending upon the type of prey species in the area of the blast. As previously indicated, fish with swim bladders are more susceptible to blast injuries than fish without swim bladders. Invertebrate species, however, like squid, do not possess air-filled cavities, and therefore are less prone to blast effects (Voss, 1965), although impulsive sound has been implicated in mortality of deep water species (Guerra *et al.*, 2004).

In addition to physical effects of an underwater blast, prey might have behavioral reactions to underwater sound. For instance, squid might exhibit a strong startle reaction to detonations that might include swimming to the surface, jetting away from the source, and releasing ink (McCauley *et al.*, 2000). This startle and flight response is the most common secondary defense among animals (Hanlon and Messenger, 1996). The sound from underwater explosions might induce startle reactions and temporary dispersal of schooling fish and squid if they are within close proximity. The abundances of fish and invertebrate prey species near the detonation point could be diminished for a short period of time before being repopulated by animals from adjacent waters. No lasting effect on prey availability or the pelagic food web would be expected. Indirect effects of underwater detonations and HE ordnance use under the No Action Alternative would not result in a decrease in the quantity or quality of EFH in the Study Area and would have no adverse effects to EFH as defined under the MSFCMA. In accordance with NEPA, indirect effects of underwater detonations and HE ordnance use in territorial waters under the No Action Alternative would not result in significant impacts to fish populations or habitat. In accordance with EO 12114, indirect effects of underwater detonations and HE ordnance use in non-territorial waters would not cause significant harm to fish populations or habitat.

Military Expended Material

Overview

The Navy uses a variety of military expended materials during training exercises conducted in the JAX Study Area. The types and quantities of expended materials used and information regarding fate and transport of these materials within the marine environment are discussed in Section 3.2. The analyses presented in Sections 3.2, 3.3, and 3.6 predict that the majority of the expended materials would rapidly sink to the sea floor, become encrusted by natural processes, and incorporated into the sea floor, with no significant accumulations in any particular area and no significant negative effects to water quality or marine benthic communities. Based on the analyses presented in Sections 3.2, 3.3, and 3.6, impacts associated with military expended to EFH would be temporary and/or minimal. Military expended materials under the No Action Alternative would not reduce the quality and/or quantity of EFH in the Study Area. Therefore, the remainder of this section focuses on the effects of military expended material on fish.

Fish could be exposed to some expended materials via contact and ingestion. Benthic-foraging fish are more likely to encounter and ingest military expended materials than species that forage in the water column. Fish ingest non-food items incidentally to normal feeding, but also commonly expel non-food items before swallowing them. The effects of military expended material ingestion on fish are largely unknown, but would likely vary depending on species and size of the individual, as well as the type and quantity of material ingested. If ingested, some military expended materials could lodge in the digestive system and interfere with food consumption and digestion; resulting in sublethal or lethal effects.

Ordnance-related Materials

Ordnance-related materials include various sizes of NEPM and shrapnel from explosive rounds (Tables 2.2-5 and 2.2-6). The solid metal materials would quickly move through the water column and settle to the sea floor where they could be available for ingestion by benthic-foraging fish. Some materials such as an intact non-explosive practice bomb would be too large to be ingested, but other materials such as small caliber ammunition and shrapnel are small enough to be ingested. These materials could pass through the digestive tract without causing harm, but could also lodge in the digestive system and interfere with food consumption and digestion. Some ordnance-related materials contain lead, copper and other metals, which could be toxic to fish when ingested. While ingestion of ordnance related materials could result in sublethal or lethal effects, the likelihood of ingestion is low based on the dispersed nature of the materials. Furthermore, a fish might expel the item before swallowing it. Based on these factors, the number of fish potentially affected by ingestion of ordnance-related materials would be low and population-level effects would not occur.

Target-related Materials

Most targets are recovered after use and reused or properly disposed of onshore. Some targets such as 55-gallon metal drums cannot be recovered and sink to the sea floor after use. Unrecoverable floating materials generated by target use are expected to be minimal. Descriptions of targets used in the Study Area and information on fate and transport are provided in Section 3.2. Benthic foraging fish may encounter an expended target on the bottom, but the size of the target would prohibit fish from ingesting it.

Chaff Fibers, End Caps, and Pistons

The background information and general exposure analysis presented in Section 3.7 for marine mammals and chaff is also applicable to fish and is not repeated here. Similar to marine mammals, fish could be exposed to chaff through direct body contact and ingestion. Fish are not expected to respond to direct contact with chaff. In addition, any changes in water quality from chaff use would be negligible and would not be expected to affect fish.

Based on the small size of chaff fibers, fish would not confuse the fibers with prey items or purposefully feed on them. However, fish could occasionally ingest low concentrations of chaff incidentally while feeding on prey items on the surface, in the water column, or on the bottom. The effects of chaff fiber ingestion on fish are expected to be negligible based on the low concentration that could reasonably be ingested, the small size of the chaff fibers, and available data on the toxicity of chaff and aluminum (see Section 3.7).

The potential also exists for fish to ingest chaff end caps and pistons as they sink through the water column or after they have settled to the bottom. If ingested, it is possible the small, (1.3-inch diameter, 0.13-inch thick) round, plastic end cap or piston would pass through the digestive tract of

larger fish without causing harm and that a large quantity would need to be ingested to cause harm. Based on the low environmental concentration (1.4 pieces/nm^2/year), it is unlikely that a larger number of fish would ingest an end cap or piston, much less a harmful quantity. Furthermore, a fish might expel the item before swallowing it. Based on these factors, the number of fish potentially affected by ingestion of chaff end cap or pistons would be low and population-level effects would not occur.

Self-protection Flares

Self-protection flares consist of a magnesium/Teflon formulation that, when ignited and released from an aircraft, burn for a short period of time (less than 10 seconds) at very high temperatures. Flares release heat and light to disrupt tracking of Navy aircraft by enemy infrared tracking devices or weapons. Flares are designed to burn completely. Under normal operations, the only material that would enter the water would be a small, round plastic end cap (approximately 1.4 inch diameter). About 60 self-protection flares would be used per year under the No Action Alternative.

An extensive literature review and controlled experiments conducted by the U.S. Air Force revealed that self-protection flare use poses little risk to the environment (USAF 1997). The light generated by flares would have no effect on fish based on short burn time, relatively high altitudes where they are used, and the wide-spread and infrequent use. The potential exists for fish to ingest self-protection flare end caps as they sink through the water column or after they have settled to the bottom. The number of fish potentially affected by ingestion of self-protection flare end caps would be low based on the small number used and population-level effects would not occur.

Marine Markers

The MK-25 and MK-58 marine markers produce chemical flames and regions of surface smoke and are used in various training exercises to mark a surface position to simulate divers, ships, and points of contact on the surface of the ocean. The marker is not designed to be recovered after use and would sink to the bottom after burning out. Chemical components of the marker would be consumed during the burning process. Fish in the immediate vicinity could be startled by the light generated by a burning marine marker on the sea surface. However, the effects would be short-term and localized. The tin and aluminum marine mark canisters are cylindrical. The M-25 is 18.5 in long by 2.9 in diameter and the MK-58 is 21.8 in long by 5 in diameter. While marine markers do not present an ingestion risk based on their size, a slight chance exists for a fish to encounter a canister while foraging on the bottom and to become lodged in the canister. Adverse effects from marine markers are not anticipated based on the small number used under the No Action Alternative (300 per year).

In summary, fish could be exposed to a variety of military expended materials under the No Action Alternative, but the analysis presented above indicates that the effects on fish would be negligible to minor. Military expended materials under the No Action Alternative would not result in adverse effects to fish populations. In accordance with NEPA, military expended materials in territorial waters under the No Action Alternative would have no significant impact on fish populations or habitat. Furthermore, military expended materials in non-territorial waters would not cause significant harm to fish populations or habitat in accordance with EO 12114.

Shortnose Sturgeon

Based on information presented in Section 3.9.2.3, the shortnose sturgeon is not expected to occur in portions of the Study Area located in the Atlantic Ocean. Therefore, training that would take

place in this portion of the Study Area under the No Action Alternative would have no effect on the shortnose sturgeon. The No Action Alternative would have no effect on critical habitat because none has been designated for the shortnose sturgeon. Potential effects to the shortnose sturgeon in Lake George are addressed in Section 3.11.

Smalltooth Sawfish

As discussed in Section 3.9.2.3, occurrence of smalltooth sawfish is considered rare in the OPAREAs, while occurrence is more likely in Florida state waters adjacent to the JAX OPAREA's western boundary. Only two encounters have been recorded within the boundaries of the OPAREAs and four within the vicinity of JAX OPAREA (*i.e.*, Florida state waters) (MML, 2005; Simpfendorfer and Wiley 2005a).

Smalltooth Sawfish - Vessel Movements

Disturbance associated with vessel movements would have no effect on the smalltooth sawfish. Smalltooth sawfish would not be exposed to vessel strikes because they are mobile and primarily use benthic habitats.

Smalltooth Sawfish – Aircraft Overflights

Smalltooth sawfish would not be exposed to disturbances associated with aircraft over flights because they primarily use benthic habitats and few low altitude overflights occur in nearshore waters where this species is most likely to occur. Aircraft overflights would have no effect on the smalltooth sawfish.

Smalltooth Sawfish – Towed Mine Warfare Devices

The use of towed Mine Warfare devices would result in short-term and localized disturbances to the water column, but benthic habitats would not be affected because the devices are not towed on the bottom and the training areas are located in deep waters (about 30 to 800 m). Smalltooth sawfish would not be exposed to towed Mine Warfare devices because they primarily use benthic habitats. The use of towed Mine Warfare devices would have no effect on the smalltooth sawfish.

Smalltooth Sawfish – Mine Warfare Training

Mine warfare training areas would not be designated under the No Action Alternative.

Smalltooth Sawfish – Non-explosive Practice Munitions

Smalltooth sawfish would not be exposed to NEPM strikes in state waters because NEPM is not used in state waters. As discussed above for other species of fish, a remote possibility exists that some individual fish at or near the surface may be directly impacted if they are in the target area and at the point of physical impact at the time of NEPM delivery. However, smalltooth sawfish are not expected to occur at or near the surface because they primarily use benthic habitats. Within the OPAREAs, NEPM use occurs in waters greater than 20 m deep. NEPM velocity would rapidly decrease upon contact with the water and as it travels through the water column. Smalltooth sawfish would not be exposed to NEPM strikes based on their use of benthic habitats and the decrease in NEPM velocity as it comes in contact with the surface and travels through the water column. NEPM use under the No Action Alternative would have no effect on the smalltooth sawfish.

Smalltooth Sawfish – Underwater Detonations and High Explosive Ordnance

Explosions that occur in the OPAREAs are associated with training exercises that use HE ordnance, including bombs (BOMBEX), missiles (MISSILEX), naval gun shells (FIREX with IMPASS, 5-in HE rounds), and anti-swimmer grenades, as well as UNDETs associated with Mine Neutralization training (MINEX). Underwater detonation and HE ordnance use is limited to a few specific training areas (see Table 2.2-7 for a summary of explosions by training area) and does not occur in state waters (0 to 3 nm from shore).

Smalltooth sawfish could be injured or killed if they were in the immediate vicinity of an UNDET or HE ordnance explosion. However, several factors discussed below indicate that the probability of a smalltooth sawfish being exposed to impacts from explosions is extremely low. First of all, UNDETs and HE ordnance use are limited to the OPAREAs where smalltooth sawfish rarely occur. Explosions do not take place in nearshore waters where this species is more likely to occur. These operations are conducted well offshore and many are conducted in very deep waters where smalltooth sawfish are not expected to occur.

Of the ordnance used in the OPAREAs, HE bombs have the highest net explosive weights and largest zones of influence (see Table 2.2-4 for net explosive weights). HE bombs detonate on or near the water's surface and are only dropped west of the continental shelf break in Area 31J, where water depths are over 700 m. While smalltooth sawfish have been reported from waters as deep as 122 m (Poulakis and Seitz, 2004), they are not expected to occur in waters as deep as those found in Area 31J. Therefore, HE bombs would have no effect on the smalltooth sawfish.

HE missiles and HE naval gun shells also detonate on or near the water surface and are used in areas greater than 12 nm offshore where depths range from 20 m to over 900 m. Smalltooth sawfish may rarely occur in the shallower waters where these types of HE ordnance are used, but they are not expected to occur in the deepest waters. This reduces the likelihood of exposure. In addition, the likelihood of exposure is low because most HE missiles and HE gun shells have relatively low NEWs, the ordnance detonates at or near the surface, and smalltooth sawfish primarily use benthic habitats. The AGM-65 Maverick missile has a relatively high NEW (80-lbs), but the likelihood of exposure is low because only three of these missiles would be used per year under the No Action Alternative.

The No Action Alternative includes 18 UNDETs per year (20-lbs NEW) in the North and South Underwater Detonation Areas (10L and 12I), which are about five to 15 nm offshore with water depths of about 10 to 20 m. Some charges would be detonated directly on the bottom and the others would be detonated in the water column. Rare occurrence of the smalltooth sawfish in this area and the low number of operations per year indicate an extremely low probability of this species being exposed to impacts from an UNDET under the No Action Alternative. As discussed above for other species of fish, impacts of UNDETs on soft bottom benthic habitats would be short-term (less than one year) and localized.

The No Action Alternative also includes the use of 80 anti-swimmer grenades (0.5-lbs NEW) in the UNDET Areas. These grenades detonate about 3 m under the water's surface within four to five seconds of being deployed. This reduces the likelihood of smalltooth sawfish on the bottom being exposed. Exposure is extremely unlikely based on rare occurrence of the species in this area, the low NEW, and the location of the detonation in the water column versus on the bottom.

In summary, the probability of the smalltooth sawfish being exposed to UNDETs and HE ordnance would be extremely low based on its infrequent occurrence in the Study Area and other factors discussed above. The effects of UNDETs and HE ordnance use would be considered discountable because the effects are extremely unlikely to occur. Underwater detonations and HE ordnance use under the No Action Alternative may affect the smalltooth sawfish.

Smalltooth Sawfish – Military Expended material

Overview

As a species that primarily uses benthic habitats, the smalltooth sawfish could be exposed to MEM on the sea floor through ingestion and entanglement. While it is unknown if smalltooth sawfish ingest anthropogenic debris regularly, many elasmobranchs are known to ingest a variety of non-food items (Hamlett, 1999). The smalltooth sawfish primarily feeds on schooling fish by swinging its saw from side to side, sometimes impaling prey on its rostral teeth. If necessary, they scrap the prey off against the bottom and eat the prey whole. These fish also capture and consume benthic invertebrates by disturbing the bottom with their saw (NMFS, 2006b; Florida Museum of Natural History, 2008). While it seems unlikely that smalltooth sawfish would mistake MEM as prey, incidental ingestion of some types of material from the bottom is possible based on its feeding habitats.

The smalltooth sawfish may be exceptionally susceptible to entanglement because of its unique toothed-rostrum. Entanglement in nets, lines, and ropes has been reported in smalltooth sawfish encounters. Smalltooth sawfish have also been observed with their rostrum encircled by a polyvinyl chloride pipe and a coffee can (Seitz and Poulakis, 2006).

Ordnance-Related Material

Ordnance-related material includes various sizes of NEPM and shrapnel from explosive rounds (Tables 2.2-5 and 2.2-6). The solid metal material would quickly move through the water column and settle to the sea floor where it could be available for ingestion by smalltooth sawfish. Some material such as an intact NEPM, would be too large to be ingested by a smalltooth sawfish, but other material, such as small caliber ammunition and shrapnel, are small enough to be ingested. While incidental ingestion of some ordnance-related material is possible, the likelihood of this occurring is remote based on the infrequent occurrence of sawfish in the Study Area. Ordnance is not used in state waters, where this species is most likely to occur. In addition, a portion of the ordnance is expended in very deep waters beyond the continental shelf break, where sawfish are not expected to occur. The effect of ordnance-related material would be considered discountable because the effects are extremely unlikely to occur. Ingestion of ordnance-related material may affect the smalltooth sawfish.

Target-Related Material

As discussed above for other species of fish, target-related materials would be too large to present an ingestion risk and would have no effect to smalltooth sawfish.

Chaff Fibers, End Caps, and Pistons

Smalltooth sawfish could be exposed to chaff through direct body contact and ingestion. Smalltooth sawfish are not expected to respond to direct contact with chaff and any changes in water quality from chaff use would be negligible and would not be expected to affect this species. Furthermore, it is highly unlikely that a smalltooth sawfish would ingest a toxic dose of chaff fibers

based on the anticipated environmental concentration of chaff and relatively low toxicity of chaff (see background information in Section 3.7.4.1).

Incidental ingestion of chaff plastic end caps and pistons from the bottom by smalltooth sawfish is also possible, but the likelihood of this occurring is remote based on the infrequent occurrence of sawfish in the Study Area and the low environmental concentration (2.4 pieces/nm^2/year, Table 3.7-16). Chaff is not used in state waters, where this species is most likely to occur. In addition, a portion of the end caps and pistons would sink in very deep waters beyond the continental shelf break, where sawfish are not expected to occur. If ingested, it is likely the small (1.3-inch diameter, 0.13-inch thick) round end cap or piston would pass through the digestive tract of a sawfish without causing harm and that a large quantity would need to be ingested to cause harm. It is extremely unlikely that a smalltooth sawfish would ingest an end cap or piston, much less a harmful quantity. The effects of chaff use on smalltooth sawfish are considered discountable or insignificant. Chaff use under the No Action Alternative may affect the smalltooth sawfish.

Self-Protection Flares

Similar to chaff end caps and pistons, smalltooth sawfish could potentially ingest flare end caps. Ingestion of flare end caps under the No Action Alternative may affect the smalltooth sawfish, but the effects would be considered discountable because ingestion is extremely unlikely to occur based on the low number of end caps (70 per year) and infrequent occurrence of this species in the Study Area.

Marine Markers

While marine markers do not present an ingestion risk based on their size, a slight chance exists for a smalltooth sawfish to encounter a canister while foraging on the bottom and for the canister to get stuck around the rostrum. Smalltooth sawfish have been observed with their rostrum encircled by similar items; a polyvinyl chloride pipe and a coffee can (Seitz, 2006). The polyvinyl chloride pipe that was found encircling a live smalltooth sawfish's rostrum was about 3.9 in long by 3.9 in diameter and had caused damage to several rostral teeth. This fish appeared emaciated, suggesting that it was not feeding normally (Seitz, 2006). About 300 marine markers would be used per year in the Study Area and use would be widely dispersed. The probability of a smalltooth sawfish having a harmful encounter with a marine marker is extremely low based on the low number of markers used and infrequent occurrence of this species in the Study Area. Marine marker use under the No Action Alternative may affect the smalltooth sawfish, but the effect would be considered discountable.

Candidate Species

The effects of the No Action Alternative on the Atlantic sturgeon would be the same as those described above for other fish species. The No Action Alternative would not result in significant impacts or significant harm to candidate species.

Species of Concern

The effects of the No Action Alternative on species of concern would be the same as those described above for other fish species. The No Action Alternative would not result in significant impacts or significant harm to species of concern.

Precision Anchoring

Effects on Essential Fish Habitat

Ship crews conduct Precision Anchoring during the training cycle to fulfill qualification requirements. These exercises are conducted at two designated anchorage areas located about 3 nm offshore from Naval Station Mayport (Figure 2.2-5). Each exercise involves several practice anchor drops and the final drop is graded. Anchors are dropped as close as possible to the coordinates for the designated anchorage area. Drops occur within 1,000 ft of the designated point. About 168 Precision Anchoring exercises would be conducted per year under the No Action Alternative and each exercise would include several anchor drops. An aircraft carrier anchor weighs about 60,000 pounds. The total anchor weight including the chain is about 735,000 pounds.

Precision Anchoring would result in short-term (typically less than an hour) and localized disturbances to water column habitats and long-term disturbances to benthic habitats. Bottom sediments would be disturbed and localized increases in turbidity would occur when an anchor makes contact with the sea floor, but turbidity would quickly dissipate following the exercise. Available geographic information system mapping data indicates that no hard bottom habitat exists within about 6,500 ft of the designated anchorage areas and no artificial habitats are located within about 10,000 ft. Therefore, only soft bottom benthic habitats would be affected. The soft bottom benthic habitat present in the designated anchorage areas has likely suffered some degradation from long-term, historical use of the areas for anchoring. Baseline conditions would not be expected to change under the No Action Alternative. Confining these exercises to two relatively small areas (approximately 0.09 nm^2 each) that lack hard bottom and artificial habitats minimizes impacts to EFH. Impacts to from Precision Anchoring to EFH would be minimal. Precision Anchoring under the No Action Alternative would not reduce the quality or quantity of EFH in the Study Area.

Effects on Fish

The probability of an anchor striking and injuring a fish is remote. Precision Anchoring is not expected to adversely affect individual fish or fish populations. In accordance with NEPA, Precision Anchoring in territorial waters under the No Action Alternative would have no significant impact on fish populations or habitat. Precision Anchoring would not take place in non-territorial waters.

3.9.3.2 Alternative 1

Vessel Movements

Vessel movements would increase by about five percent per year in the Study Area under Alternative 1 (Table 2.2-5). These changes would result in increased potential for vessel collision-related fish mortalities and injuries (primarily eggs and larvae) to occur compared to baseline conditions. However, no measurable effects on fish recruitment would occur because the number of eggs and larvae exposed to vessel movements would continue to be low relative to total ichthyoplankton biomass. Vessel movements would continue to result in short-term and localized disturbances to water column and *Sargassum* habitats, but benthic habitats would not be affected. Navy mitigation measures, which include avoidance of large *Sargassum* mats where some fish species tend to concentrate, further reduce the probability of habitat disturbance and injury or mortality. Impacts to EFH from vessel movements under Alternative 1 would be temporary and minimal. Vessel movements would not reduce the quality and/or quantity of EFH in the Study Area. In accordance with NEPA, vessel movements in territorial waters under Alternative 1 would

have no significant impact on fish populations or habitat. Furthermore, vessel movements in non-territorial waters would not cause significant harm to fish populations or habitat in accordance with EO 12114.

Aircraft Overflights

Alternative 1 would include an eight percent increase in fixed-wing aircraft sorties per year and a 22 percent increase in helicopter sorties per year in the OPAREAs (Table 2.2-5). As a result, the potential for fish to be exposed to elevated noise levels would be increase compared to the No Action Alternative. The magnitude of individual exposures would not increase because Alternative 1 does not include use of new aircraft that are louder than current equipment. Peak noise levels generated by the new MH-60R and MH-60S Multi-Mission Combat Support Helicopters would be similar to the noise levels generated by the helicopters that they would replace.

Similar to the No Action Alternative, the responses would be limited to short-term behavioral or physiological reactions (*e.g.,* swimming away and increased heart rate) and the general health of individual fish would not be compromised. Impacts to EFH from aircraft overflights under Alternative 1 would be temporary and minimal. Aircraft overflights would not reduce the quality and/or quantity of EFH in the Study Area. In accordance with NEPA, aircraft overflights over territorial waters under Alternative 1 would have no significant impact on fish populations or habitat. Furthermore, aircraft overflights over non-territorial waters would not cause significant harm to fish populations or habitat in accordance with EO 12114.

Towed Mine Warfare Devices

Towed Mine Warfare device sorties would increase from 78 to 150 sorties per year (92 percent increase) under Alternative 1. These operations would continue to occur in Amber Strait and the Kaiser Carrier Operating Area. These changes would result in increased potential for towed device-related fish mortalities and injuries (primarily eggs and larvae) to occur compared to baseline conditions. However, no measurable effects on fish recruitment would occur because the number of eggs and larvae exposed to towed Mine Warfare devices would continue to be low relative to total ichthyoplankton biomass. Disturbances to water column and *Sargassum* habits would be short-term and localized. Impacts to EFH from towed Mine Warfare device use under Alternative 1 would be temporary and minimal. Towed Mine Warfare device use would not reduce the quality and/or quantity of EFH in the Study Area. In accordance with EO 12114, towed Mine Warfare device use in non-territorial waters under Alternative 1 would not cause significant harm to fish populations or habitat. Towed MIW devices would not be used in territorial waters under Alternative 1.

Mine Warfare Training

Mine Warfare Training Areas would not be designated under Alternative 1.

Non-Explosive Practice Munitions

The amount of NEPM used would increase in the Study Area under Alternative 1 (Table 2.2-4). These changes would result in increased potential for fish/NEPM strikes and associated fish mortalities and injuries to occur compared to baseline conditions. However, the number of fish affected would continue to be small. Navy mitigation measures, which include avoidance of large *Sargassum* mats where some fish species tend to concentrate, further reduce the probability of

NEPM-related injury or mortality. Disturbances to water column habitats from NEPM strikes would be short-term and localized. The number of non-explosive practice bombs, which are some of the largest types of NEPM, would not change under Alternative 1. One additional non-explosive practice missile and 198 additional non-explosive practice naval gun shells would be used under Alternative 1; increasing the total area of benthic habitat affected from 7,151 ft2 per year to 7,383 ft2 per year. Otherwise, the analysis presented for non-explosive practice bombs, missiles, and naval gun shells and the No Action Alternative is applicable to Alternative 1. NEPM strikes would cause little or no physical damage to soft bottom benthic habitat, and any damage would be localized. Non-explosive practice bomb, missile, and naval gun shell strikes could result in long-term, minor effects to benthic EFH, but the effects would be localized and no long-term changes to community structure or function would be expected. Impacts to EFH from NEPM use under Alternative 1 would be temporary and minimal. NEPM use would not reduce the quality and/or quantity of EFH in the Study Area. In accordance with NEPA, NEPM use in territorial waters under Alternative 1 would have no significant impact on fish populations or habitat. Furthermore, NEPM use in non-territorial waters would not cause significant harm to fish populations or habitat in accordance with EO 12114.

Underwater Detonations and High Explosive Ordnance

The number and location of explosions occurring in the Study Area would not change under Alternative 1, with the exception of missiles and 20-lbs NEW underwater detonation charges (Tables 2.2-5 and 2.2-7). Forty additional Hellfire missile explosions would occur in W-157A/W-159A. These changes would result in increased potential for explosion-related fish injury or mortality compared to baseline conditions. The number of 20-lbs NEW underwater detonation charges in the North and South Underwater Detonation Areas (10L and 12I) would decrease from 18 to 12 per year. The types of impacts would be the same as those discussed for the No Action Alternative, but a smaller area would be affected per year under Alternative 1 based on the decrease in operations. A 20-lbs NEW charge detonated on the bottom can create depressions in the substrate up to 4 to 5 feet in diameter (12.6 to 19.6 ft^2) and 1-foot deep (DoN, 2000b). Assuming a worst-case scenario where all UNDETs occurred on the bottom, about 151 to 235 ft^2 of benthic habitat would be affected per year under Alternative 1 (based on 12 detonations per year and 12.6 to 19.6 ft^2 affected per detonation). Habitat disturbance and fish injury and mortality from explosions are reduced by Navy mitigation measures. Large *Sargassum* mats where some fish species tend to concentrate are avoided and underwater explosive charges are not set within 1,000 ft of known live/hard bottom, artificial reefs, and shipwrecks. Impacts to EFH from underwater detonations and HE ordnance use under Alternative 1 would be minimal. Underwater detonations and HE ordnance use would not reduce the quality and/or quantity of EFH in the Study Area. In accordance with NEPA, UNDETs and HE ordnance use in territorial waters under Alternative 1 would have no significant impact on fish populations or habitat. Furthermore, underwater detonations and HE ordnance use in non-territorial waters would not cause significant harm to fish populations or habitat in accordance with EO 12114.

Military Expended Material

Alternative 1 would include slight increases in ordnance-related expended material, chaff use, and self-protection flare use (Table 2.2-5). Marine marker use would not change under Alternative 1. These changes would result in increased exposure of fish and EFH to MEM. As discussed above for the No Action Alternative and based on the analyses presented in Sections 3.2, 3.3, and 3.6, impacts associated with military expended materials to EFH would be temporary and/or minimal. Military expended materials under Alternative 1 would not reduce the quality and/or quantity of EFH in the

Study Area. In accordance with NEPA, MEM in territorial waters under Alternative 1 would have no significant impact on fish populations or habitat. Furthermore, MEM in non-territorial waters would not cause significant harm to fish populations or habitat in accordance with EO 12114.

Shortnose Sturgeon

Based on information presented in Section 3.9.2.3, the shortnose sturgeon is not expected to occur in portions of the Study Area located in the Atlantic Ocean. Therefore, training that would take place in this portion of the Study Area under Alternative 1 would have no effect on the shortnose sturgeon. Alternative 1 would have no effect on critical habitat because none has been designated for the shortnose sturgeon. Potential effects to the shortnose sturgeon in Lake George are addressed in Section 3.11.

Smalltooth Sawfish

The smalltooth sawfish would not be exposed to vessel movements, aircraft overflights, towed Mine Warfare devices, or NEPM under Alternative 1, as was the case for the No Action Alternative. Therefore, these stressors would have no effect on the smalltooth sawfish under Alternative 1.

Smalltooth Sawfish – Underwater Detonations and High Explosive Ordnance

The number and location of explosions occurring in the Study Area would not change under Alternative 1, with the exception of missiles and 20-lbs NEW underwater detonation charges (Tables 2.2-5 and 2.2-7). Forty additional Hellfire missile explosions would occur under Alternative 1. Nonetheless, the effects of Hellfire missile use would continue to be discountable because the smalltooth sawfish infrequently occurs in the OPAREAs, Hellfire missiles have relatively low NEWs, the ordnance detonates at or near the surface, and smalltooth sawfish primarily use benthic habitats. The number of 20-lbs NEW underwater detonation charges in the North and South Underwater Detonation Areas (10L and 12I) would decrease from 18 to 12 per year. Therefore, the potential for exposure to UNDETs would decrease under Alternative 1 and the effects would continue to be discountable. Underwater detonations and HE ordnance use under Alternative 1 may affect the smalltooth sawfish.

Smalltooth Sawfish – Military Expended Material

Alternative 1 would include slight increases in ordnance-related expended material, chaff use, and self-protection flare use (Table 2.2-5). Marine marker use would not change under Alternative 1. The effects of MEM would continue to be discountable under Alternative 1 based on infrequent use of the OPAREAs by smalltooth sawfish and other factors discussed above for the No Action Alternative. Military expended material, except for target-related material, under Alternative 1 may affect the smalltooth sawfish.

Candidate Species

The effects of Alternative 1 on the Atlantic sturgeon would be the same as those described above for other fish species. Alternative 1 would not result in significant impacts or significant harm to candidate species.

Species of Concern

The effects of Alternative 1 on species of concern would be the same as those described above for other fish species. Alternative 1 would not result in significant impacts or significant harm to species of concern.

Precision Anchoring

Precision Anchoring would not change under Alternative 1. Therefore, the analysis presented for the No Action Alternative is applicable to Alternative 1. Impacts to from Precision Anchoring to EFH would be minimal. Precision Anchoring under Alternative 1 would not reduce the quality or quantity of EFH in the Study Area. In accordance with NEPA, Precision Anchoring in territorial waters under Alternative 1 would have no significant impact on fish populations or habitat. Precision Anchoring would not take place in non-territorial waters.

3.9.3.3 Alternative 2 (Preferred Alternative)

Vessel Movements

Vessel movements under Alternative 2 would be the same as Alternative 1 (Table 2.2-5). Therefore, the analysis presented above for Alternative 1 is applicable to Alternative 2. Impacts to EFH from vessel movements under Alternative 2 would be temporary and minimal. Vessel movements would not reduce the quality and/or quantity of EFH in the Study Area. In accordance with NEPA, vessel movements in territorial waters under Alternative 2 would have no significant impact on fish populations or habitat. Furthermore, vessel movements in non-territorial waters would not cause significant harm to fish populations or habitat in accordance with EO 12114.

Aircraft Overflights

Alternative 2 would include a nine percent increase in fixed-wing aircraft sorties per year and a 60 percent increase in helicopter sorties per year in the OPAREAs (Table 2.2-5). As a result, the potential for fish to be exposed to elevated noise levels would be increase compared to the No Action Alternative. The magnitude of individual exposures would not increase because Alternative 2 does not include use of new aircraft that are louder than current equipment. Peak noise levels generated by the new MH-60R and MH-60S Multi-Mission Helicopters would be similar to the noise levels generated by the helicopters that they would replace.

Similar to the No Action Alternative, the responses would be limited to short-term behavioral or physiological reactions (*e.g.,* swimming away and increased heart rate) and the general health of individual fish would not be compromised. Impacts to EFH from aircraft overflights under Alternative 2 would be temporary and minimal. Aircraft overflights would not reduce the quality and/or quantity of EFH in the Study Area. In accordance with NEPA, aircraft overflights over territorial waters under Alternative 2 would have no significant impact on fish populations or habitat. Furthermore, aircraft overflights over non-territorial waters would not cause significant harm to fish populations or habitat in accordance with EO 12114.

Towed Mine Warfare Devices

Towed MIW device sorties would increase from 78 per year under the No Action Alternative to 456 per year under Alternative 2 (485% increase). These operations would continue to occur in Amber Strait and the Kaiser Carrier Operating Area. These changes would result in increased potential for towed device-related fish mortalities and injuries (primarily eggs and larvae) to occur

compared to baseline conditions. However, no measurable effects on fish recruitment would occur because the number of eggs and larvae exposed to towed MIW devices would continue to be low relative to total ichthyoplankton biomass. Impacts to EFH from towed MIW device use under Alternative 2 would continue to be temporary and minimal. Towed MIW device use would not reduce the quality and/or quantity of EFH in the Study Area. In accordance with EO 12114, towed MIW device use in non-territorial waters under Alternative 2 would not cause significant harm to fish populations or habitat. Towed MIW devices would not be used in territorial waters under Alternative 2.

Mine Warfare Training

Alternative 2 would include designation of Mine Warfare Training Areas in Amber Strait and the Kaiser Carrier Operating Area, as well as the North (10L) and South (12I) Underwater Detonation Areas. This would result in increased training with towed Mine Warfare devices in Amber Strait and Kaiser Carrier Operating Area, the impacts of which are analyzed above under aircraft overflights and towed Mine Warfare devices. Training with the Airborne Mine Neutralization System (AMNS) and the Rapid Airborne Mine Clearance System (RAMICS) would be conducted in the Underwater Detonation Areas. This training would include additional helicopter overflights in the areas, which are analyzed above under aircraft overflights. The AMNS uses a self-propelled mine neutralization device that is controlled from the helicopter. Only non-explosive devices would be used during AMNS training in the Study Area and the devices would be recovered after use. The self-propelled mine neutralization device would cause short-term (typically less than one hour) and localized disturbances to the water column, but are not expected to have any adverse effects on fish. The RAMICS uses a non-explosive, 30 mm armor-piercing projectile, the impacts of which are analyzed below under NEPM. Training mine shape assemblies would be deployed in the Underwater Detonation Areas to support the AMNS and RAMICS training.

The training mine shape assemblies deployed in the Underwater Detonation Areas would include a concrete anchor, mooring line (steel cable or chain), and the mine shape. Approximately 54 mine shape assemblies would be deployed per year under Alternative 2. The process of deploying mine shapes assemblies would result in localized disturbances to benthic habitat. Soft bottom habitats and live/hard bottom habitats are expected to occur in the proposed training areas, but shipwrecks are not known to be present (Figures 3.6-1 and 3.6-4). Artificial reef structures exist near the northwestern boundary of the North Underwater Detonation Area (12I). Major reef systems such as Gray's Reef, Stetson Reefs, Savannah Lithoherms, and East Florida Lophelia Reefs are located outside of the proposed training areas and would not be impacted. In accordance with Navy mitigation measures, mine shapes would not be deployed in locations with known hard bottom, artificial reefs, or shipwrecks. Therefore, only soft bottom habitat would be disturbed. Approximately 12.5 ft^2 of benthic habitat would be disturbed when a concrete anchor makes contact with the sea floor(assuming the affected area is two time the anchor footprint of 6.25 ft^2). The total area affected per year would be small (675 ft2 per year based on 54 deployments). No population- or community-level effects are expected based on the small area affect and the ability of soft bottom habitats to recover relatively quickly (*i.e.*, less than one year).

Impacts to EFH from Mine Warfare Training under Alternative 2 would be temporary and minimal. Mine Warfare Training would not reduce the quality and/or quantity of EFH in the Study Area. In accordance with NEPA, Mine Warfare Training in territorial waters under Alternative 2 would have no significant impact on fish populations or habitat. Furthermore, Mine Warfare

Training in non-territorial waters under Alternative 2 would not cause significant harm to fish populations or habitat in accordance with EO 12114.

Non-Explosive Practice Munitions

The amount of NEPM used in the Study Area under Alternative 2 would be the same as Alternative 1, with the exception of 192 additional non-explosive practice bombs per year (96 each in W-157A/B and W-158A/B, Table 3.9-5). These changes would result in increased potential for NEPM/fish strikes and associated fish mortalities and injuries to occur compared to baseline conditions. However, the number of fish affected would continue to be small. Navy mitigation measures, which include avoidance of large *Sargassum* mats where some fish species tend to concentrate, further reduce the probability of NEPM-related injury or mortality.

As discussed for the No Action Alternative, disturbances to water column habitats from NEPM strikes would be short-term and localized. NEPM strikes would cause little or no physical damage to soft bottom benthic habitat, and any damage would be localized. The area affected by non-explosive practice bombs, missiles, and naval gun shells would increase under Alternative 2. The relative non-explosive practice bomb concentration would increase from 1.7 to 2.6 per 100 nm^2/year in W-157A/B and from 2.1 to 3.2 per 100 nm^2/year in W-158A/B. The probability of non-explosive practice bombs, missiles, and naval gun shells striking hard bottom EFH, artificial habitats, proposed deep water coral HAPC, and the designated deepwater snapper grouper marine protected area would increase under Alternative 2. However, the total area of benthic habitat affected would continue to be small. As shown in Table 3.9-6, the maximum area of benthic habitat affected by non-explosive practice bomb, missile, and naval gun shell strikes would increase from 7,151 ft^2 (0.00019 nm^2) per year to 9,482 ft^2 (0.00026 nm^2) per year or 94,820 ft^2 (0.0026 nm^2) over a ten-year period. Only a percentage of the total area affected (less than 9,482 ft^2 per year) would be sensitive benthic habitat such as live hard bottom or coral mounds. Based on geographic information system data obtained through SAFMC, the Study Area contains about 18,919 nm^2 of live hard bottom EFH. The total benthic habitat affected represents less than 0.000001 percent of the total hard bottom EFH in the Study Area. Non-explosive practice bomb, missile, and naval gun shell strikes under Alternative 2 could result in long-term, minor effects to benthic EFH, but the effects would be localized and no long-term changes to community structure or function would be expected. Impacts to benthic EFH would be minimal based on the relatively small area affected by non-explosive practice bombs, missiles, and naval gun shells. Given the small area affected, NEPM use under Alternative 2 would not reduce the quality and/or quantity of EFH in the Study Area.

In accordance with NEPA, NEPM use in territorial waters under Alternative 2 would have no significant impact on fish populations or habitat. Furthermore, NEPM use in non-territorial waters would not cause significant harm to fish populations or habitat in accordance with EO 12114.

Underwater Detonations and High Explosive Ordnance

The number and location of explosions that would occur under Alternative 2 would be the same as Alternative 1, with the exception of HE bombs (Tables 2.2-5 and 2.2-7). Under Alternative 2, the Navy proposes to eliminate all BOMBEX training events that involve dropping HE ordnance on at-sea targets. As such, water column disturbances and potential fish mortality associated with explosions under Alternative 2 would be substantially lower than the No Action Alternative and Alternative 1 based on the reduction in HE bomb use. Impacts to EFH from underwater detonations and HE ordnance use under Alternative 2 would be minimal. Underwater detonations

and HE ordnance use would not reduce the quality and/or quantity of EFH in the Study Area. In accordance with NEPA, UNDETs and HE ordnance use in territorial waters under Alternative 2 would have no significant impact on fish populations or habitat. Furthermore, UNDETs and HE ordnance use in non-territorial waters would not cause significant harm to fish populations or habitat in accordance with EO 12114.

Military Expended Material

The amount of MEM entering the marine environment under Alternative 2 would be the same as Alternative 1, with the exception of an increase in non-explosive practice bombs (Table 2.2-6), which do not present an ingestion risk to fish based on their large size. As discussed above for the No Action Alternative and based on the analyses presented in Sections 3.2, 3.3, and 3.6, impacts associated with military expended materials to EFH would be temporary and/or minimal. Military expended materials under Alternative 2 would not reduce the quality and/or quantity of EFH in the Study Area. In accordance with NEPA, MEM in territorial waters under Alternative 2 would have no significant impact on fish populations or habitat. Furthermore, MEM in non-territorial waters would not cause significant harm to fish populations or habitat in accordance with EO 12114.

Shortnose Sturgeon

Based on information presented in Section 3.9.2.3, the shortnose sturgeon is not expected to occur in portions of the Study Area located in the Atlantic Ocean. Therefore, training that would take place in this portion of the Study Area under Alternative 2 would have no effect on the shortnose sturgeon. Alternative 2 would have no effect on critical habitat because none has been designated for the shortnose sturgeon. Potential effects to the shortnose sturgeon in Lake George are addressed in Section 3.11.

Smalltooth Sawfish

The smalltooth sawfish would not be exposed to vessel movements, aircraft overflights, towed Mine Warfare devices, or NEPM under Alternative 2, as was the case for the No Action Alternative and Alternative 1. Therefore, these stressors would have no effect on the smalltooth sawfish under Alternative 2. Mine Warfare Training under Alternative 2 would have no effect on the smalltooth sawfish because the only stressors associated with this action are aircraft overflights, the use of towed Mine Warfare devices, and NEPM.

Smalltooth Sawfish – Underwater Detonations and High Explosive Ordnance

The number and location of explosions that would occur under Alternative 2 would be the same as Alternative 1, with the exception of HE bombs, which would not be used in the Study Area under Alternative 2 (Tables 2.2-5 and 2.2-7). The reduction in HE bombs has no bearing on the analysis for the smalltooth sawfish because HE bomb use under the No Action Alternative and Alternative 1 would have no effect on this species. Therefore, the analysis presented above for Alternative 1 is applicable to Alternative 2. Underwater detonations and HE ordnance use under Alternative 2 may affect the smalltooth sawfish.

Smalltooth Sawfish – Military Expended Material

The amount of MEM entering the marine environment under Alternative 2 would be the same as Alternative 1, with the exception of an increase in non-explosive practice bombs (Table 2.2-6). The effects of MEM would continue to be discountable under Alternative 2 based on infrequent use of the OPAREAs by smalltooth sawfish and other factors discussed above for the No Action

Alternative. Military expended material, except for target-related material, under Alternative 2 may affect the smalltooth sawfish.

Candidate Species

The effects of Alternative 2 on the Atlantic sturgeon would be the same as those described above for other fish species. Alternative 2 would not result in significant impacts or significant harm to candidate species.

Species of Concern

The effects of Alternative 2 on species of concern would be the same as those described above for other fish species. Alternative 2 would not result in significant impacts or significant harm to species of concern.

Precision Anchoring

Precision Anchoring would not change under Alternative 2. Therefore, the analysis presented for the No Action Alternative is applicable to Alternative 2. Impacts to from Precision Anchoring to EFH would be minimal. Precision Anchoring under Alternative 2 would not reduce the quality or quantity of EFH in the Study Area. In accordance with NEPA, Precision Anchoring in territorial waters under Alternative 2 would have no significant impact on fish populations or habitat. Precision Anchoring would not take place in non-territorial waters.

3.9.4 Unavoidable Significant Environmental Effects

As summarized in Table 3.9-9, the No Action Alternative, Alternative 1, and Alternative 2 would not adversely affect EFH. Any impacts would be temporary and/or minimal. The No Action Alternative, Alternative 1, or Alternative 2 would not reduce the quality and/or quantity of EFH in the Study Area.

3.9.5 Summary of Environmental Effects

3.9.5.1 Endangered Species Act

Table 3.9-8 provides a summary of the Navy's determination of effect for the No Action Alternative, Alternative 1, and Alternative 2 (the Preferred Alternative) and federally listed fish that potentially occur in or near the Study Area. The No Action Alternative, Alternative 1, and Alternative 2 would have no effect on the shortnose sturgeon in the Atlantic Ocean portion of the Study Area. Potential effects to the shortnose sturgeon in Lake George are addressed in Section 3.11. The No Action Alternative, Alternative 1, and Alternative 2 may affect the smalltooth sawfish. The No Action Alternative, Alternative 1, and Alternative 2 would have no effect on critical habitat because none has been designated for the shortnose sturgeon or smalltooth sawfish. The Navy has consulted with NMFS regarding its determination of effect for federally listed fish.

TABLE 3.9-8
SUMMARY OF THE NAVY'S DETERMINATION OF EFFECT FOR FEDERALLY LISTED FISH POTENTIALLY OCCURRING IN THE ATLANTIC OCEAN PORTION OF THE JAX STUDY AREA FOR ALL ALTERNATIVES

Stressor	Shortnose Sturgeon	Smalltooth Sawfish
Vessel Movements		
Vessel Disturbance	No Effect	No Effect
Vessel Collisions	No Effect	No Effect
Aircraft Overflights		
Aircraft Disturbance	No Effect	No Effect
Towed Mine Warfare Devices		
Towed Device Strikes	No Effect	No Effect
MIW Training		
Training	No Effect	No Effect
NEPM		
Weapons Firing Disturbance	No Effect	No Effect
NEPM Strikes	No Effect	No Effect
Explosions		
UNDETs	No Effect	May Affect
HE Ordnance	No Effect	May Affect
Expended Material		
Ordnance-Related Material	No Effect	May Affect
Target-Related Material	No Effect	No Effect
Chaff	No Effect	May Affect
Self-protection Flares	No Effect	May Affect
Marine Markers	No Effect	May Affect

3.9.5.2 Sustainable Fisheries Act – Essential Fish Habitat

As summarized in Table 3.9-9, impacts to EFH from the No Action Alternative, Alternative 1, and Alternative 2 would be temporary and/or minimal. The No Action Alternative, Alternative 1, or Alternative 2 would not reduce the quality and/or quantity of EFH in the Study Area. In a 17 February 2009 letter to Navy, NMFS initiated EFH consultation with Navy by providing conservation recommendations based on NMFS's separate determination that Navy's release of expended materials would adversely affect EFH. Pursuant to the Magnuson-Stevens Act, Navy will complete the consultation process by responding in writing to NMFS's EFH Conservation Recommendations within the 30-day statutory timeline.

3.9.5.3 National Environmental Policy Act and Executive Order 12114

The environmental effects of the No Action Alternative, Alternative 1, and Alternative 2 on fish populations and EFH are summarized in Table 3.9-9. The analysis of environmental stressors and alternatives indicated no significant impact to fish populations or habitat in U.S. territorial waters; likewise, no significant harm in non-territorial waters would be expected.

TABLE 3.9-9
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON FISH AND ESSENTIAL FISH HABITAT IN THE JAX STUDY AREA

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	NEPA and SFA (U.S. Territory)	Executive Order 12114 and SFA (Non-Territorial Waters, >12 nm)
No Action		
Vessel Movements	EFH – Vessel movements would result in short-term, localized disturbances to water column and *Sargassum* habitats. Impacts to *Sargassum* habitats would be avoided and minimized by mitigation measures. Vessel movements would not disturb the sea floor and would have no impact on benthic habitats. Impacts to EFH would be temporary and minimal. Fish/Managed Species – Vessel movements could elicit behavioral and/or physiological responses in fish, but the effects would be temporary and localized. The probability of vessel collisions with adult and juvenile fish would be low. Injury and mortality to fish eggs and larvae would occur, but the effects would be localized. No population-level impacts would occur.	EFH – Same as U.S. Territory. Fish/Managed Species – Same as U.S. Territory.
Aircraft Overflights	EFH – Aircraft overflights would result in short-term and localized increases in ambient sound levels in the water column and possibly in shallow water benthic habitats. Impacts to EFH would be temporary and minimal. Fish/Managed Species – Aircraft overflights could elicit behavioral and/or physiological responses in some species of fish, but the effects would be temporary and localized. No population-level impacts would occur.	EFH – Same as U.S. Territory. Fish/Managed Species – Same as U.S. Territory.

TABLE 3.9-9 (Continued)
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON FISH AND ESSENTIAL FISH HABITAT IN THE JAX STUDY AREA

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	NEPA and SFA (U.S. Territory)	Executive Order 12114 and SFA (Non-Territorial Waters, >12 nm)
Towed MIW Devices	Not applicable. Towed MIW devices would not be used in territorial waters.	EFH - Towed MIW devices would result in short-term, localized disturbances to water column and *Sargassum* habitats. Impacts to *Sargassum* habitats would be minimized by avoidance. Towed MIW devices would not disturb the sea floor and would have no impact on benthic habitats. Impacts to EFH would be temporary and minimal. Fish/Managed Species – Towed MIW devices could elicit behavioral and/or physiological responses in fish, but the effects would be temporary and localized. The probability of collisions with adult and juvenile fish would be low. Injury and mortality to fish eggs and larvae would occur, but the effects would be localized. No population-level impacts would occur.
MIW Training	Not applicable to the No Action Alternative.	Not applicable to the No Action Alternative.
NEPM	EFH – Similar to non-territorial waters, but lower magnitude because most NEPM is used in non-territorial waters. Fish/Managed Species - Similar to non-territorial waters, but lower magnitude because most NEPM is used in non-territorial waters.	EFH - Disturbances to water column habitats from NEPM strikes would be temporary and minimal. Impacts to *Sargassum* habitat would be minimal because Navy mitigation measures require avoidance of *Sargassum* mats. Impacts to soft bottom benthic EFH would be temporary and minimal. The total area of benthic habitat affected by non-explosive practice bombs, missiles, and naval gun shells would be small (about 7,151 ft^2 per year) and only a percentage of the total area affected (less than 7,151 ft^2 per year) would be sensitive benthic habitat such as live hard bottom or coral mounds. The total benthic habitat affected represents less than 0.000001% of the total hard bottom EFH in the Study Area. Non-

TABLE 3.9-9 (Continued)
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON FISH AND ESSENTIAL FISH HABITAT IN THE JAX STUDY AREA

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	NEPA and SFA (U.S. Territory)	Executive Order 12114 and SFA (Non-Territorial Waters, >12 nm)
		explosive practice bombs, missiles, and naval gun shells could result in long-term, minor effects to hard bottom EFH, but the effects would be localized and no long-term changes to community structure or function would be expected. Impacts to hard bottom EFH would be minimal based on the relatively small area affected. Fish/Managed Species - A remote possibility exists that some individual fish at or near the surface may be directly impacted if they are in the target area and at the point of physical impact at the time of NEPM delivery. Navy mitigation measures, which include avoidance of large *Sargassum* mats where some fish species tend to concentrate, reduce the probability of NEPM-related injury or mortality. A limited number of fish might be injured or killed, but NEPM strikes would not result in population-level effects.
UNDET and HE Ordnance	EFH – Underwater explosions in territorial waters would be limited to MINEX UNDETs and anti-swimmer grenades, which would result in disturbance to water column habitats. However, water column disturbances would be short-term and localized, and associated effects to water column EFH would be temporary and minimal. Impacts to *Sargassum* habitat would also be minimal because Navy mitigation measures require avoidance of *Sargassum* mats. Anti-swimmer grenades are not expected to impact benthic EFH because the explosions occur near the surface. UNDETs would result in short-term and localized impacts to soft bottom benthic habitat, but impacts to hard bottom EFH and artificial habitats would be avoided through mitigation measures. Assuming a worst–case scenario where all 18 MINEX 20-lb charges were detonated directly on the bottom, up to 227 to 253 ft^2 of soft bottom benthic habitat could	EFH – MINEX UNDETs and anti-swimmer grenade use may also occur in non-territorial waters and the effects would be the same as described for territorial waters. Explosions associated with BOMBEX, MISSILEX, and FIREX with IMPASS occur at or near the water's surface in relatively deep waters. Water column disturbances would be short-term and localized, and associated effects to water column EFH would be temporary and minimal. Impacts to *Sargassum* habitat would also be minimal because Navy mitigation measures require avoidance of *Sargassum* mats. Calculations indicate that the maximum radius of the gas bubble produced by these explosions would not extend to

TABLE 3.9-9 (Continued)
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON FISH AND ESSENTIAL FISH HABITAT IN THE JAX STUDY AREA

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	NEPA and SFA (U.S. Territory)	Executive Order 12114 and SFA (Non-Territorial Waters, >12 nm)
	be disturbed by underwater detonations per year. Crater effects are usually temporary in sand and mud bottoms and repopulation of displaced sediments should be relatively rapid compared to hard bottom areas (NRC, 2002). Impacts to EFH would be temporary and minimal. Fish/Managed Species – A limited number of fish would be killed in the proximity of underwater explosions. Additional fish would be injured and could subsequently die or suffer greater rates of predation. Beyond the range of lethal or injurious effects, there could be short-term effects such as masking, stress, behavioral changes, and hearing threshold shifts. However, given the relatively small area that would be affected, and the abundance and distribution of the species concerned, no population-level effects would be expected.	the sea floor. Therefore, explosions during these exercises are not expected to result in physical disturbance to benthic habitats. Impacts to EFH would be temporary and minimal. Fish/Managed Species – Effects would be similar to those described for territorial waters, but additional fish would be affected because explosions associated with BOMBEX, MISSILEX, and FIREX with IMPASS occur in non-territorial waters. Given the relatively small area that would be affected, and the abundance and distribution of the species concerned, no population-level effects would be expected.
MEM	EFH – The analyses presented in Sections 3.2, 3.3, and 3.6 predict that the majority of the expended materials would rapidly sink to the sea floor, become encrusted by natural processes, and incorporated into the sea floor, with no significant accumulations in any particular area and no significant negative effects to water quality or marine benthic communities. Based on the analyses presented in Sections 3.2, 3.3, and 3.6, impacts associated with military expended to EFH would be temporary and/or minimal. Fish/Managed Species – Some MEM could be ingested by some species of fish and could cause sublethal or lethal effects. However, the number of fish affected would be small and no population-level effects would occur.	EFH – Same as U.S. Territory. Fish/Managed Species – Same as U.S. Territory.
Conclusion	SFA – Impacts to EFH would be temporary and/or minimal. No reduction in the quality and/or quantity of EFH in the Study Area. NEPA - No significant impact to fish populations or habitat.	SFA – Impacts to EFH would be temporary and/or minimal. No reduction in the quality and/or quantity of EFH in the Study Area. Executive Order 12114 - No significant harm to fish populations or habitat.

TABLE 3.9-9 (Continued)
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON FISH AND ESSENTIAL FISH HABITAT IN THE JAX STUDY AREA

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	NEPA and SFA (U.S. Territory)	Executive Order 12114 and SFA (Non-Territorial Waters, >12 nm)
Alternative 1		
Vessel Movements	EFH - Slight increase compared to No Action. Fish/Managed Species - Slight increase compared to No Action.	EFH – Same as U.S. Territory. Fish/Managed Species – Same as U.S. Territory.
Aircraft Overflights	EFH - Slight increase compared to No Action. Fish/Managed Species - Slight increase compared to No Action.	EFH – Same as U.S. Territory. Fish/Managed Species – Same as U.S. Territory.
Towed Mine Warfare Devices	Not applicable. Towed MIW devices would not be used in territorial waters.	EFH – Similar to No Action with increase in sorties. Fish/Managed Species - Similar to No Action with increase in sorties.
Mine Warfare Training	Not applicable to Alternative 1.	Not applicable to Alternative 1.
NEPM	EFH – Similar to non-territorial waters, but lower magnitude because most NEPM is used in non-territorial waters. Fish/Managed Species - Similar to non-territorial waters, but lower magnitude because most NEPM is used in non-territorial waters.	EFH - Slight increase compared to No Action. Fish/Managed Species - Slight increase compared to No Action.
UNDET and HE Ordnance	EFH – Similar to No Action. Decrease in MINEX UNDETs and associated short-term effects to water column and soft bottom EFH. Fish/Managed Species - Similar to No Action. Decrease in MINEX UNDETs and associated effects to fish.	EFH – Similar to No Action. Decrease in MINEX UNDETs and associated short-term effects to water column and soft bottom EFH. Fish/Managed Species - Similar to No Action. Decrease in MINEX UNDETs and associated effects to fish.
MEM	EFH – Similar to No Action. Slight increase in ordnance-related materials, chaff, and self-protection flares. Fish/Managed Species - Similar to No Action. Slight increase in ordnance-related materials, chaff, and self-protection flares.	EFH – Same as U.S. Territory. Fish/Managed Species – Same as U.S. Territory.
Conclusion	SFA – Impacts to EFH would be temporary and/or minimal. No reduction in the quality and/or quantity of EFH in the Study Area. NEPA - No significant impact to fish populations or habitat.	SFA – Impacts to EFH would be temporary and/or minimal. No reduction in the quality and/or quantity of EFH in the Study Area. Executive Order 12114 - No significant harm to fish populations or habitat.

TABLE 3.9-9 (Continued)
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON FISH AND ESSENTIAL FISH HABITAT IN THE JAX STUDY AREA

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	NEPA and SFA (U.S. Territory)	Executive Order 12114 and SFA (Non-Territorial Waters, >12 nm)
Alternative 2		
Vessel Movements	EFH - Slight increase compared to No Action. Fish/Managed Species - Slight increase compared to No Action.	EFH – Same as U.S. Territory. Fish/Managed Species – Same as U.S. Territory.
Aircraft Overflights	EFH - Slight increase compared to No Action. Fish/Managed Species - Slight increase compared to No Action.	EFH – Same as U.S. Territory. Fish/Managed Species – Same as U.S. Territory.
Towed Mine Warfare Devices	Not applicable. Towed MIW devices would not be used in territorial waters.	EFH – Similar to No Action with increase in sorties. Fish/Managed Species - Similar to No Action with increase in sorties.
Mine Warfare Training	Same as those described for aircraft overflights and NEPM.	Same as those described for aircraft overflights and towed Mine Warfare devices.
NEPM	EFH – Similar to non-territorial waters, but lower magnitude because most NEPM is used in non-territorial waters. Fish/Managed Species - Similar to non-territorial waters, but lower magnitude because most NEPM is used in non-territorial waters.	EFH – Similar to No Action with increase in non-explosive practice bombs, missiles, and naval gun shells. The total area of benthic habitat affected by non-explosive practice bombs, missiles, and nval gun shells would be small (about 9,482 ft^2 per year) and only a percentage of the total area affected (less than 9,482 ft^2 per year) would be sensitive benthic habitat such as live hard bottom or coral mounds. The total benthic habitat affected represents less than 0.000001% of the total hard bottom EFH in the Study Area. Non-explosive practice bombs, missiles, and naval gun shells could result in long-term, minor effects to hard bottom EFH, but the effects would be localized and no long-term changes to community structure or function would be expected. Impacts to hard bottom EFH would be minimal based on the relatively small area affected. Fish/Managed Species – Similar to No Action with increased potential for

TABLE 3.9-9 (Continued)
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON FISH AND ESSENTIAL FISH HABITAT IN THE JAX STUDY AREA

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	NEPA and SFA (U.S. Territory)	Executive Order 12114 and SFA (Non-Territorial Waters, >12 nm)
		NEPM/fish strikes from increased NEPM use.
UNDET and HE Ordnance	EFH – Similar to No Action. Decrease in MINEX UNDETs and associated short-term effects to water column and soft bottom EFH. Fish/Managed Species - Similar to No Action. Decrease in MINEX UNDETs and associated effects to fish.	EFH – Decrease in MINEX UNDETs and associated short-term effects to water column and soft bottom EFH. Elimination of HE BOMBEX would result in a substantial decrease in water column disturbance. Fish/Managed Species - Decrease in MINEX UNDETs and associated effects to fish. Elimination of HE BOMBEX would result in a substantial decrease in associated effects to fish.
MEM	EFH – Similar to No Action. Slight increase in ordnance-related materials, chaff, and self-protection flares. Fish/Managed Species - Similar to No Action. Slight increase in ordnance-related materials, chaff, and self-protection flares.	EFH – Similar to No Action with increase in non-explosive practice bombs. Fish/Managed Species – Similar to No Action with increase in non-explosive practice bombs..
Conclusion	SFA – Impacts to EFH would be temporary and/or minimal. No reduction in the quality and/or quantity of EFH in the Study Area. NEPA - No significant impact to fish populations or habitat.	SFA – Impacts to EFH would be temporary and/or minimal. No reduction in the quality and/or quantity of EFH in the Study Area. Executive Order 12114 - No significant harm to fish populations or habitat.

3.10 SEABIRDS AND MIGRATORY BIRDS

3.10.1 Introduction and Methods

3.10.1.1 Regulatory Framework

This section focuses on seabirds in the open waters of the Atlantic Ocean and migratory birds that could seasonally migrate through the area. The analysis for birds occurring at Rodman Range and Lake George Range is provided in Section 3.11. Seabirds are birds whose normal habitat and food source is the sea, whether they utilize coastal waters (the nearshore), offshore waters (the continental shelf), or pelagic waters (the open sea) (Harrison, 1983). Migratory birds are any species or family of birds that live, reproduce, or migrate within or across international borders at some point during their annual life cycle. The seabirds addressed in this FEIS/OEIS are migratory birds.

The regulatory framework for seabirds and migratory birds is described in detail in Appendix K. The Migratory Bird Treaty Act (MBTA) of 1918 is the primary legislation in the United States established to conserve migratory birds. The MBTA prohibits the taking, killing, or possessing of migratory birds unless permitted by regulation. Incidental take of migratory birds during Department of Defense military readiness activities is addressed by a regulation promulgated by the Secretary of the Interior and published in the Federal Register on February 28, 2007 (50 CFR Part 21). One federally listed seabird species (roseate tern, *Sterna dougallii*) potentially occurs within the OPAREAs. Therefore, the ESA requirements discussed in Appendix K are applicable to the analysis of the roseate tern.

3.10.1.2 Assessment Methods and Data Used

General Approach to Analysis

The general approach to analysis for seabirds and migratory birds is the same as the approach described for marine mammals in Section 3.7.1.2.

Study Area

The Study Area for seabirds and migratory birds is described in Section 1.5 and is shown in Figure 1.5-1, and includes open waters of the Atlantic Ocean. The analysis for birds occurring at Rodman Range and Lake George Range is provided in Section 3.11.

Data Sources

A comprehensive and systematic review of relevant literature and data has been conducted to complete this analysis for seabirds and migratory birds and to ensure that best available data were used. Of the available scientific literature (both published and unpublished), the following types of documents were utilized in the assessment: journals, books, periodicals, bulletins, Department of Defense operations reports, EISs, and other technical reports published by government agencies, private businesses, consulting firms, or non-governmental conservation organizations. The scientific literature was also consulted during the search for geographic location data on the occurrence of resources within the Study Area. A primary source of information used to describe the affected environment for pelagic seabirds was the *Pelagic Bird Assessment for the Navy's Atlantic Operating Areas* (DoN, 2007), which provides information that describes and documents the life history and distribution of seabirds occurring along the U.S. Atlantic coast and in the offshore waters of the U.S. Navy's Atlantic Operating Areas. Descriptions of literature and data

searches conducted during preparation of the pelagic bird assessment report are described in detail in that document.

Factors Used to Assess Effects

This FEIS/OEIS analyzes potential effects to seabirds and migratory birds in the context of the MBTA, ESA (listed species only), NEPA, and EO 12114. The factors used to assess the significance of effects vary under these Acts. Factors considered under the MBTA, NEPA, and EO 12114 include the extent to which an alternative could diminish the capacity of a population of a migratory bird species to maintain genetic diversity, to reproduce, and to function effectively in its native ecosystem over a reasonable period of time. For purposes of ESA compliance, effects of the action were analyzed to make the Navy's determination of effect for listed species. The definitions used in making the determination of effect under Section 7 of the ESA are based on the USFWS and NMFS *Endangered Species Consultation Handbook* (USFWS and NMFS, 1998) and are provided in Section 3.7.1.2.

3.10.1.3 Warfare Areas and Associated Environmental Stressors

The Navy used a screening process to identify aspects of the proposed action that could act as stressors to seabirds and migratory birds. Navy subject matter experts de-constructed the warfare areas and operations included in the proposed action to identify specific activities that could act as stressors. Public and agency scoping comments, previous environmental analyses, previous agency consultations, laws, regulations, Executive Orders, and resource-specific information were also evaluated. This process was used to focus the information presented and analyzed in the affected environment and environmental consequences sections of this FEIS/OEIS. As summarized in Table 3.10-1, potential stressors to seabirds and migratory birds include vessel movements (disturbance and collisions), aircraft overflights (disturbance and strikes), towed Mine Warfare devices (strikes), Mine Warfare Training (non-explosive mine shape deployment/recovery), NEPM (disturbance and strikes), UNDETs and HE ordnance, and MEM (targets, chaff, self-protection flares, and marine markers). The potential effects of these stressors on seabirds and migratory birds are analyzed in detail in Section 3.10.3.

As discussed in Section 3.3 – Water Resources and Section 3.4 – Air Quality, some water and air pollutants would be released into the environment as part of the proposed action. The analyses presented in Sections 3.3 and 3.4 indicate that any increases in water or air pollutant concentrations resulting from Navy training in the Study Area would be negligible and localized, and impacts to water and air quality would not be significant. Based on the analyses presented in Sections 3.3 and 3.4, water and air quality changes would have no effect or negligible effects on seabirds and migratory birds. Accordingly, the effects of water and air quality changes on seabirds and migratory birds are not addressed further in this FEIS/OEIS.

TABLE 3.10-1
SUMMARY OF POTENTIAL STRESSORS TO SEABIRDS AND MIGRATORY BIRDS

Warfare Area and Operation	Training Areas	Vessel Movements (Disturbance)	Vessel Movements (Collisions)	Aircraft Overflights (Disturbance)	Aircraft Overflights (Strikes)	Towed Mine Warfare Devices	Non-explosive Mine Shape Deployment/Recovery	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Material
Mine Warfare (MIW)										
Mine Laying	Lake George Range									
MCM	Carrier Operating Areas	✓	✓	✓	✓	✓				
Mine Neutralization	Charleston OPAREA (North and South UNDET Boxes)	✓	✓	✓	✓		✓	✓	✓	✓
Surface Warfare (SUW)										
MISSILEX (A-S)	W-157A (Area 4X) and W-159A (Area 5X)			✓	✓			✓	✓	✓
GUNEX (A-S)	W-132, W-133, W-134, W-157, W-158			✓	✓			✓		✓
GUNEX (S-S) Boat	Charleston OPAREA (Areas 11J)	✓	✓					✓		✓
GUNEX (S-S) Ship	JAX OPAREA (AA, BB, and CC)	✓	✓					✓		✓
BOMBEX (A-S) (at sea)	HE, W-158 (31J) NEPM, W157A/B and W-158 A/B			✓	✓			✓	✓	✓
Laser Targeting	W-132, W-133, W-134, W-157, W-158			✓	✓					
GUNEX (S-S) (FAC/FIAC)	Amber Strait: Charleston OPAREA (Boxes Q-9&10, R-9&10)	✓	✓							
VBSS/MIO-Ship	JAX and Charleston OPAREAs	✓	✓							
VBSS/MIO-Helicopter	W-157A (Area 4X) and W-159A (Area 5X)			✓	✓					

TABLE 3.10-1 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO SEABIRDS AND MIGRATORY BIRDS

Warfare Area and Operation	Training Areas	Vessel Movements (Disturbance)	Vessel Movements (Collisions)	Aircraft Overflights (Disturbance)	Aircraft Overflights (Strikes)	Towed Mine Warfare Devices	Non-explosive Mine Shape Deployment/Recovery	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Material
Air Warfare (AW)										
ACM	W-157A (Areas 3X & 4X)			✓	✓					
Air Intercept Control	JAX and Charleston OPAREAs	✓	✓	✓	✓					
ACM Chaff Exercise	W-157A (Areas 3X & 4X)			✓	✓					✓
ACM Flare Exercise	W-157A (Areas 3X & 4X)			✓	✓					✓
MISSILEX (A-A)	W-132, W-133, W-134, W-157, W-158			✓	✓			✓	✓[1]	✓
MISSILEX (S-A)	JAX and Charleston OPAREAs									✓
Detect-to-Engage	W-132, W-133, W-134, W-157, W-158	✓	✓	✓	✓					
GUNEX (S-A)	JAX OPAREA (AA, BB, and CC)	✓	✓	✓	✓			✓		✓
GUNEX (A-A)	W-157A/W-133 (Area 2X)									✓
Amphibious Warfare (AMW)										
FIREX (S-S) with IMPASS	JAX OPAREA (BB and CC)	✓	✓					✓	✓	✓
Strike Warfare (STW)										
BOMBEX (A-G)	Rodman Range									
CSAR and Convoy Operations	Rodman Range									
Electronic Combat (EC)										
EC Operations - Aircraft	W-132, W-133, W-134, W-157, W-158			✓	✓					

TABLE 3.10-1 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO SEABIRDS AND MIGRATORY BIRDS

Warfare Area and Operation	Training Areas	Vessel Movements (Disturbance)	Vessel Movements (Collisions)	Aircraft Overflights (Disturbance)	Aircraft Overflights (Strikes)	Towed Mine Warfare Devices	Non-explosive Mine Shape Deployment/Recovery	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Material
EC Operations - Surface Ships	JAX and Charleston OPAREAs	✓	✓							
Chaff Exercise	JAX and Charleston OPAREAs	✓	✓	✓	✓					✓
Flare exercise - Helicopter	Lake George Range									
Other Training										
SESEF Utilization	5-15 nm east of Mayport	✓	✓							
Precision Anchoring	NS Mayport	✓								
Small Arms with anti-swimmer grenades (MK3A2)	Charleston OPAREA (Area 10L, 12I)	✓	✓						✓	✓

[1] Missile explodes in air, no explosive sound in the water.

3.10.2 Affected Environment

3.10.2.1 Seabirds and Migratory Birds

Table 3.10-2 provides a list of seabirds that could potentially occur in the OPAREAs. Seabird distribution and abundance varies considerably by species, with some species primarily occurring in nearshore habitats and others primarily occurring in offshore pelagic habitats. The area from the beach to about 10 nm offshore provides foraging areas for breeding terns, gulls, skimmers, and pelicans; a migration corridor and winter habitat for terns, gulls, skimmers, pelicans, loons, cormorants, and gannets; and supports non-breeding and transient pelagic seabirds. Offshore pelagic waters support non-breeding and transient pelagic seabirds, loons, gannets, and several tern species (Hunter *et al.*, 2006). Pelagic seabirds are generally widely distributed, but they tend to congregate in areas of higher productivity and prey availability (Haney, 1986). Such areas include the Gulf Stream, particularly the western frontal boundary and associated eddies and upwelling; areas with productive live/hard bottom habitats, including Gray's Reef and Charleston Bump, and large *Sargassum* mats. Downstream (north) of the Charleston Bump, a somewhat permanent cyclonic circulation (the Charleston Gyre) is generated as Gulf Stream Current encounters this sudden physiographic change. This area off South Carolina is a highly dynamic area where pelagic *Sargassum* can become concentrated (SAFMC, 1998; Govoni and Hare, 2001). No current population estimates exist for pelagic seabirds in the Southeastern United States region (Hunter *et al.*, 2006).

The roseate tern is listed under the ESA and could potentially occur in the OPAREAs. Additional information about this species is provided below. Critical habitat for listed birds has not been designated under the ESA within the OPAREAs. While not listed under the ESA, others species potentially occurring in the OPAREAs are of management concern based on relatively low or declining populations, including the black-capped petrel, masked and brown boobies, razorbill, sooty shearwater, and northern gannet (Hunter *et al*., 2006). The black-capped petrel is of particular concern because the worldwide breeding population is currently estimated at 1,000 pairs (BirdLife International, 2007a). Waters in or adjacent to the Gulf Stream between northern Florida and southern Virginia comprise the primary non-breeding range of black-capped petrels. The main foraging area appears to be offshore from Cape Hatteras National Seashore, North Carolina (Hunter *et al*., 2006), which is outside the Study Area.

TABLE 3.10-2
SEABIRDS POTENTIALLY OCCURRING IN THE OPAREAS

Family and Scientific Name	Common Name
Alcidae	
Alca torda	Razorbill
Alle alle	Dovekie
Uria lomvia	Thick-billed murre
Diomedeidae	
Thalassarche chlororhynchos	Yellow-nosed albatross
Fregatidae	
Fregata magnificens	Magnificent frigatebird
Gaviidae	
Gavia immer	Common loon
Hydrobatidae	
Oceanites oceanicus	Wilson's storm-petrel
Oceanodroma castro	Band-rumped storm-petrel
Oceanodroma leucorhoa	Leach's storm-petrel
Laridae	
Anous stolidus	Brown noddy
Larus argentatus	Herring gull
Larus atricilla	Laughing gull
Larus delawarensis	Ring-billed gull
Larus fuscus	Lesser black-backed gull
Larus glaucoides	Iceland gull
Larus hyperboreous	Glaucous gull
Larus marinus	Great black-backed gull

TABLE 3.10-2 (Continued)
SEABIRDS POTENTIALLY OCCURRING IN THE OPAREAS

Family and Scientific Name	Common Name
Larus minutus	Little gull
Larus ridibundus	Black-headed gull
Larus thayeri	Thayer's gull
Larus philadelphia	Bonaparte's gull
Rissa tridactyla	Black-legged kittiwake
Stercorarius maccormicki	South polar skua
Sterna anaethetus	Bridled tern
Sterna antillarum	Least tern(1)
Sterna caspia	Caspian tern
Sterna dougallii	Roseate tern(2)
Sterna forsteri	Forster's tern
Sterna fuscata	Sooty tern
Sterna hirundo	Common tern
Sterna maxima	Royal tern
Sterna nilotica	Gull-billed tern
Sterna sandvicensis	Sandwich tern
Pelecanidae	
Pelecanus erythroryhyncos	American white pelican
Pelecanus occidentalis	Brown pelican
Phaethontidae	
Phaethon aethereus	Red-billed tropicbird
Phaethon lepturus	White-tailed tropicbird
Phalacrocoracidae	
Phalacrocorax auritus	Double-crested cormorant
Phalacrocorax carbo	Great cormorant
Procellariidae	
Calonectris diomedea	Cory's shearwater
Fulmarus glacialis	Northern fulmar
Pterodroma feae	Fea's petrel
Pterodroma hasitata	Black-capped petrel
Puffinus gravis	Greater shearwater
Puffinus griseus	Sooty shearwater
Puffinus lherminieri	Audubon's shearwater
Puffinus puffinus	Manx shearwater
Scolopacidae	

TABLE 3.10-2 (Continued)
SEABIRDS POTENTIALLY OCCURRING IN THE OPAREAS

Family and Scientific Name	Common Name
Phalaropus fulicarius	Red phalarope
Phalaropus lobatus	Red-necked phalarope
Sulidae	
Sula dactylatra	Masked booby
Sula leucogaster	Brown booby
Stercorariidae	
Stercorarius parasiticus	Parasitic jaeger
Stercorarius longicaudus	Long-tailed jaeger
Stercorarius pomarinus	Pomarine jaeger

Source: DoN, 2007

(1) Least tern is federally listed as endangered on the U.S. west coast and interior rivers. Birds that might occur in the JAX Study Area are not federally listed.

(2) Northeast breeding population of the roseate tern is federally listed as endangered. Listed as threatened in other areas.

3.10.2.2 Endangered Species Act-Listed Birds

The roseate tern could potentially occur in the JAX Study Area and is listed under the ESA. Additional information about this species is provided below. Critical habitat has not been designated under the ESA within the JAX Study Area. The piping plover (*Charadrius melodus*), which is federally listed as threatened, is known to occur adjacent to the JAX Study Area. Atlantic coast piping plovers breed on coastal beaches from Newfoundland and southeastern Quebec to North Carolina. They forage along the shoreline and on mud flats. None of the proposed training activities would take place within 1 mile of the shoreline. Therefore, the piping plover would not be exposed to stressors associated with the proposed activities and is not addressed in further detail in this EIS/OEIS. The Navy has completed the ESA Section 7 informal consultation process with USFWS. In a letter dated October 7, 2008, USFWS concurred that Alternative 2 (the Preferred Alternative) would have no effect on the piping plover (Appendix C).

Roseate Tern

Status and Management

The northeastern breeding population of roseate terns is listed as endangered under the ESA. The range of this population extends along the U.S. Atlantic coast from Canada south to North Carolina (USFWS, 2007a and 2007b). Roseate terns in this population are known to occur in Maine, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, North Carolina, and Virginia as well as in Newfoundland, Nova Scotia, and Quebec. Beyond the northeastern region, the roseate tern is listed as threatened in the Western Hemisphere and adjacent oceans, essentially wherever it is not listed as endangered. Threatened populations are known to occur in Florida, Georgia, North Carolina, South Carolina, Puerto Rico, and the U.S. Virgin islands (USFWS, 2007a).

The global population is estimated to be 40,000 breeding pairs. The northeastern population has been fluctuating at around 3,500 pairs, recording a low of 3,125 pairs in 1992 and a high of 3,775 pairs in 1996 (BirdLife International, 2007b; USFWS, 2007b). In 1993, the Caribbean population was estimated to be between 5,000 and 8,500 pairs with 350 of those pairs breeding in the Florida Keys (USFWS, 2007b).

Distribution

The roseate tern is widespread in the Atlantic, Indian, and southwestern Pacific oceans; although local populations are generally small (BirdLife International, 2007b; NatureServe, 2007). In the Atlantic, the northeastern breeding population is concentrated in isolated colonies mainly between Cape Cod, Massachusetts and Long Island, New York. The northern population migrates to their Caribbean wintering grounds well off the Atlantic Coast and are only rarely observed during pelagic trips or in coastal areas in the Southeastern United States (Hunter *et al.*, 2006). Additionally, a Caribbean population breeds in the Florida Keys, the Bahamas, the West Indies, and in other locations in central and northern South America. Non-breeding populations are found in and around the Bahamas, Cuba, and the Lesser Antilles (NatureServe, 2007).

Roseate Tern Occurrence in JAX Study Area

Roseate terns are not expected to occur in the JAX Study Area except as occasional transient individuals.

3.10.3 Environmental Consequences

3.10.3.1 No Action Alternative

Vessel Movements

As discussed in Section 3.7.3, many of the ongoing and proposed operations within the OPAREAs involve maneuvers by various types of Navy vessels. Birds could be exposed to moving vessels throughout the Study Area, but direct encounters would be few based on the infrequency of operations and the low density of vessels within the Study Area at any given time (0 to 10 vessels at any given time, maximum density less than 0.0002 vessels/nm^2, see Section 3.7.3 for overview of vessel movements). The Navy would log about 1,000 total steaming days within the Study Area during a typical year under the No Action Alternative (Table 2.2-5).

Birds respond to moving vessels in various ways. Some birds commonly follow vessels, including certain species of gulls, storm petrels, and albatrosses (Hamilton, 1958; Hyrenbach, 2001; Hyrenbach, 2006); while other species such as frigate birds and sooty terns seem to avoid vessels (Borberg *et al*., 2005; Hyrenbach, 2006). Vessel movements could elicit short-term behavioral or physiological responses (*e.g.,* alert response, startle response, fleeing the immediate area, temporary increase in heart rate). However, the general health of individual birds would not be compromised (see additional discussion of these responses below under aircraft overflights). Direct collisions with vessels or interactions with a vessel's rigging (fishing gear, wires, poles, masts, *etc*.) can result in bird injury or mortality. The possibility of encounters could increase at night, especially during inclement weather. Birds can become disoriented at night in the presence of artificial light (Bruderer *et al*., 1999; Black, 2005) and lighting on vessels may attract some seabirds (Hunter *et al*., 2006), increasing the potential for harmful encounters. Harmful seabird/vessel interactions are commonly associated with commercial fishing vessels because birds

are attracted to concentrated food sources around these vessels (Melvin *et al*., 2001; Dietrich and Melvin, 2004).

Based on the low Navy vessel density and patchy distribution of seabirds in the Study Area, the probability of bird/vessel collisions is extremely low. Navy training activities attempt to simulate war like conditions; therefore, vessels do not typically use large deck lights or strobes in an attempt to remain visually disguised. This reduces the potential attraction of nocturnal foraging seabirds. Furthermore, the concentrated food sources that attract seabirds to commercial fishing vessels are not present around Navy vessels. Navy mitigation measures (see Chapter 5), which include avoidance of large *Sargassum* mats where seabirds tend to concentrate, further reduce the probability of vessel disturbance and collisions. If a bird were to collide with a vessel, injury or mortality could occur. Vessel movements under the No Action Alternative would not have a significant adverse effect on migratory bird populations as defined by MBTA regulations applicable to military readiness activities. In accordance with NEPA, vessel movements in territorial waters would have no significant impact on birds. Furthermore, vessel movements in non-territorial waters would not cause significant harm to birds in accordance with EO 12114. Effects of the No Action Alternative on the federally listed roseate tern are analyzed below.

Aircraft Overflights

Aircraft Disturbance

Various types of fixed-wing aircraft and helicopters are used in training exercises throughout the Study Area (see Chapter 2 and Appendix D). Seabirds and other migratory birds could be exposed to airborne noise associated with subsonic and supersonic fixed-wing aircraft overflights and helicopter operations (see Section 3.5 – Noise Environment for a description of the existing noise environment and Appendix H for an overview of airborne acoustics). Birds could be exposed to elevated noise levels while foraging or migrating in open water environments within the Atlantic Ocean. Exposure of birds to aircraft noise while on land would be negligible because few overflights occur in nearshore areas.

Numerous studies have documented that birds and other wild animals respond to human-made noise including aircraft overflights, weapons firing, and explosions (Larkin, 1996; National Park Service, 1994; Plumpton, 2006). The manner in which birds respond to noise depends on several factors including life-history characteristics of the species, characteristics of the noise source, loudness, onset rate, distance from the noise source, presence/absence of associated visual stimuli, and previous exposure. Researchers have documented a range of bird behavioral responses to noise including no response, alert behavior, startle response, flying or swimming away, diving into the water, and increased vocalizations. While difficult to measure in the field, some of these behavioral responses are likely accompanied by physiological responses, such as increased heart rate, or stress. Chronic stress can compromise the general health of birds, but stress is not necessarily indicative of negative consequences to individual birds or to populations (Larkin, 1996; National Park Service, 1994; Bowles, *et al*., 1990 in Larkin, 1996). For example, the reported behavioral and physiological responses of birds to noise exposure are within the range of normal adaptive responses to external stimuli, such as predation, that birds face on a regular basis. Unless repeatedly exposed to loud noises or simultaneously exposed to synergistic stressors, it is possible that individuals would return to homeostasis almost immediately after exposure and the individual's overall metabolism and energy budgets would not be affected. Studies have also shown that birds can become habituated to noise following frequent exposure and cease to respond behaviorally to

the noise (Larkin, 1996; National Park Service, 1994; Plumpton, 2006). Little is known about physiological responses of birds that have habituated to noise.

Approximately 1,607 fixed-wing sorties would occur in the OPAREAs annually under the No Action Alternative and approximately 98 percent of the sorties would be above 3,000 feet. Bird exposure to fixed-wing aircraft noise would be brief (seconds) as an aircraft quickly passes overhead. Exposures would be infrequent based on the transitory and dispersed nature of the overflights; repeated exposure of individual birds over a short period of time (hours or days) is extremely unlikely.

It is quite possible that seabirds at or near the sea surface would not respond to overflight noise based on the relatively high flight altitudes (3,000 to 30,000 feet). Most documented responses of birds have been to low-level aircraft overflights occurring below 3,000 feet (National Park Service, 1994). As discussed above, the duration of exposure would be very short (seconds) and exposures would be infrequent. Unlike the situation at a busy commercial airport or military landing field, repeated exposure of individual birds or groups of birds is unlikely based on the dispersed nature of the overflights. If birds were to respond to an overflight, the responses would be limited to short-term behavioral or physiological reactions (*e.g.,* alert response, startle response, temporary increase in heart rate) and the general health of individual birds would not be compromised.

Approximately 487 helicopter sorties would occur in the OPAREAs annually under the No Action Alternative. Unlike fixed-wing aircraft, helicopter training operations occur mostly at low altitudes (approximately 90% below 3,000 feet AGL and 10% below 200 feet AGL), which increases the likelihood that birds would respond to helicopter overflights. In addition, some studies have suggested that birds respond more to disturbance from helicopters than from that of fixed-wing aircraft (Larkin, 1996; Plumpton, 2006). Noise from low-altitude helicopter overflights would be expected to elicit short-term behavioral or physiological responses (*e.g.,* alert response, startle response, temporary increase in heart rate) in exposed birds. Repeated exposure of individual birds or groups of birds is unlikely based on the dispersed nature of the overflights. The general health of individual birds would not be compromised.

In summary, aircraft noise under the No Action Alternative could elicit short-term behavioral or physiological responses in exposed birds. Helicopter overflights are more likely to elicit responses than fixed-wing aircraft, but the general health of individual birds would not be compromised. Aircraft noise under the No Action Alternative would not have a significant adverse effect on migratory bird populations as defined by MBTA regulations applicable to military readiness activities. In accordance with NEPA, aircraft noise over territorial waters would have no significant impact on birds. Furthermore, aircraft noise over non-territorial waters would not cause significant harm to birds in accordance with EO 12114.

Aircraft Strikes

Wildlife/aircraft strikes are a major concern for the Navy because they can cause harm to aircrews, damage to equipment, and injury or mortality to wildlife. From 2002 through 2004 an annual average of 596 known wildlife/aircraft strike events occurred Navy-wide and most of these events involved birds (Navy Safety Center, 2004). While all wildlife/aircraft strikes are considered serious and dangerous events, the number of animals injured or killed annually is small considering the number of Navy-wide aircraft operations. While bird strikes can occur anywhere aircraft are operated, Navy data indicate they occur most often over land or close to shore. The potential for bird strikes to occur in offshore areas is relatively low because operations are widely dispersed at

relatively high altitudes (above 3,000 feet for fixed-wing aircraft) and bird densities are generally low. For example, from 2002 through 2004 only five known bird strikes involving vessel-based aircraft occurred Navy-wide. Of the 1,789 Navy-wide, wildlife strike events reported for 2002 through 2004, only 19 (1%) involved seabirds. Nine (47%) of the seabird strike events involved gulls (Navy Safety Center, 2004), which commonly occur in terrestrial environments or over nearshore waters. Few, if any, bird/aircraft strikes and associated bird mortalities or injuries are expected to occur in the Study Area under the No Action Alternative. Aircraft strikes under the No Action Alternative would not have a significant adverse effect on migratory bird populations as defined by MBTA regulations applicable to military readiness activities. In accordance with NEPA, aircraft strikes over territorial waters would have no significant impact on birds. Furthermore, aircraft strikes over non-territorial waters would not cause significant harm to birds in accordance with EO 12114.

Towed Mine Warfare Devices

As described in Chapter 2 and Appendix D, Mine Warfare Exercises conducted in the Study Area include the use of various underwater mine detection and countermeasures systems that are towed through the water by helicopters flying approximately 75 feet above the water at low airspeeds. Seventy-eight towed Mine Warfare device sorties would be conducted in Amber Strait and Kaiser Carrier Operating Area (Figure 2.2-1) under the No Action Alternative. Birds could be injured or killed if they were struck by the towed device or the tow line connecting the helicopter to the device. The noise, downdraft, and visual cues from the oncoming helicopter would likely cause birds to flee the immediate area. Birds could be struck by the tow line during an evasive response because the tow line might be difficult to see. However, it is expected that birds would evade the helicopter long before the tow lines present a strike risk. Similar to aircraft strikes discussed above, few, if any, bird/towed device strikes and associated bird mortalities or injuries are expected to occur in the Study Area under the No Action Alternative. Towed Mine Warfare device use under the No Action Alternative would not have a significant adverse effect on migratory bird populations as defined by MBTA regulations applicable to military readiness activities. Towed Mine Warfare devices would not be used in territorial waters under the No Action Alternative. In accordance with EO 12114, towed MIW devices used in non-territorial waters would not cause significant harm to birds.

Mine Warfare Training (Non-explosive Mine Shape Deployment / Recovery)

The No Action Alternative does not include establishment of Mine Warfare Training Areas where non-explosive mineshapes would be deployed.

Non-Explosive Practice Munitions

Weapons Firing Disturbance

Current Navy operations in the OPAREAs include firing a variety of weapons and employ a variety of NEPM, including bombs, missiles, naval gun shells, cannon shells, and small caliber ammunition. NEPM use occurs in several training areas within the OPAREAs, but it is not used in state waters (0 to 3 nm from shore) (see Table 2.2-6 for a summary of ordnance use by training area). Disturbance associated with weapons firing noise and direct NEPM strikes are potential stressors to birds.

As discussed above for fixed-wing aircraft and helicopter operations, bird responses to weapons firing noise would be limited to short-term behavioral or physiological responses (*e.g.,* alert response, startle response, temporary increase in heart rate). These operations are often preceded

by some other type of activity in the general area such a vessel movement or target setting, which might disperse birds away from the associated weapons firing noise. Therefore, birds might not be exposed to the loudest noise levels associated with weapons firing. The general health of individual birds would not be compromised and weapons firing noise would not result in significant impacts to migratory bird populations as defined by MBTA regulations applicable to military readiness activities. In accordance with NEPA, weapons firing noise in territorial waters would have no significant impact on birds. Furthermore, weapons firing noise in non-territorial waters would not cause significant harm to birds in accordance with EO 12114.

Non-Explosive Practice Munitions Strikes

Fired NEPM has the potential to directly strike birds as it travels through the air to its intended target. As discussed in Sections 3.7.3 and 3.8.3, statistical modeling conducted for the JAX Study Area indicates that the probability of NEPM striking marine mammals and sea turtles is extremely low. Statistical modeling could not be conducted to estimate the probability of seabird/NEPM strikes because seabird density data are not available. Nonetheless, several factors discussed below indicate that the probability of NEPM directly striking a seabird is also expected to be extremely low under the No Action Alternative.

The small number of bombs and missiles that would be expended in the Study Area annually (Table 2.2-5), coupled with the often patchy distribution of seabirds (Schneider and Duffy, 1985; Haney, 1986; Fauchald *et al*., 2002), suggest that the probability of these types of NEPM striking a seabird would be extremely low. The number of cannon shells, gun shells, and small arms rounds that would be expended annually during gunnery exercises is much higher (Table 2.2-5). However, the total number of rounds expended is not a good indicator of strike probability during gunnery exercises because multiple rounds are fired at individual targets. Human activity such as vessel or boat movement, aircraft overflights, and target setting, could cause birds to flee a target area prior to the onset of firing, thus avoiding harm. If birds were in the target area, they would likely flee the area after the initial rounds strike the target area (assuming birds were not struck by the initial rounds). Navy mitigation measures, which include, but are not limited to avoidance of large *Sargassum* mats where seabirds tend to concentrate, further reduce the probability of NEPM strikes (see Chapter 5 for detailed description of mitigation measures). While a remote possibility exists that some individuals of some bird species may be directly impacted if they are in the target area and at the point of physical impact at the time of ordnance delivery, NEPM strikes under the No Action Alternative would not result in significant impacts to populations of migratory birds as defined by MBTA regulations applicable to military readiness activities. In accordance with NEPA, NEPM strikes in territorial waters would have no significant impact on birds. Furthermore, NEPM strikes in non-territorial waters would not cause significant harm to birds in accordance with EO 12114.

Underwater Detonations and High Explosive Ordnance

Explosions that occur in the OPAREAs are associated with training exercises that use HE ordnance, including bombs (BOMBEX), anti-swimmer grenades (Small Arms), missiles (MISSILEX), and naval gun shells (FIREX with IMPASS, 5-inch HE rounds), as well as UNDETs associated with Mine Neutralization training (MINEX). Underwater detonation and HE ordnance use is limited to specific training areas (see Table 2.2-7 for a summary of explosions by training area) and does not occur in state waters (0 to 3 nm from shore). The potential for seabirds to be

exposed to explosions is difficult to quantify and depends on several factors including the following:

- The geographic location of the explosions within the Study Area and whether or not birds are present at the time of the explosion. Table 2.2-7 provides a summary of explosions by training area.
- Position of the explosion in relationship to the sea surface (*e.g.*, altitude above the surface, at the surface, and depth below the surface). Explosions associated with bombs, missiles, and naval gun shells occur at or immediately below the sea surface, while UNDETs occur on the bottom and at depths below the surface.
- Position of the bird in the environment at the time of explosion (*e.g.*, in the air, on the surface, diving below the surface). Studies show that birds are more susceptible to underwater explosions when they are submerged versus on the surface (Yelverton, *et al.*, 1973). Similarly, birds in flight are expected to be less susceptible to underwater explosions than those on the surface.
- Magnitude of the explosion (*i.e.*, net explosive weight) and the ZOI associated with the explosion. While ZOIs cannot be calculated for seabirds based on available data, higher NEWs would produce larger ZOIs. Of the explosions that occur in the Study Area, HE bombs are expected to have the largest ZOIs (see Table 2.2-7 for NEW values).

In general, the effects of explosions correspond to the distance of the animal from the explosion, ranging from lethal injury to short-term behavioral effects. Birds in the immediate vicinity of an explosion could be susceptible to lethal injury and birds on the outer edges of the ZOI could exhibit a short-term behavioral response. Yelverton *et al.* (1973) found that ducks submerged 2 feet below the surface experienced 100 percent mortality when exposed to 1-lbs underwater charges at slant ranges of 28 feet or less. Mortality decreased at slant ranges of 31 to 33 feet (33%) and no mortality was observed at a slant range of 36 feet. Most birds at 36 feet experienced extensive lung hemorrhage and some experienced liver ruptures, hemorrhagic kidneys, and eardrum ruptures. No internal injuries were found at a slant range of 110 feet for submerged ducks exposed to 1-lbs charges. Ducks exposed while on the water surface were less susceptible to injury and death than the submerged ducks. Death occurred at slant ranges of 13 to 14 feet for ducks on the surface when exposed to 8-lbs charges. Ducks exposed to 8-lbs charges while on the surface survived at slant ranges of 15 to 21 feet, but they experienced internal injuries. No mortality was observed in ducks on the surface when exposed to 1-lbs changes at slant ranges of 10 to 18 feet, but internal injuries were observed in all birds except at 18 feet (Yelverton *et al.*, 1973).

While the effects of explosions in the Study Area on seabirds cannot be quantified, lethal injury to some individuals of some bird species could occur based on the total number of explosions that would take place per year (Table 2.2-7) under the No Action Alternative.

Navy mitigation measures are expected to reduce, but not eliminate, the potential for seabird mortality from explosions. As discussed in Chapter 5 Navy mitigation measure include, but are not limited to avoidance of large *Sargassum* mats where some seabirds tend to concentrate. Human activity such as vessel movement, aircraft overflights, and target setting, could cause birds to flee a target area prior to the onset of an explosion, thus avoiding harm. In addition, birds in flight during an explosion would be less susceptible to harm than birds on the sea surface or diving underwater during an explosion.

On the other hand, seabirds could be attracted to an area to forage if an explosion resulted in a fish kill. This would only be a concern for events that involve multiple explosions in the same area over a relatively long period of time (8 hours) such as FIREX with IMPASS events, which involve firing 39 HE 5-in rounds per event.

While some seabird mortality could occur, the above analysis indicates that a small number of birds would be affected and that population level effects would not be expected. UNDETs and HE ordnance use under the No Action Alternative would not result in significant impacts to populations of migratory birds as defined by MBTA regulations applicable to military readiness activities. In accordance with NEPA, underwater detonations and HE ordnance use in territorial waters would have no significant impact on birds. Furthermore, UNDETs and HE ordnance use in non-territorial waters would not cause significant harm to birds in accordance with EO 12114.

Military Expended Material

The Navy uses a variety of MEM during training exercises conducted in the Study Area. The types and quantities of MEM and information regarding fate and transport of this material within the marine environment are discussed in Section 3.2. A majority of the MEM currently used by the Navy rapidly sinks to the sea floor and seabirds would not be exposed to this material. Ordnance-related material would sink in relatively deep waters, would not present an ingestion risk to seabirds, and would have no effect on birds. Most targets are recovered after use, while some targets such as metal drums rapidly sink after use. Targets would have no effect on birds. However, seabirds could be exposed to some material such as chaff fibers in the air or at the sea surface through direct contact or inhalation. Seabirds could also ingest some types of MEM if the material floats on the sea surface or become entrained in *Sargassum* mats at the surface.

Based on the dispersion characteristics of chaff, large areas of air space and open water within the Study Area would be exposed to chaff, but the chaff concentrations would be very low (see Section 3.7.4.1). Several literature reviews and controlled experiments have indicated that chaff poses little environmental risk except at concentrations substantially higher than those that could reasonably occur from military training use (Arfsten *et al*., 2002; Hullar *et al*., 1999; and USAF, 1997). Birds would occasionally come in direct contact with chaff fibers, but such contact would be inconsequential. Chaff is similar in form to fine human hair (USAF, 1997). Due to its flexible nature and softness, external contact with chaff would not be expected to adversely affect most wildlife (USAF, 1997) and the fibers would quickly blow off or wash off shortly after contact. Inhalation of chaff fibers is not expected to have any adverse effects on birds because the fibers are too large to be inhaled into the lung. If inhaled, the fibers are predicted to deposit in the nose, mouth, or trachea and are either swallowed or expelled (Hullar *et al*., 1999).

While chaff clouds are undetectable to the human eye (Arfsten *et al*., 2002), the ability of a bird to see a chaff cloud and possibly become disoriented is unknown. Normally, chaff exercises occur above 10,000 ft altitude and most are during the day. Birds normally are below 1,000 ft except during migration and then they primarily migrate at night. There are exceptions to both of these generalizations, but any overlap of occurrence of birds and high concentrations of chaff would be rare. Therefore, chaff would not be expected to disorient birds or effect bird migration.

After falling from the air, chaff fibers float on the sea surface for some period of time depending on wave and wind action. Seabirds would be expected to unintentionally ingest low concentrations of floating chaff fibers, which consist of about 60 percent silica and 40 percent aluminum by weight.

Some fibers would likely become entrained in *Sargassum* mats and remain at or near the surface for longer periods of time.

Ingestion of chaff fibers is not expected to cause physical damage to a bird's digestive tract based on the small size (ranging in lengths of 0.25 to 3 inches with a diameter of about 40 micrometers) and flexible nature of the fibers and the small quantity that could reasonably be ingested. In addition, concentrations of chaff fibers that could reasonably be ingested are not expected to be toxic to birds. Scheuhammer (1987) reviewed the metabolism and toxicology of aluminum in birds and mammals. Intestinal adsorption of orally ingested aluminum salts was very poor, and the small amount adsorbed was almost completely removed from the body by excretion. Dietary aluminum normally has small effects on healthy birds and mammals, and often high concentrations (>1,000 mg/kg) are needed to induce effects such as impaired bone development, reduced growth, and anemia (Nybo, 1996). A bird weighing approximately 1 kg would need to ingest more than 83,000 chaff fibers per day to receive a daily aluminum dose equal to 1,000 mg/kg (based on chaff consisting of 40% aluminum by weight and a 5-ounce chaff canister containing 5 million fibers). As an example, an adult herring gull weighs about 0.8 to 1.2 kg (Cornell Lab of Ornithology, 2008). It is highly unlikely that a bird would ingest a toxic dose of chaff based on the anticipated environmental concentration of chaff (1.8 fibers/ft^2 for an unrealistic, worst-case scenario of 360 chaff cartridges simultaneously released at a single drop point).

Other MEM that could be ingested by seabirds include small plastic end caps and pistons associated with chaff and self-protection flares (see Section 3.2 for description). The chaff end cap and piston are both round and are 1.3-inch diameter and 0.13 inches thick (Spargo, 2007). This plastic expended material sinks in saltwater (Spargo, 2007), which reduces the likelihood of ingestion. However, some of the material could remain at or near the surface if it were to fall directly on a dense *Sargassum* mat. Currently, about 7,540 end caps and pistons are released into the marine environment in the Study Area annually resulting in a low environmental concentration (2.4 pieces/nm^2/year, see Table 3.7-24). The number of end caps and pistons that would remain at the surface in *Sargassum* mats and would potentially be available to seabirds is unknown, but is expected to be an extremely small percentage of the total.

Many species of seabirds are known to ingest plastic debris. For example, 21 of 38 seabird species (55%) collected off the coast of North Carolina from 1975 – 1989 contained plastic particles (Moser and Lee, 1992). Plastic is often mistaken for prey and the incidence of plastic ingestion appears to be related to a species' feeding mode and diet. Seabirds that feed by pursuit-diving, surface-seizing, and dipping tend to ingest plastic, while those that feed by plunging or piracy typically do not ingest plastic. Birds of the order Procellariiformes, which include petrels and shearwaters, tend to accumulate more plastic than do other species. Some seabirds, including gulls and terns, regularly regurgitate indigestible parts of their food items such as shell and fish bones. However, most procellariiforms have small gizzards and an anatomical constriction between the gizzard and proventriculus that make it difficult to regurgitate solid material such as plastic (Azzarello and Van Vleet, 1987; Moser and Lee, 1992; Pierce *et al*., 2004).

Moser and Lee (1992) found no evidence that seabird health was affected by the presence of plastic, but other studies have documented adverse consequences of plastic ingestion. As summarized by Pierce *et al*. (2004) and Azzarello and Van Vleet (1987), documented consequences of plastic ingestion by seabirds include blockage of the intestines and ulceration of the stomach; reduction in the functional volume of the gizzard leading to a reduction of digestive capability; and distention of the gizzard leading to a reduction in hunger. Studies have found

negative correlations between body weight and plastic load, as well as body fat, a measure of energy reserves, and the number of pieces of plastic in a seabird's stomach. Other possible concerns that have been identified include toxic plastic additives and toxic contaminants that could be adsorbed to the plastic from ambient seawater. Pierce *et al*. (2004) described two cases where plastic ingestion caused seabird mortality from starvation. A necropsy of an adult northern gannet revealed that a 1.5-in diameter plastic bottle cap lodged in the gizzard, obstructed passage of food into the small intestine, and resulted in death from starvation. Dissection of an adult greater shearwater gizzard revealed that a 1.5-in by 0.5-in fragment of plastic blocked the pylorus, obstructed the passage of food, and resulted in death from starvation.

Based on the information presented above, if a seabird were to ingest a plastic end cap or piston the response would vary based on the species and individual bird. The responses could range from none, to sublethal (reduced energy reserves), to lethal (digestive tract blockage leading to starvation). Ingestion of end caps and pistons by species that regularly regurgitate indigestible items would likely have no adverse effects. However, end caps and pistons are similar in size to those plastic pieces described above that caused digestive tract blockages and eventual starvation. Therefore, ingestion of plastic end caps and pistons could be lethal to some individuals of some species of seabirds. Species with small gizzards and anatomical constrictions that make it difficult to regurgitate solid material would likely be most susceptible to blockage (procellariiforms). Based on available information, it is not possible to accurately estimate actual ingestion rates or responses of individual birds. Nonetheless, the number of end caps or piston ingested by seabirds is expected to be very low based on the low concentration (2.4 pieces/nm^2/year) and the fact that an extremely small percentage of the total would be potentially available to seabirds (*i.e.,* those that land on *Sargassum* mats and remain at the sea surface). Plastic ingestion under the No Action Alternative would not result in a significant adverse effect on migratory bird populations because sublethal and lethal effects, if they occur, would be limited to a few individual birds.

In summary, MEM would not result in a significant adverse effect on migratory bird populations as defined by MBTA regulations applicable to military readiness activities. In accordance with NEPA, MEM in territorial waters would have no significant impact on birds. Furthermore, MEM in non-territorial waters would not cause significant harm to birds in accordance with EO 12114.

Roseate Tern

Roseate terns are not expected to occur in the JAX Study Area except as occasional transient individuals (USFWS, 2007b). Consequently, roseate terns would most likely not be exposed to vessel movements, aircraft overflights, towed mine warfare devices, non-explosive mine shape deployment/recovery, NEPM, UNDETs and HE ordnance, or MEM associated with the No Action Alternative. Consequently, the No Action Alternative would have no effect on the roseate tern. The No Action Alternative would have no effect on critical habitat because none has been designated for the roseate tern.

3.10.3.2 Alternative 1

Vessel Movements

Vessel movements would increase by approximately five percent in the Study Area under Alternative 1 (Table 2.2-5). These changes would result in increased potential for bird collisions and associated bird mortalities and injuries to occur compared to baseline conditions. Even though vessel movements would increase 5% under Alternative 1, seabirds are not expected to be harmed

by vessel collisions for the same reasons discussed under the No Action Alternative. Navy mitigation measures, which include avoidance of large *Sargassum* mats where seabirds tend to concentrate, further reduce the probability of vessel collisions. Vessel movements under Alternative 1 would not have a significant adverse effect on migratory bird populations as defined by MBTA regulations applicable to military readiness activities. In accordance with NEPA, vessel movements in territorial waters would have no significant impact on birds. Furthermore, vessel movements in non-territorial waters would not cause significant harm to birds in accordance with EO 12114.

Aircraft Overflights

Alternative 1 would include an eight percent increase in fixed-wing aircraft sorties per year and a 22 percent increase in helicopter sorties per year in the OPAREAs (Table 2.2-5). Many of the new helicopter sorties would be associated with Mine Warfare exercises in Amber Strait, Kaiser Carrier Operating Area, and the Charleston OPAREA (10L and 12I, Figure 2.2-1). As a result, the potential for birds to be exposed to elevated noise levels would increase compared to baseline conditions, particularly in the areas with increased helicopter operations. The magnitude of individual exposures would not increase because Alternative 1 does not include use of new aircraft that are louder than current equipment. Peak noise levels generated by the new MH-60R and MH-60S Multi-Mission Combat Support Helicopters would be similar to the noise levels generated by the helicopters that they would replace.

Similar to the No Action Alternative, the responses would be limited to short-term behavioral or physiological reactions (*e.g.,* alert response, startle response, temporary increase in heart rate) and the general health of individual birds would not be compromised. Birds repeatedly exposed to aircraft noise often become habituated to the noise and do not respond behaviorally (Larkin, 1996; National Park Service, 1994; Plumpton, 2006). However, habituation seems unlikely in the Study Area given the widely dispersed nature of the operations and the relative infrequency of the operations. Aircraft noise exposures under Alternative 1 would result in negligible effects to individual birds and would not result in significant adverse effects to migratory bird populations, as defined by MBTA regulations applicable to military readiness activities. In accordance with NEPA, aircraft noise over territorial waters would have no significant impact on birds. Furthermore, aircraft noise over non-territorial waters would not cause significant harm to birds in accordance with EO 12114.

As discussed above for the No Action Alternative, bird/aircraft strikes are rare in offshore areas and the numbers of bird mortalities that occur Navy-wide are insignificant from a population standpoint. Bird/aircraft strikes are not expected to occur. If they do occur, the number of birds affected would be small. Aircraft strikes under Alternative 1 would have no significant adverse effect on migratory bird populations as defined by MBTA regulations applicable to military readiness activities. In accordance with NEPA, aircraft strikes over territorial waters would have no significant impact on birds. Furthermore, aircraft strikes over non-territorial waters would not cause significant harm to birds in accordance with EO 12114.

Towed Mine Warfare Devices

Towed Mine Warfare device sorties would increase by 92 percent per year under Alternative 1. These operations would continue to occur in Amber Strait and the Kaiser Carrier Operating Area. Many of the sorties would occur over an approximate 10-day period during major exercises, when multiple helicopters (approximately seven) would conduct two to three sorties per day with each

sortie lasting about two or three hours. Disturbance associated with this relatively intensive helicopter and towed device use could limit habitat suitability in the training areas for a relatively short period of time (10 days). Similar to the No Action Alternative, the potential for a towed Mine Warfare device to strike a bird under Alternative 1 is low because birds would likely see and hear the oncoming helicopter and flee the immediate area. Use of towed Mine Warfare devices under Alternative 1 would not have a significant adverse effect on migratory bird populations as defined by MBTA regulations applicable to military readiness activities. Towed Mine Warfare devices would not be used in territorial waters under Alternative 1. In accordance with EO 12114, towed MIW devices used in non-territorial waters would not cause significant harm to birds.

Mine Warfare Training (Non-explosive Mine Shape Deployment / Recovery)

Alternative 1 does not include establishment of Mine Warfare Training Areas where non-explosive mineshapes would be deployed.

Non-Explosive Practice Munitions

The amount of NEPM used in the Study Area would increase under Alternative 1 (Tables 2.2-5 and 2.2-6). These changes would result in increased potential for birds to be exposed to weapons firing noise. The potential for bird/NEPM strikes and associated bird mortalities and injuries would also increase. However, the number of birds affected would continue to be small. Navy mitigation measures, which include avoidance of large *Sargassum* mats where seabirds tend to concentrate, further reduce the probability of ordnance strikes.

While a remote possibility exists that some individuals of some bird species may be directly impacted if they are in the target area and at the point of physical impact at the time of ordnance delivery, NEPM strikes under Alternative 1 would not result in significant impacts to populations of migratory birds as defined by MBTA regulations applicable to military readiness activities. In accordance with NEPA, NEPM strikes in territorial waters would have no significant impact on birds. Furthermore, NEPM strikes in non-territorial waters would not cause significant harm to birds in accordance with EO 12114.

Underwater Detonations and High Explosive Ordnance

The number and location of explosions occurring in the Study Area would not change under Alternative 1, with the exception of missiles and 20-lbs NEW UNDET charges (Tables 2.2-5 and 2.2-7). Forty additional Hellfire missile explosions would occur in W-157A/W-159A. The number of 20-lbs NEW UNDET charges in the north and south UNDET boxes (10L and 12I) would decrease from 18 to 12 per year. While some seabird mortality could occur, mitigation measures and factors discussed for the No Action Alternative indicate that a small number of birds would be affected and that population level effects would not be expected. Underwater detonations and HE ordnance use under Alternative 1 would not result in significant impacts to populations of migratory birds as defined by MBTA regulations applicable to military readiness activities. In accordance with NEPA, UNDETs and HE ordnance use in territorial waters would have no significant impact on birds. Furthermore, UNDETs and HE ordnance use in non-territorial waters would not cause significant harm to birds in accordance with EO 12114.

Military Expended Material

The amount of chaff fibers and plastic end caps and pistons entering the marine environment would increase in the Study Area under Alternative 1 (Table 2.2-5). These changes would result in

increased potential for birds to ingest chaff and plastic end caps and pistons. However, the number of birds affected would continue to be small. Military expended material would not result in a significant adverse effect on migratory bird populations as defined by MBTA regulations applicable to military readiness activities. In accordance with NEPA, MEM in territorial waters would have no significant impact on birds. Furthermore, MEM in non-territorial waters would not cause significant harm to birds in accordance with EO 12114.

Roseate Tern

Roseate terns are not expected to occur in the JAX Study Area except as occasional transient individuals. Roseate terns would most likely not be exposed to one or more stressors associated with Alternative 1. Consequently, Alternative 1 would have no effect on the roseate tern. Alternative 1 would have no effect on critical habitat because none has been designated for the roseate tern.

3.10.3.3 Alternative 2 (Preferred Alternative)

Vessel Movements

Vessel movements under Alternative 1 would be the same as Alternative 2 (Table 2.2-5). Therefore, the analysis presented above for Alternative 1 is applicable to Alternative 2. Vessel movements under Alternative 2 would not have a significant adverse effect on migratory bird populations as defined by MBTA regulations applicable to military readiness activities. In accordance with NEPA, vessel movements in territorial waters would have no significant impact on birds. Furthermore, vessel movements in non-territorial waters would not cause significant harm to birds in accordance with EO 12114.

Aircraft Overflights

Alternative 2 would include a nine percent increase in fixed-wing aircraft sorties per year and a 60 percent increase in helicopter sorties per year in the OPAREAs (Table 2.2-5). Many of the new helicopter sorties would be associated with Mine Warfare exercises in Amber Strait, Kaiser Carrier Operating Area, and the Charleston OPAREA (10L and 12I, Figure 2.2-1). As a result, the potential for birds to be exposed to elevated noise levels would increase compared to baseline conditions, particularly in the areas with increased helicopter operations. The magnitude of individual exposures would not increase because Alternative 2 does not include use of new aircraft that are louder than current equipment. Peak noise levels generated by the new MH-60R and MH-60S Multi-Mission Combat Support Helicopters would be similar to the noise levels generated by the helicopters that they would replace.

Similar to the No Action Alternative, the responses would be limited to short-term behavioral or physiological reactions (*e.g.,* alert response, startle response, temporary increase in heart rate) and the general health of individual birds would not be compromised. Birds repeatedly exposed to aircraft noise often become habituated to the noise and do not respond behaviorally (Larkin, 1996; National Park Service, 1994; Plumpton, 2006). However, habituation seems unlikely in the Study Area given the widely dispersed nature of the operations and the relative infrequency of the operations. Aircraft noise exposures under Alternative 2 would result in negligible effects to individual birds and would not result in significant adverse effects to migratory bird populations, as defined by MBTA regulations applicable to military readiness activities. In accordance with NEPA, aircraft noise over territorial waters would have no significant impact on birds.

Furthermore, aircraft noise over non-territorial waters would not cause significant harm to birds in accordance with EO 12114.

As discussed above for the No Action Alternative, bird/aircraft strikes are rare in offshore areas and the numbers of bird mortalities that occur Navy-wide are insignificant from a population standpoint. Bird/aircraft strikes are not expected to occur. If they do occur, the number of birds affected would be small. Aircraft strikes under Alternative 2 would have no significant adverse effect on migratory bird populations as defined by MBTA regulations applicable to military readiness activities. In accordance with NEPA, aircraft strikes over territorial waters would have no significant impact on birds. Furthermore, aircraft strikes over non-territorial waters would not cause significant harm to birds in accordance with EO 12114.

Towed Mine Warfare Devices

Towed Mine Warfare device sorties would increase from 78 per year under the No Action Alternative to 456 per year under Alternative 2 (485% increase). These operations would continue to occur in Amber Strait and the Kaiser Carrier Operating Area. Many of the annual sorties would occur over an approximate 10-day period during major exercises, when multiple helicopters (approximately seven) would conduct two to three sorties per day with each sortie lasting about two or three hours. Disturbance associated with this relatively intensive helicopter and towed device use could limit habitat suitability in the training areas for a relatively short period of time (10 days). As discussed for the No Action Alternative, the noise, downdraft, and visual cues from the oncoming helicopter would likely cause birds to flee the immediate area and avoid being struck. While the increased operations would increase the likelihood of bird/towed device strikes under Alternative 2, few, if any, bird/towed device strikes and associated bird mortalities or injuries are expected to occur. Use of towed Mine Warfare devices under Alternative 2 would not have a significant adverse effect on migratory bird populations as defined by MBTA regulations applicable to military readiness activities. Towed Mine Warfare devices would not be used in territorial waters under Alternative 2. In accordance with EO 12114, towed Mine Warfare devices used in non-territorial waters would not cause significant harm to birds.

Mine Warfare Training (Non-explosive Mine Shape Deployment / Recovery)

As discussed in Chapter 2, MIW training areas would be designated in the North (10L) and South (12I) Underwater Detonation Areas under Alternative 2 (Figure 2.2-1). This section addresses potential effects associated with establishing and maintaining these training areas (*i.e.*, non-explosive mine shape deployment/recovery). The Navy proposes to conduct mine hunting and sweeping operations in the same general area used for other major exercise events. Since water depth there is too deep for routine retrieval of submerged objects, these operations would take place without target mineshapes. The water depth in areas currently designated for UNDET training is much shallower, thereby allowing placement of expendable inert mineshapes to simulate mine threats. The effects of conducting training exercises in these areas are the same as those analyzed under aircraft overflights and NEPM.

Approximately 20 to 40 non-explosive mineshapes would be deployed/recovered per year in these training areas. If seabirds are present at the time of mine shape deployment/recovery they could be startled by the process and flee the immediate area. However, the effects would be negligible, short-term, and localized. Mine Warfare Training under Alternative 2 would have no significant adverse effect on migratory bird populations as defined by MBTA regulations applicable to military readiness activities. In accordance with NEPA, Mine Warfare Training in territorial

waters would have no significant impact on birds. Furthermore, establishment of Mine Warfare Training Areas in non-territorial waters would not cause significant harm to birds under Alternative 2.

Non-Explosive Practice Munitions

The amount of NEPM used in the Study Area under Alternative 2 would be the same as Alternative 1, with the exception of 336 additional non-explosive practice bombs per year (168 each in W-157A/B and W-158A/B, Table 2.2-6). As a result, the potential for bird/NEPM strikes and associated bird mortalities and injuries would increase. However, if birds were affected the number would continue to be small. Navy mitigation measures, which include avoidance of large *Sargassum* mats where seabirds tend to concentrate, further reduce the probability of NEPM strikes.

While a remote possibility exists that some individuals of some bird species may be directly impacted if they are in the target area and at the point of physical impact at the time of ordnance delivery, NEPM strikes under Alternative 2 would not result in significant impacts to populations of migratory birds as defined by MBTA regulations applicable to military readiness activities. In accordance with NEPA, NEPM strikes in territorial waters would have no significant impact on birds. Furthermore, NEPM strikes in non-territorial waters would not cause significant harm to birds in accordance with EO 12114.

Underwater Detonations and High Explosive Ordnance

The number and location of explosions that would occur under Alternative 2 would be the same as Alternative 1, with the exception of HE bombs, which would not be used in the Study Area under Alternative 2 (Tables 2.2-5 and 2.2-7). With this change for BOMBEX from live to non-explosive bombs, the potential for seabirds to be exposed to impacts associated with explosions would decrease substantially under Alternative 2 compared to the No Action Alternative and Alternative 1. Underwater detonations and HE ordnance use under Alternative 2 would not result in significant impacts to populations of migratory birds as defined by MBTA regulations applicable to military readiness activities. In accordance with NEPA, UNDETs and HE ordnance use in territorial waters would have no significant impact on birds. Furthermore, underwater detonations and HE ordnance use in non-territorial waters would not cause significant harm to birds in accordance with EO 12114.

Military Expended Material

The amount of MEM entering the marine environment under Alternative 2 would be the same as Alternative 1, with the exception of an increase in non-explosive practice bombs (Table 2.2-6). Military expended material associated with increased NEPMs would have no effect on seabirds because the material rapidly sinks to the sea floor. Therefore, the analysis of MEM presented above for Alternative 1 is applicable to Alternative 2. Military expended material would not result in a significant adverse effect on migratory bird populations as defined by MBTA regulations applicable to military readiness activities. In accordance with NEPA, MEM in territorial waters would have no significant impact on birds. Furthermore, MEM in non-territorial waters would not cause significant harm to birds in accordance with EO 12114.

Roseate Tern

Roseate terns are not expected to occur in the JAX Study Area except as occasional transient individuals. Roseate terns would most likely not be exposed to one or more stressors associated with Alternative 2. Consequently, Alternative 2 would have no effect on the roseate tern. Alternative 2 would have no effect on critical habitat because none has been designated for the roseate tern.

3.10.4 Unavoidable Significant Environmental Effects

The analysis presented above indicates that the No Action Alternative, Alternative 1, and Alternative 2 would not result in unavoidable significant adverse effects to seabirds or migratory birds.

3.10.5 Summary of Environmental Effects

3.10.5.1 Endangered Species Act

Roseate terns are not expected to occur in the JAX Study Area except as occasional transient individuals. Consequently, the No Action Alternative, Alternative 1, and Alternative 2 would most likely have no effect on the roseate tern. The alternatives would have no effect on critical habitat because none has been designated for the roseate tern. The Navy has completed informal consultation with USFWS for the preferred alternative in accordance with Section 7 of the ESA. The USFWS concurred with the Navy's no effect determination for the roseate tern. Copies of correspondence with USFWS are provided in Appendix C.

3.10.5.2 Migratory Bird Treaty Act

As discussed in the analysis presented above in Section 3.10.3 and summarized in Table 3.10-3, the No Action Alternative, Alternative 1, and Alternative 2 would not diminish the capacity of a population of a migratory bird species to maintain genetic diversity, to reproduce, and to function effectively in its native ecosystem. The proposed action would not have a significant adverse effect on migratory bird populations. As a result and in accordance with 50 CFR Part 21, the Navy is not required confer with the USFWS on the development and implementation of conservation measures to minimize or mitigate adverse effects to migratory birds not listed under the ESA.

3.10.5.3 National Environmental Policy Act and Executive Order 12114

As summarized in Table 3.10-3, the No Action Alternative, Alternative 1, and Alternative 2 would have no significant impact on seabirds and migratory birds in territorial waters. Furthermore, the No Action Alternative, Alternative 1, and Alternative 2 would not cause significant harm to seabirds and migratory birds in non-territorial waters.

TABLE 3.10-3
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON SEABIRDS AND MIGRATORY BIRDS IN THE OPAREAS

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	NEPA (U.S. Territory)	Executive Order 12114 (Non-Territorial Waters, >12 nm)
No Action		
Vessel Movements	Short-term behavioral responses to vessels and extremely low potential for injury/mortality from collisions. No long-term population-level effects.	Short-term behavioral responses to vessels and extremely low potential for injury/mortality from collisions. No long-term population-level effects.
Aircraft Overflights	Short-term behavioral responses to overflights, primarily helicopters. Extremely low potential for injury/mortality from strikes. No long-term population-level effects.	Short-term behavioral responses to overflights, primarily helicopters. Extremely low potential for injury/mortality from strikes. No long-term population-level effects.
Towed Mine Warfare Devices	No effect.	Extremely low potential for towed device strikes. No long-term population-level effects.
MIW Training	No Effect.	No Effect.
NEPM	Short-term behavioral responses to firing noise. Extremely low potential for injury/mortality from strikes. No long-term population-level effects.	Short-term behavioral responses to firing noise. Extremely low potential for injury/mortality from strikes. No long-term population-level effects.
UNDETs and HE Ordnance	Short-term behavioral responses to explosion noise. Potential for a small number of injuries/mortalities in the immediate vicinity of an explosion. No long-term population-level effects.	Short-term behavioral responses to explosion noise. Potential for a small number of injuries/mortalities in the immediate vicinity of an explosion. No long-term population-level effects.
MEM	No effects associated with ordnance-related material, targets, or marine markers. Extremely low potential for sublethal or lethal effects from ingestion of chaff or flare end-caps or pistons. No long-term population-level effects.	No effects associated with ordnance-related material, targets, or marine markers. Extremely low potential for sublethal or lethal effects from ingestion of chaff or flare end-caps or pistons. No long-term population-level effects.
Conclusion	No significant impact to seabirds and migratory birds.	No significant harm to seabirds and migratory birds.
Alternative 1		
Vessel Movements	Short-term behavioral responses to vessels and extremely low potential for injury/mortality from collisions. Slight increase compared to No Action. No long-term population-level effects.	Short-term behavioral responses to vessels and extremely low potential for injury/mortality from collisions. Slight increase compared to No Action. No long-term population-level effects.

TABLE 3.10-3
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON SEABIRDS AND MIGRATORY BIRDS IN THE OPAREAS

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	NEPA (U.S. Territory)	Executive Order 12114 (Non-Territorial Waters, >12 nm)
Aircraft Overflights	Short-term behavioral responses to overflights, primarily helicopters. Extremely low potential for injury/mortality from strikes. Slight increase compared to No Action. No long-term population-level effects.	Short-term behavioral responses to overflights, primarily helicopters. Extremely low potential for injury/mortality from strikes. Slight increase compared to No Action. No long-term population-level effects.
Towed MIW Devices	No effect.	Extremely low potential for towed device strikes. Slight increase compared to No Action. No long-term population-level effects.
MIW Training	No Effect.	No Effect.
NEPM	Short-term behavioral responses to firing noise. Extremely low potential for injury/mortality from strikes. Slight increase compared to No Action. No long-term population-level effects.	Short-term behavioral responses to firing noise. Extremely low potential for injury/mortality from strikes. Slight increase compared to No Action. No long-term population-level effects.
UNDETs and HE Ordnance	Short-term behavioral responses to explosion noise. Potential for a small number of injuries/mortalities in the immediate vicinity of an explosion. Slight increase compared to No Action. No long-term population-level effects.	Short-term behavioral responses to explosion noise. Potential for a small number of injuries/mortalities in the immediate vicinity of an explosion. Slight increase compared to No Action. No long-term population-level effects.
MEM	No effects associated with ordnance-related material, targets, or marine markers. Extremely low potential for sublethal or lethal effects from ingestion of chaff or flare end-caps or pistons. Slight increase compared to No Action. No long-term population-level effects.	No effects associated with ordnance-related material, targets, or marine markers. Extremely low potential for sublethal or lethal effects from ingestion of chaff or flare end-caps or pistons. Slight increase compared to No Action. No long-term population-level effects.
Conclusion	No significant impact to seabirds and migratory birds.	No significant harm to seabirds and migratory birds.
Alternative 2		
Vessel Movements	Short-term behavioral responses to vessels and extremely low potential for injury/mortality from collisions. Slight increase compared to No Action. No long-term population-level effects.	Short-term behavioral responses to vessels and extremely low potential for injury/mortality from collisions. Slight increase compared to No Action. No long-term population-level effects.

TABLE 3.10-3
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON SEABIRDS AND MIGRATORY BIRDS IN THE OPAREAS

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	NEPA (U.S. Territory)	Executive Order 12114 (Non-Territorial Waters, >12 nm)
Aircraft Overflights	Short-term behavioral responses to overflights, primarily helicopters. Extremely low potential for injury/mortality from strikes. Slight increase compared to No Action. No long-term population-level effects.	Short-term behavioral responses to overflights, primarily helicopters. Extremely low potential for injury/mortality from strikes. Slight increase compared to No Action. No long-term population-level effects.
Towed MIW Devices	No effect.	Low potential for towed device strikes. Increase compared to No Action. No long-term population-level effects.
MIW Training	Minor, short-term, and localized disturbances associated with non-explosive mine shape deployment/recovery. No long-term population-level effects.	No effect.
NEPM	Short-term behavioral responses to firing noise. Extremely low potential for injury/mortality from strikes. Slight increase compared to No Action. No long-term population-level effects.	Short-term behavioral responses to firing noise. Extremely low potential for injury/mortality from strikes. Slight increase compared to No Action. No long-term population-level effects.
UNDETS and HE Ordnance	Short-term behavioral responses to explosion noise. Potential for a small number of injuries/mortalities in the immediate vicinity of an explosion. Slight increase compared to No Action. No long-term population-level effects.	Short-term behavioral responses to explosion noise. Potential for a small number of injuries/mortalities in the immediate vicinity of an explosion. Substantial decrease in impacts associated with HE bombs compared to No Action. No long-term population-level effects.
MEM	No effects associated with ordnance-related material, targets, or marine markers. Extremely low potential for sublethal or lethal effects from ingestion of chaff or flare end-caps or pistons. Slight increase compared to No Action. No long-term population-level effects.	No effects associated with ordnance-related material, targets, or marine markers. Extremely low potential for sublethal or lethal effects from ingestion of chaff or flare end-caps or pistons. Slight increase compared to No Action. No long-term population-level effects.
Conclusion	No significant impact to seabirds and migratory birds.	No significant harm to seabirds and migratory birds.

3.11 BIOLOGICAL RESOURCES AT RODMAN AND LAKE GEORGE RANGES

3.11.1 Introduction and Methods

3.11.1.1 Regulatory Framework

This section addresses biological resources at Rodman and Lake George Ranges, including vegetation, wetlands, wildlife, aquatic life, and threatened and endangered species. The regulatory framework that governs and protects these resources is described in Appendix K and includes Section 404 of the Clean Water Act (wetlands), the Migratory Bird Treaty Act (MBTA), the Bald and Golden Eagle Protection Act (Eagle Act), ESA, and MMPA.

The DoN Policy Guidance, dated 9 September 2008 for Compliance with the Bald and Golden Eagle Protection Act established among other provisions that environmental documents shall continue to address the occurrences of Bald Eagles in study areas, and analyze proposed actions for potential adverse effects as defined in the Bald and Golden Eagle Protecion Act (16 U.S.C. 668a-d) and the Final Rule on Authorizations Under the Bald and Golden Eagle Protection Act for Take of Eagles (USFWS, 20 May 2008, 73 FR 29075). Proposed actions that may result in the incidental take of Bald Eagles shall incorporate to the maximum extent practicable, and as appropriate, measures provided in the National Bald Eagle Management Guidelines (May 2007, USFWS, http://www.fws.gov/migratorybirds/baldeagle.htm.

3.11.1.2 Assessment Methods and Data Used

General Approach to Analysis

The general approach to analysis for biological resources at Rodman and Lake George Ranges is the same as the approach described for marine mammals in Section 3.7.1.1.

Study Area

The Rodman Range and Lake George Range Study Areas for biological resources are generally defined as those areas that could potentially be affected by the proposed actions. The limits of the Study Areas vary based on the resources being addressed and the nature of the proposed training operations. Collectively, the Rodman Range Study Area includes all areas within the range property boundary, as well as areas outside the boundary where low-altitude (*i.e.*, below 3,000 feet) aircraft overflights would occur. The Rodman Range Study Area for terrestrial vegetation and wetlands is limited to areas within the range property boundary because potential effects to these resources would not extent outside the boundary. The collective Study Area for Lake George Range includes areas within the range boundary, the open waters of Lake George, and land areas where low-altitude aircraft overflights would occur.

Data Sources

A comprehensive and systematic review of relevant literature and data has been conducted to complete this analysis for biological resources and to ensure that best available information was used. Of the available scientific literature (both published and unpublished), the following types of documents were utilized in the assessment: journals, books, periodicals, bulletins, Department of Defense operations reports, Environmental Impact Statements, and other technical reports published by government agencies, private businesses, consulting firms, or non-governmental conservation organizations. The scientific literature was also consulted during the search for

geographic location data on the occurrence of resources within the Study Area. In addition to the sources mentioned above, the following were used to determine if threatened and endangered species may occur on or near the ranges: field survey reports prepared by the Florida Natural Areas Inventory (FNAI) for Rodman Range (FNAI, 1997; 2004), the Integrated Natural Resources Management Plan covering Rodman Range (DoN, 2005), an online search of the FNAI Biodiversity Matrix (FNAI, 2007), and information provided by the USFWS and FFWCC in response to the Navy's request for information.

Factors Used to Assess Effects

This FEIS/OEIS analyzes potential effects to biological resources at Rodman Range and Lake George Range in the context of Section 404 of the Clean Water Act (for wetlands only), MBTA, Eagle Act (for bald eagles only), ESA (for listed species only), and NEPA. The factors used to assess the significance of effects vary under these Acts and are:

- Factors considered under Section 404 of the Clean Water Act include the extent to which an alternative could result in disturbance, filling, or permanent loss of jurisdictional wetland areas or wetland functions and values.
- Factors considered under the MBTA include the extent to which an alternative could diminish the capacity of a population of a migratory bird species to maintain genetic diversity, to reproduce, and to function effectively in its native ecosystem over a reasonable period of time.
- For bald eagles, factors considered include weather an alternative would result in "take" of a bald eagle as defined by the Eagle Act. The Act defines “take” as pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb. “Disturb’’ means to agitate or bother a bald eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior.
- For purposes of ESA compliance, effects of the action were analyzed to make the Navy’s determination of effect for listed species. The definitions used in making the determination of effect under Section 7 of the ESA are based on the USFWS and NMFS *Endangered Species Consultation Handbook* (USFWS and NMFS, 1998) and are provided in Section 3.7.1.2.
- All the factors discussed above were considered in assessing the significance of effects under NEPA.

3.11.1.3 Warfare Areas and Associated Environmental Stressors

The Navy used a screening process to identify aspects of the proposed action that could act as stressors to biological resources at Rodman and Lake George Ranges. Navy subject matter experts de-constructed the warfare areas and operations included in the proposed action to identify specific activities that could act as stressors. Public and agency scoping comments, previous environmental analyses, previous agency consultations, laws, regulations, Executive Orders, and resource-specific information were also evaluated. This process was used to focus the information presented and analyzed in the affected environment and environmental consequences sections of this FEIS/OEIS. As summarized in Table 3.11-1, potential stressors to biological resources at Rodman and Lake George Ranges include aircraft overflights (disturbance and strikes), land-based training operations (wildlife and habitat disturbance), non-explosive practice munitions (NEPM) (disturbance and strikes), and MEM (ordnance-related material and flares). High explosive ordnance, vessel

movements, towed mine warfare devices, mine warfare deployment/recovery, marine markers, and chaff are not used on these ranges; therefore, these stressors are not applicable to this section.

TABLE 3.11-1
POTENTIAL STRESSORS TO BIOLOGICAL RESOURCES AT RODMAN AND LAKE GEORGE RANGES

Warfare Area and Operation	Training Areas	Aircraft Overflights (Disturbance)	Aircraft Overflights (Strikes)	Land-Based Training	Non-Explosive Practice Munitions	Military Expended Material
Mine Warfare (MIW)						
Mine Laying	Lake George Range	✓	✓		✓	✓
Strike Warfare (STW)						
BOMBEX (A-G)	Rodman Range	✓	✓		✓	✓
CSAR and Convoy Operations	Rodman Range	✓	✓	✓	✓	
Electronic Combat (EC)						
Flare Exercise - Helicopter	Lake George Range	✓	✓			✓

The next step of the screening process analyzed the spatial extent of potential stressors within each Study Area, resource occurrence data (as presented in Section 3), and species habitat requirements to identify resources and listed species likely to co-occur with the stressors in space and time. Tables 3.11-2 and 3.11-3 provide summaries of this exposure analysis and show the stressors that each resource or species could be exposed to in each Study Area.

Only those stressors that may co-occur with biological resources or listed species and have the potential to affect the resources or species were carried forward for detailed analysis in Section 3.11.3 (as indicated by the check marks in Tables 3.11-2 and 3.11-3). Following is a brief summary of stressors and/or resources not analyzed in further detail, along with the rationale for screening them out.

TABLE 3.11-2
BIOLOGICAL RESOURCES THAT COULD BE EXPOSED TO POTENTIAL STRESSORS AT RODMAN AND LAKE GEORGE RANGES

Biological Resource	Aircraft Overflights	Land-based Training	Non-Explosive Practice Munitions	Military Expended Material
Rodman Range				
Terrestrial Vegetation		✓	✓	✓
Aquatic Vegetation				
Terrestrial Wildlife	✓	✓	✓	✓
Aquatic Life				
Threatened and Endangered Species	✓	✓	✓	✓
Lake George Range				
Terrestrial Vegetation				
Aquatic Vegetation			✓	✓
Terrestrial Wildlife	✓			
Aquatic Life	✓		✓	✓
Threatened and Endangered Species	✓		✓	✓

TABLE 3.11-3
POTENTIAL STRESSORS THAT FEDERALLY LISTED SPECIES MAY BE EXPOSED TO IN EACH STUDY AREA

Study Area and Species that May Occur in Each Study Area[1]	Vessel Movements (Disturbance)	Vessel Movements (Collisions)	Aircraft Overflights (Disturbance)	Aircraft Overflights (Strikes)	Land-based Training	Non-explosive Practice Munitions	Military Expended Material
Rodman Range							
Florida scrub-jay	-	-	✓	✓	o	o	o
Wood stork	-	-	✓	✓	✓	✓	o
Eastern indigo snake	-	-	x	o	✓	✓	o
Sand skink	-	-	x	o	o	o	o
West Indian manatee	-	-	x	o	o	o	o

TABLE 3.11-3 (Continued)
POTENTIAL STRESSORS THAT FEDERALLY LISTED SPECIES MAY BE EXPOSED TO IN EACH STUDY AREA

Study Area and Species that May Occur in Each Study Area[1]	Vessel Movements (Disturbance)	Vessel Movements (Collisions)	Aircraft Overflights (Disturbance)	Aircraft Overflights (Strikes)	Land-based Training	Non-explosive Practice Munitions	Military Expended Material
Lake George Range							
Florida scrub-jay	-	-	✓	✓	-	o	o
Red-cockaded woodpecker	-	-	✓	✓	-	o	o
Wood stork	-	-	✓	✓	-	o	o
Eastern indigo snake	-	-	x	o	-	o	o
Sand skink	-	-	x	o	-	o	o
West Indian Manatee	-	-	✓	o	-	✓	✓

[1] *Species occurrence based on information presented in Section 3.11.2.*

Key:
✓ = Stressor and species may co-occur, and the stressor is expected to elicit a response in exposed individuals.
- = Stressor does not occur in Study Area.
o = Stressor occurs in Study Area, but species would not be exposed.
x = Stressor and species may co-occur, but stressor is not expected to elicit a response or affect the fitness of individuals.

Rodman Range Study Area

- **All Resources and Species (MEM) -** The only MEM at Rodman Range would be NEPM, which would be limited to the immediate target area. The expended NEPM material would not pose a risk to biological resources or listed species because it is inert and routinely cleared from the target area. Range clearance is conducted under the *Final Operational Range Clearance Plan for the Pinecastle Range and Rodman Range* (DoN, 2007). Military expended material would have no effect on biological resources or listed species at Rodman Range and are not analyzed in further detail for this range.
- **Florida Scrub-jay (NEPM and Land-based Training) –** The Florida scrub-jay may occur in the Rodman Range Study Area, but is not expected to occur within the range property boundaries. The spatial extent of potential effects associated with NEPM and land-based training would be limited to areas within the range boundaries. Therefore, Florida scrub-jays would not be exposed to these stressors. Non-explosive practice munitions and land-based training at Rodman Range would have no effect on the Florida scrub-jay. These stressors are not analyzed in further detail for the Florida scrub-jay in this Study Area.
- **Eastern Indigo Snake (Aircraft Overflights) -** Aircraft overflights at Rodman Range would have no effect on the eastern indigo snake because the fitness of individuals would not be affected. Therefore, aircraft overflights are not analyzed in further detail for this species.
- **Sand Skink (Aircraft Overflights, NEPM, and Land-based Training) -** Aircraft overflights at Rodman Range would have no effect on the sand skink because the fitness of individuals

would not be affected. Therefore, aircraft overflights are not analyzed in further detail for this species. While sand skinks may occur in the Rodman Range Study Area, they are not expected to occur within the range boundaries. The spatial extent of potential effects associated with NEPM and land-based training would be limited to areas within the range boundaries. Therefore, sand skinks would not be exposed to these stressors. The proposed action at Rodman Range would have no effect on the sand skink. Critical habitat has not been designated for the sand skink. The sand skink is not analyzed in further detail for this Study Area.

- **West Indian Manatee (All Stressors) -** West Indian manatees may occur in the Ocklawaha River along the southern boundary of Rodman Range. No training operations take place in or near the river. Therefore, the proposed action at Rodman Range would have no effect on the manatee and manatees are not analyzed in further detail for Rodman Range.

Lake George Range Study Area

- **Florida Scrub-jay, Red-cockaded Woodpecker, Wood Stork, Eastern Indigo Snake, and Sand Skink (NEPM and MEM)** – These species may occur in the terrestrial portions of the Lake George Range Study Area, but are not expected to occur in the open water environment within the range boundaries. The spatial extent of potential effects associated with NEPM and MEM would be limited to areas within the range boundaries. Therefore, the Florida scrub-jay, red-cockaded woodpecker, wood stork, eastern Indigo snake, and sand skink would not be exposed to these stressors. Non-explosive practice munitions and MEM would have no effect on these listed species in the Lake George Study Area. These stressors are not analyzed in further detail for these species in the Lake George Study Area.
- **Eastern Indigo Snake and Sand Skink (Aircraft Overflights) -** Aircraft overflights at Lake George Range would have no effect on the eastern indigo snake or sand skink because the fitness of individuals would not be affected. Therefore, aircraft overflights are not analyzed in further detail for these species.
- **Shortnose Sturgeon (All Stressors) –** As discussed in Section 3.11.2, the shortnose sturgeon is not expected to occur in the Lake George Study Area except as occasional transient individuals. Based on the transient occurrence, the shortnose sturgeon would not be affected by exposure to one or more stressors associated with the actions. Consequently, the proposed action would have no effect on the shortnose sturgeon. Critical habitat has not been designated for the shortnose sturgeon. Therefore, the shortnose sturgeon is not analyzed in further detail.

Both Study Areas

- **All Species (Water Resources and Air Quality) –** As discussed in Section 3.3 Water Resources and Section 3.4 Air Quality, some water and air pollutants would be released into the environment as part of the proposed action. The analyses presented in Sections 3.3 and 3.4 indicate that any increases in water or air pollutant concentrations resulting from Navy training in the Study Area would be negligible and localized, and impacts to water and air quality would not be significant. Based on the analyses presented in Sections 3.3 and 3.4, water and air quality changes would have no effect on terrestrial and freshwater aquatic species. Accordingly, the effects of water and air quality changes are not addressed further in this section.

3.11.2 Affected Environment

3.11.2.1 General Description

Rodman Range

Rodman Range (Figures 3.11-1 and 3.11-2) consists of 2,696 acres of land and is located approximately 58 miles south of Jacksonville. Most of the range is located in Putnam County, but the southwestern corner of the property is located in Marion County. The range supports Air-to-Ground Bombing Exercises using non-explosive practice bombs, Combat Search and Rescue training, and Convoy Operations. No explosive ordnance or gunnery is authorized. The range and surrounding areas are largely forested. The southwest quadrant of the range area is non-forested and contains a single impact area/target (Figure 3.11-2) of approximately 100 acres. Six helicopter landing zones are situated in various open areas of the range (Figure 3.11-2). The property is owned by the Department of the Navy.

Lake George Range

Lake George Range (Figures 3.11-1 and 3.11-3) is located entirely within the waters of Lake George on the St. Johns River in north-central Florida and Volusia County. The Navy operates the range under an easement with the State of Florida, which has jurisdiction over the lake waters. Lake George is the second-largest freshwater lake (only Lake Okeechobee is larger) in Florida, covering some 46,000 acres (12 miles by 8 miles). The range lies in the east-central portion of the lake, and is 2 nm wide by 7 nm long (Figure 3.11-3). The range supports mine laying exercises, which involves dropping non-explosive practice bombs from fixed-wing aircraft. Targets on the lake surface include:

- North Target – This target consists of a 24-foot square reflective target center with nine corner radar reflectors. The target is surrounded by a concentric ring of pilings with a 900-foot diameter.
- Center Target – This target consists of a sled constructed of surplus drop tanks with a platform-mounted radar reflector surrounded by three concentric piling rings of 250, 500, and 1,000-foot diameters.
- South Target – This target consists of a rectangular area 30 feet by 60 feet outlined by six pilings surrounded by three concentric piling rings of 250, 500, and 1,000-foot diameters.
- Mine Laying Targets – These targets consist of four pre-planned splash points on a 129.4 bearing from the Initial Point at Kinsley Point on the southern tip of Drayton Island (located 2 miles northwest of the northern edge of the range).

Lake George is a natural impoundment on the St. Johns River resting on ancient marine limestone deposits. The 300-mile long St. Johns River provides Lake George with the Atlantic Ocean's influence. This south to north flowing river connects to the Atlantic Ocean at Jacksonville. Lake George, 115 miles up-river from the ocean, is recognized as the upper limit of tidal waters. Its bathymetry is generally uniform. The maximum depth is 11 feet and depths within the target area range from 8 to 11 feet (NOAA, 2007). The bottom is predominately sand (St. Johns River Water Management District, 1991) and tannins in runoff water from adjacent swamps stain the water dark brown (Bengtson, 1981). Three springs discharge flow into Lake George from the west: Salt,

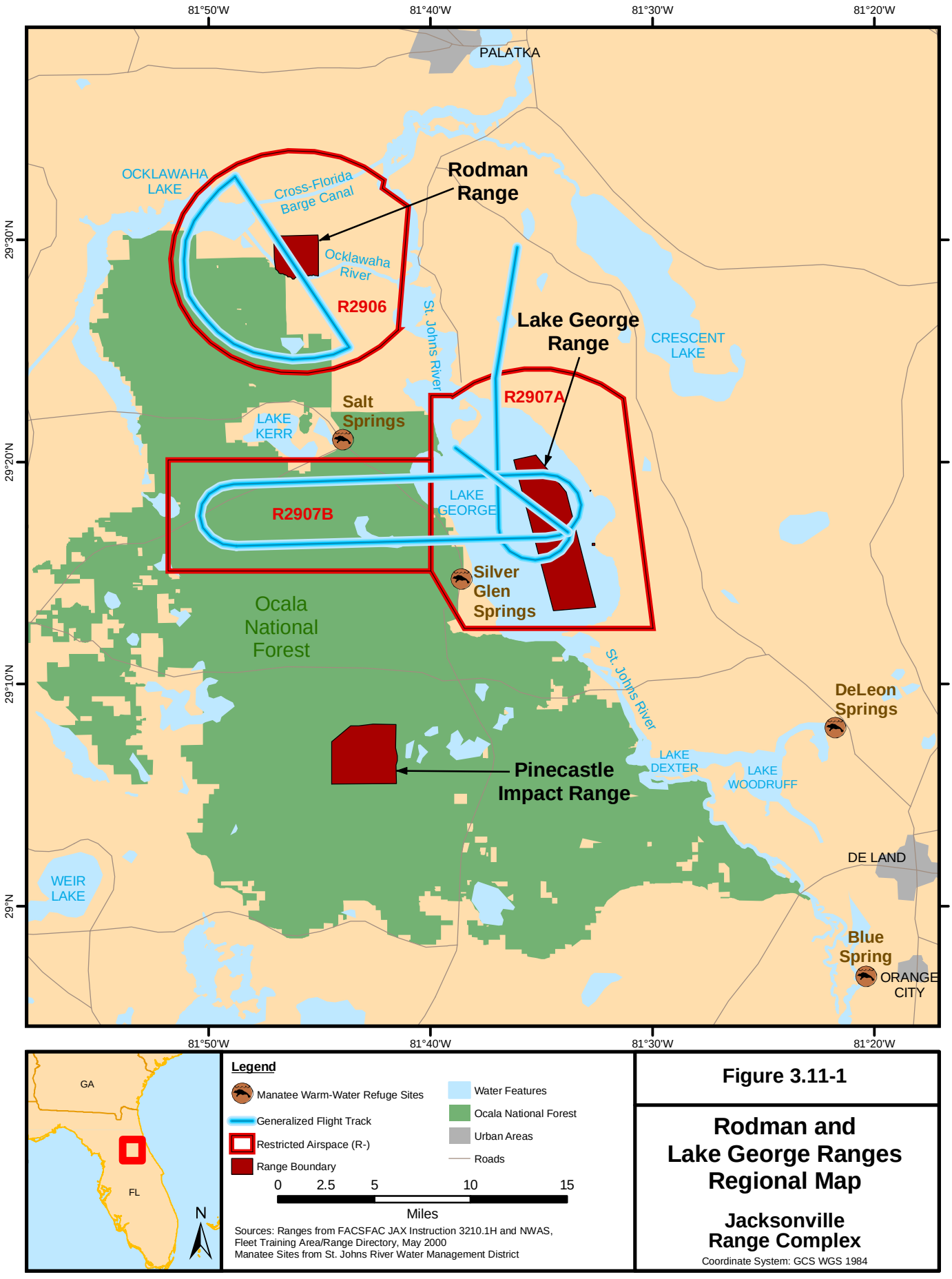
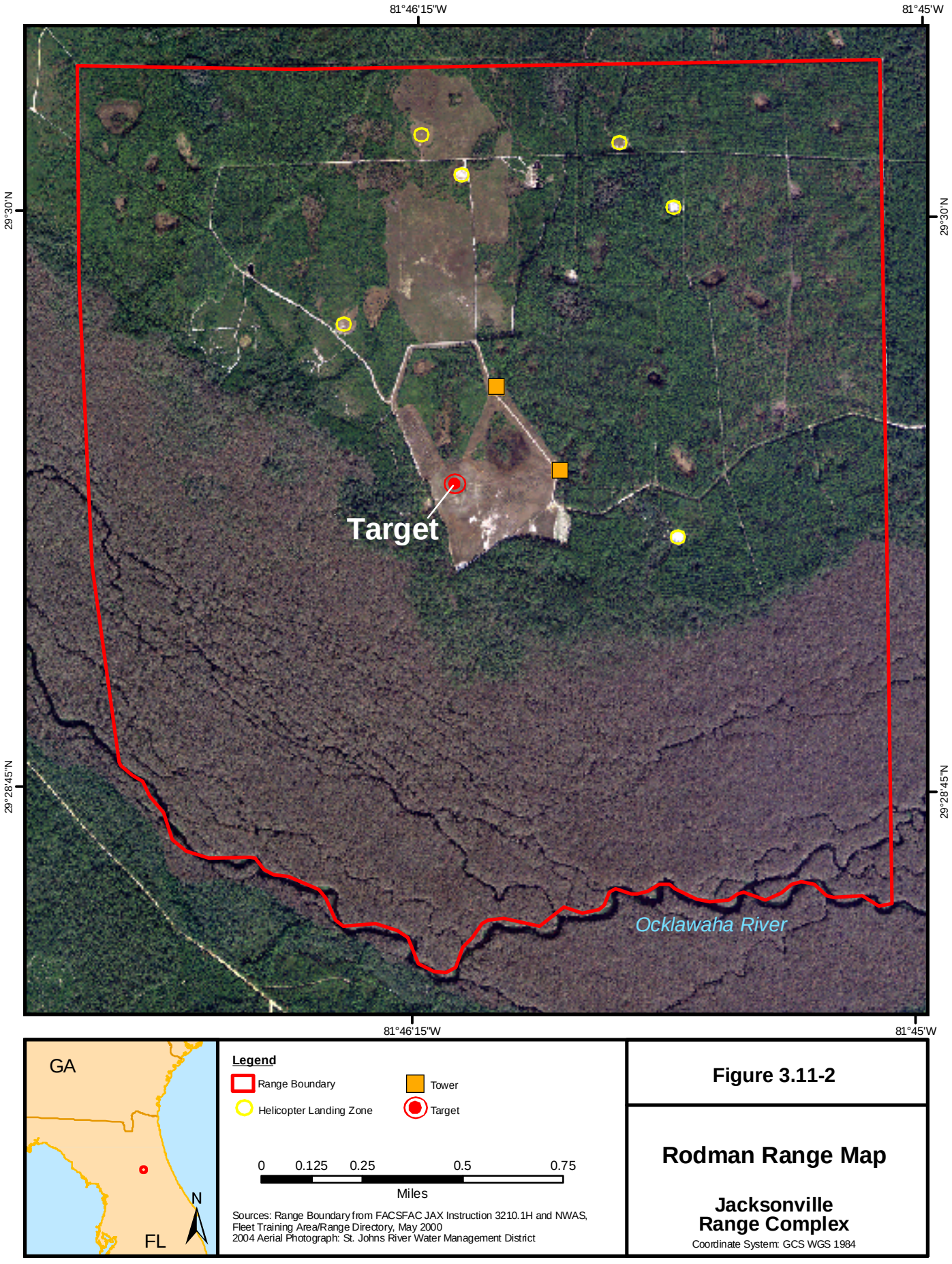


Figure 3.11-1

Rodman and Lake George Ranges Regional Map

Jacksonville Range Complex

Coordinate System: GCS WGS 1984


81°46'15"W
81°45'W
29°30'N
29°28'45"N
Target
Ocklawaha River
GA
FL
N
Legend
Range Boundary
Tower
Helicopter Landing Zone
Target
0 0.125 0.25 0.5 0.75
Miles
Sources: Range Boundary from FACSFAC JAX Instruction 3210.1H and NWAS, Fleet Training Area/Range Directory, May 2000
2004 Aerial Photograph: St. Johns River Water Management District
Figure 3.11-2
Rodman Range Map
Jacksonville Range Complex
Coordinate System: GCS WGS 1984

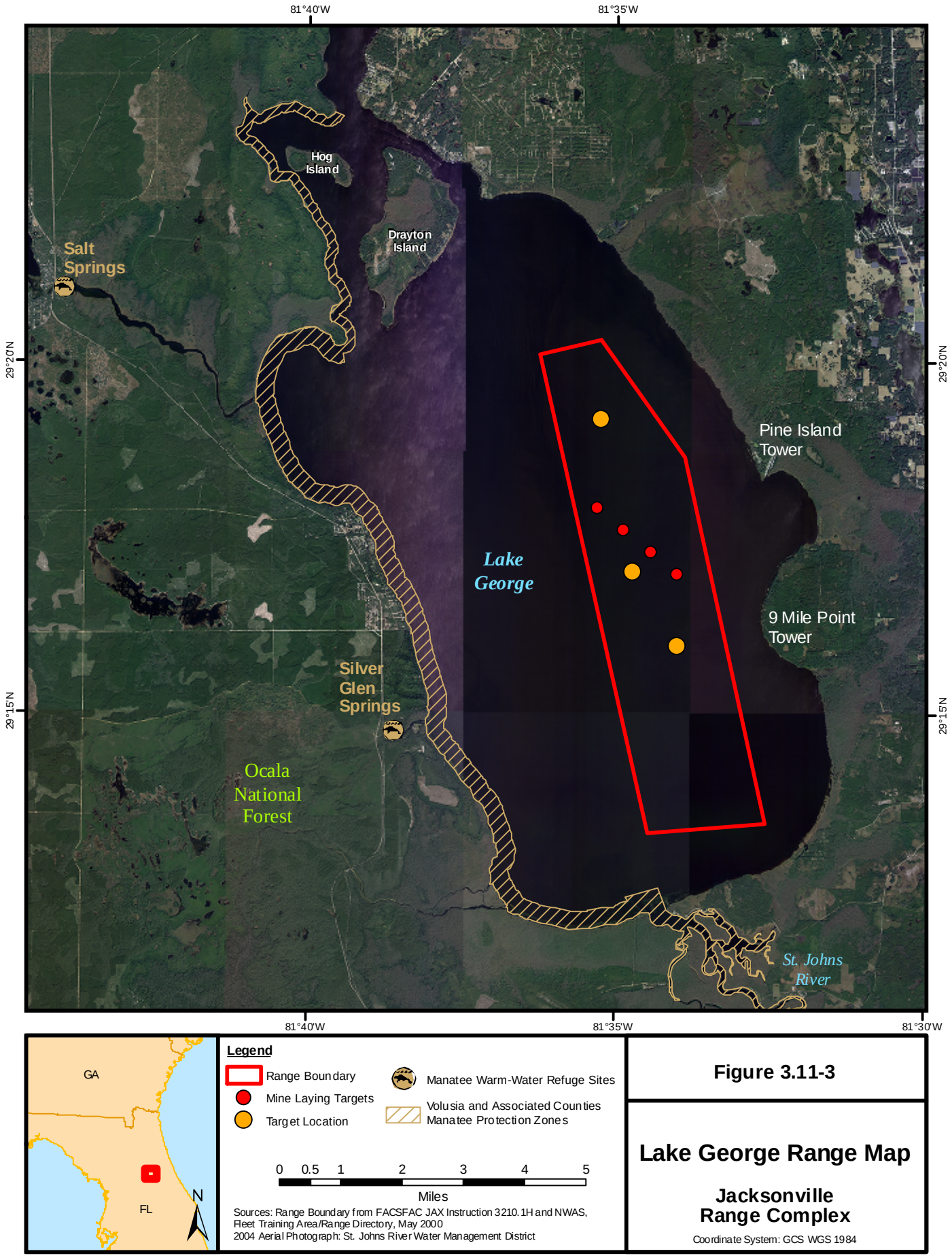


Figure 3.11-3

Lake George Range Map

Jacksonville Range Complex

Coordinate System: GCS WGS 1984

Silver Glen, and Juniper. The water from these springs has a high salt content derived from the old marine deposits through which they flow. These springs and influences of the Atlantic Ocean cause Lake George to be slightly brackish (St. Johns River Water Management District, 1991).

3.11.2.2 Vegetation

Rodman Range

A majority of the 2,696-acre Rodman Range is undeveloped and consists of forested uplands and wetlands. An inventory completed by the FNAI in 1996 - 1997 indicated that about 52 percent (1,390 acres) of the range consists of natural vegetation communities (Table 3.11-4) including approximately 1,200 acres of floodplain swamp and bottomland forest along the Ocklawaha River in the southern part of the property (FNAI, 1997). Flatwoods located on the north part of the range are composed of mostly mature slash pine plantations with a heavy saw palmetto understory. Numerous small depression marshes and dome swamps are interspersed throughout the flatwood plantations. Rodman Range has a main target area of about 100 acres, which is maintained by routine mowing and occasional plowing to meet operational and safety requirements. Vegetation in the target area consists of grasses and other herbaceous plants (DoN, 2005).

TABLE 3.11-4
NATURAL VEGETATION COMMUNITIES AT RODMAN RANGE

Natural Community	FNAI Ranking	Estimated Size (acres)	Percentage of Range
Basin Swamp	G4/S3	7	<1
Baygall	G4/S4	40	2
Bottomland Forest	G4/S3	30	1
Depression Marsh	G4/S4	30	1
Dome Swamp	G4/S4	12	<1
Floodplain Swamp	G4/S4	1,200	45
Mesic Flatwoods	G4/S4	50	2
Scrub	G2/S2	11	<1
Upland Mixed Forest	G4/S4	10	<1
Total Natural Communities		1,390	52

Sources: DoN 2002, FNAI 1997

Key: G4 = Apparently secure globally.
G2 = Imperiled globally.
S4 = Apparently secure in Florida.
S3 = Rare or uncommon in Florida.
S2 = Imperiled in Florida.

Vegetation at the range is managed in accordance with the Integrated Natural Resources Management Plan (DoN, 2005) to support the mission and to provide for sustained, multiple uses. Prescribed fire is used as a management tool throughout the range and silvicultural practices are used in the pine plantations. Lands surrounding Rodman Range are undeveloped and primarily forested. The Ocala National Forest boarders the range to the south and west. Descriptions of natural vegetation communities occurring at Rodman Range are taken from the Integrated Natural Resources Management Plan (DoN, 2005).

Basin Swamp - Basin swamp occurs near the center of the northern property line. Only the southern 10 acres are located on Navy property. This community has an open canopy of mature

bald cypress. In 1993, wildfires killed some of the cypress and hardwood trees. The surrounding pine plantation was clear-cut following the 1993 fire, and the part of the swamp north of the range boundary was clear-cut in recent years. A canal runs along the east side of the swamp. The basin swamp is given a marginal ranking because of logging activities north of the property and the canal, which has altered the hydrologic conditions.

Baygall - Baygall occurs on the slope above the river floodplain west of the target. The dense canopy has many large trees; while the shrub stratum varies from thick to fairly open. Saw palmetto is abundant in the understory of the westernmost strand, which has not been burned in several years. Dominant species are as follows: magnolia and loblolly bay, laurel oak, bay, slash pine, and sweet gum. This well-developed baygall is given a good ranking. A 10-acre block of baygall surrounds two dome swamps northeast of the target. The dense canopy of trees is dominated by loblolly bay and slash pine and occasional, mature pond cypress. This baygall is given a marginal ranking because of its altered hydrology associated with the central canal.

Bottomland Forest - Bottomland forest covers approximately 30 plus acres at the edge of the floodplain swamp where the Ocklawaha River turns to the east. Some locations have large trees; mainly laurel oak, live oak, and sabal palm, while others have more deciduous species like American hornbeam, sweet gum, and American elm. The bottomland forest is ranked as excellent to moderate as it is relatively undisturbed, but small.

Depression Marsh - Depression marsh is represented by 16 occurrences throughout the northern half of the range. Generally, they are small and have been given good ranks, although they are surrounded by mostly mature pine plantations. Vegetation occurs in concentric bands along the hydrologic gradient.

Dome Swamp - Dome swamps occur at three locations on Rodman Range. Each consists of a community dominated by bald cypress, with a subcanopy of slash pine, loblolly bay, and dahoon holly. The rankings for these dome swamps range from marginal to good.

Floodplain Swamp - The floodplain swamp located along the Ocklawaha River is relatively pristine and is given an excellent rank. It is the highest quality natural community surveyed within Rodman Range. Numerous large trees of bald cypress, black gum, red maple, and American elm form a closed canopy. The well developed sub canopy contains Carolina ash, American elm, and sabal palm.

Mesic Flatwoods - Mesic flatwoods cover about 50 acres on the slope above the river floodplain. The broadest part is south of the cleared bomb target where the open canopy consists of younger mature to mature slash pine, an occasional longleaf pine, and mature coast laurel oak. Toward the east, the flatwoods taper into a narrow band between the Ocklawaha River floodplain swamp and mature slash pine plantation. The canopy is mature slash pines; some locations have numerous large Virginia live oak. The dense saw palmetto is often more than 6 feet tall and precludes any herbaceous groundcover. This community is ranked marginal because of its small size, fire suppression, logging, and encroachment by pine plantation.

Scrub - Scrub with sand pine occurs on a narrow ridge at the crest of the slope above the river. A wildfire burned its east end (west of the target) in September 1993. This resulted in dense shrubs growing beneath a sparse canopy of dead sand pine and resprouting sand live oak. The west end of the scrub has not been burned in several years – here the community is dominated by oak. Some of the

myrtle oak, Chapmans oak, and rusty lyonia also have reached tree size. The scrub is given a good to marginal rank due to its small area and lack of burning.

Upland Mixed Forest - Upland mixed forest covers the crest and upper slope of a peninsula extending into the river floodplain at the southwest corner of Rodman Range. The canopy is primarily large, live oak, laurel oak, and loblolly pine, sweet hickory, sweet gum, magnolia, and sabal palm. The upland mixed forest is rated good to marginal due to disturbance by roads and old clearings. Xeric hammock occurs on a couple of acres at the east end of the peninsula.

Lake George Range

The St. Johns River system in Volusia County, including Lake George, is characterized as having a diverse set of plant communities, with submerged, emergent, and floating vegetation (Volusia County Government, 2001). Common aquatic plants include water hyacinth, coontail, eelgrass, yellow water-lily, spatterdock, bulrushes, and hydrilla (St. Johns River Water Management District, 1991). While comprehensive submerged aquatic vegetation mapping has not be completed for Lake George (Dobberfuhl, 2008), mapping conducted in nearby areas on the St. Johns River shows that vegetation is limited to the littoral (nearshore) zone (Dobberfuhl and Trahan, 2003). Dobberfuhl (2008) indicated that submerged aquatic vegetation would not be expected to grow in areas of Lake George that are deeper than about five feet. General descriptions of the lake also indicate that submerged aquatic vegetation is limited to the littoral zone (St. Johns River Water Management District, 1991) and nearshore waters up to about five feet deep (Porter, 2007). Vegetation growth in deeper waters is likely curtailed by limited light penetration through the tannin-stained waters. The Lake George Range is in waters ranging from 8 to 11 feet deep. The range is located 0.6 to 1.9 miles off the lake's eastern shoreline and 2.4 to 4.7 miles off the western shoreline. Therefore, submerged aquatic vegetation is not expected to occur within the Lake George Range boundaries.

No land areas or terrestrial vegetation occurs on this range. Lands surrounding Lake George are largely undeveloped and the vegetation primarily consists of forested uplands and wetlands. Ocala National Forest is located west of Lake George.

3.11.2.3 Wetlands

Rodman Range

Wetland surveys conducted in 1997 at Rodman Range indicated that approximately 70 percent (1,886 acres) of the range was composed of jurisdictional wetlands, including palustrine forested, scrub/shrub, and emergent wetlands. The southern part of the range along the Ocklawaha River supports a large (approximately 1,200 acres) and relatively pristine floodplain swamp community. Numerous small palustrine forested, scrub/shrub, and emergent wetlands are interspersed throughout the flatwood plantations in the northern part of the range (DoN, 2005). Descriptions of natural wetland communities at Rodman Range are provided above in the vegetation section.

Lake George Range

Lake George Range is located entirely within the waters of Lake George, which is classified as waters of the United States. Review of National Wetland Inventory Maps indicates that extensive palustrine forested, scrub/shrub, and emergent wetlands occur around the fringes of Lake George (USFWS, 2007a).

3.11.2.4 Wildlife

Rodman Range

The vegetation communities at Rodman Range provide a variety of habitats for wildlife. With about 48 percent of the range covered by natural swamps or marsh communities, the majority of the wildlife species using the range will be those that find food and shelter in these dynamic systems. High concentrations of invertebrates – worms, leeches, insects, and arthropods – form the base of the food chain. Amphibians and reptiles, such as frogs, salamanders, turtles, and snakes – commonly live and forage in swamps and marshes. Many common species are the marbled salamander (*Ambystoma opcacum*), tree frogs (*Hyla* spp.), and mudsnakes (*Faranica abacura*).

Birds are among the most abundant wildlife in swamps and marshes. The changing water levels, canopy, tree cavities, and abundance of invertebrates provide habitat for waterfowl, wading birds, songbirds, woodpeckers, and occasionally wild turkeys (*Meleagris gallopavo*). Wood ducks (*Aix sponsa*) can be found in the open waters of swamps and marshes. Several species of herons (*Ardea* spp.), egrets (*Egretta* spp), and limpkins (*Aramus guarauna*) as well as ibis, rails, various water fowl, and Florida sandhill crane commonly wade in the shallow waters in search of benthic invertebrates and fish. Warblers (*Limnothlypois* and *Protonotaria* spp.) and at least three species of woodpeckers can be found in the canopy (Ewel, 1990).

Bird surveys conducted at Rodman Range from 1997 through 2000 documented 46 species of birds including flycatchers, sparrows, owls, woodpeckers, herons, warblers, vireos, hawks, and game birds such as wild turkey, mourning dove, wood duck, and bobwhite quail (DoN, 2005). The Audubon Society has designation certain areas of Florida as "Important Bird Areas of Florida" in which both Rodman and Lake George Ranges are included the area identified as the Ocala National Forest-Lake George Important Bird Area (Audubon Society, 2007).

Mammals common to the swamps and marshes of Rodman Range are not necessarily confined to these wetland habitats. The most common species include white-tailed deer, wild hogs, rabbit, gray and fox squirrel, raccoon, opossum, and fox (DoN, 2005). Raccoons (*Procyon lotor*), mice (*Peromyscus* and *Ochrotomys* spp.), and squirrels (*Sciurus* spp.) range through a variety of vegetative communities daily or with changing water levels. The largest species associated with swamps is the Florida black bear (*Ursus americanus*), which is common in this portion of the state and in the Ocala National Forest. A variety of reptiles (tortoises, snakes, lizards, anoles, skinks, and alligators) and amphibians (salamanders, newts, frogs, and toads) occur at Rodman Range (DoN, 2005).

Lake George Wildlife

The shoreline vegetation at Lake George provides an excellent habitat for fish (FFWCC, 2007a) and the lake is also home to a wide variety of wildlife ranging from migratory water birds and alligators to a number of marine animals like stingray, mullet, and blue crabs. Lake George is primarily composed of freshwater, although it is slightly brackish and provides suitable habitat for some saltwater species (Crittenden and Barkuloo, 1956; Holder, 2007).

Common freshwater fish in Lake George include largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), redear sunfish (*Lepomis microlophus*), and crappie (*Pomoxis* spp.) (St. Johns River Water Management District, 1991). Lake George is recognized as one of the premier largemouth bass fishing lakes in central Florida (FFWCC, 2007a). Excellent striped bass

(*Morone saxatilis*) fishing is also available. In addition, some saltwater species occur in the lake. The gray snapper (*Lutjanus griseus*) and the red drum (*Sciaenops ocellatus*) are frequently found in Lake George. The bonnethead shark (*Sphyrna tiburo*) and sheepshead (*Archosargus probatocephalus*) are infrequently found in Lake George (Holder, 2007).

The only Essential Fish Habitat (see Section 3.9) that has been identified within Lake George are the tidal freshwater wetlands, designated for white shrimp, which surround the lake. However, it should be noted that the Lake George Range is located entirely within the waters of Lake George with a buffer zone between the shoreline and the range (see Figure 3.11-3). Since all exercise activities occur within the boundaries of the range, wetlands and other shoreline habitats will not be impacted.

The mixed hardwood swamp and pine flatwoods in the vicinity of Lake George support populations of bobcat, Florida black bear, alligator, a variety of hawks, several representatives of the heron family, river otters, owls, osprey, and white-tailed deer. Parts of the Lake George area are included in the Great Florida Birding Trail.

3.11.2.5 Threatened and Endangered Species

Overview

Threatened and endangered species include those that are federally listed, or proposed for listing, by the USFWS and/or NMFS under the ESA. Also included are species that are listed by the state of Florida as endangered, threatened, or of special concern.

The Rodman and Lake George region encompasses almost every upland and freshwater wetland habitat type found in central Florida. The interspersion of these various types of upland, wetland, and transition habitats make it one of the most biologically diverse areas in the state. The region's biodiversity is reflected by designation of several Strategic Habitat Conservation Areas, Biodiversity Hotspots, and Priority Wetlands for listed species. Florida's Strategic Habitat Conservation Areas are lands designated to meet the state's conservation and protection goals for 30 species of wildlife that are inadequately protected by the current system of conservation lands. Strategic Habitat Conservation Areas are composed of high quality sandhill sites, scrub sites, pine rocklands, tropical hardwood hammocks, dry prairies, bat caves, and wetlands. Biodiversity Hotspots are areas where the potential habitats of three or more indicator species of biodiversity overlap and they are presumed to indicate those areas of the state that are most important to biodiversity conservation. Priority Wetlands are upland or wetland habitats for wetland-dependent listed species. While no Strategic Habitat Conservation Areas have been identified on the ranges, mapping provided by FFWCC shows that several are located in the general area. Large portions of Rodman Range have been mapped as Biodiversity Hotspots and Priority Wetlands. In addition, much of the area surrounding Lake George has been mapped as Biodiversity Hotspots and Priority Wetlands.

Information regarding the occurrence of threatened and endangered species at or near Rodman and Lake George Ranges was obtained from various sources. The FNAI conducted rare species inventories for the Navy at Rodman Range in 1996 - 1997 (FNAI, 1997) and again in 2003 - 2004 (FNAI, 2004). The 1996 - 1997 surveys were broad in scope, while the 2003 - 2004 surveys focused on federally listed species that the Navy and FNAI believed additional information was needed; Eastern indigo snake (*Drymarchon couperi*) and pondberry (*Lindera melissifolia*). Site-

specific surveys have not been conducted for Lake George Range. The FNAI Biodiversity Matrix was also queried to help identify species that have been documented in the general vicinity of the ranges, as well as species that are likely to occur or potentially occur in the general area (FNAI, 2007). Information provided by the USFWS and FFWCC in response to the Navy's request for information and other sources were also used. Copies of correspondence with these agencies are provided in Appendix C. Tables 3.11-5 and 3.11-6 provide lists of threatened and endangered species that potentially occur in the Rodman and Lake George Range Study Areas.

Federally Listed Birds

Florida Scrub-jay

The Florida scrub-jay is similar in size and shape to the familiar blue jay (*Cyanocitta cristata*). Scrub-jays are opportunistic omnivores. Their diet is dominated by lizards and arthropods in spring and summer and by acorns in the fall and winter. Florida scrub-jays have a cooperative breeding system; the young may remain in natal territory as helpers at older birds' nests for up to several years. Helpers' enhancement of the survival of fledglings and breeders may be related to predator detection, not to extra food provided. The scrub-jay is sedentary; groups of related birds defend year-round territories, which grow as the family group enlarges; ultimately a male establishes a separate breeding territory in part of the enlarged area (USFWS, 2007b; NatureServe, 2007).

Status and Management

Florida scrub-jays are listed as threatened under the ESA. Critical habitat for the Florida scrub-jay has not been designated. In 2006, the USFWS received two petitions to reclassify the Florida scrub-jay from threatened to endangered, but found the petitions did not provide substantial scientific information indicating that reclassification may be warranted. Land management is required to maintain a suitable, open oak scrub habitat. Natural or prescribed fires at intervals of 10-20 years should be used to promote open canopies. Continuing loss, fragmentation, and degradation of scrub habitat has resulted in a decline of greater than 90 percent of the original pre-settlement population. In developed areas, cars and cats take their toll on the scrub-jays while they are susceptible to population crashes in wild areas due to catastrophic fires and disease (USFWS, 2007b; NatureServe, 2007).

Distribution

The Florida scrub-jay is restricted to peninsular Florida. The species mostly occurs in overgrown scrub areas or areas with sparser oaks, but at much lower densities and survivorship. The bird is rarely found in areas with greater than 50 percent canopy cover taller than 6 feet. Many populations are small and isolated (NatureServe, 2007).

Florida Scrub-jay Occurrence in Rodman Range Study Area

The Florida scrub-jay has not been observed during FNAI (1997) surveys at Rodman Range and suitable habitat is not present. Mapping provided by FFWCC showed several occurrence records for this species south of the range in Ocala National Forest, but none within the range boundaries. The Ocala National Forest supports the largest extant population of Florida scrub-jays (Audubon Society, 2007). The Florida scrub-jay is not expected to occur at Rodman Range based on the lack of sightings and lack of suitable habitat, but may occur within the Study Area.

TABLE 3.11-5
ENDANGERED SPECIES ACT-LISTED AND STATE-LISTED SPECIES POTENTIALLY OCCURRING ON OR NEAR NAVY RODMAN RANGE, PUTNAM COUNTY, FLORIDA

Common Name	Species Name	ESA Status	State Listing	Documented at Rodman	FNAI Biodiversity Matrix Results[1]
Amphibians					
Gopher frog	*Rana capito*	N	LS	Yes[2]	Documented
Birds					
Bald eagle	*Haliaeetus leucocephalus*	DL	LT	Yes[3]	Documented
Florida burrowing owl	*Athene cunicularia floridana*	N	LS	No	Potential
Florida scrub-jay	*Aphelocoma coerulescens*	LT	LT	No	Potential
Florida sandhill crane	*Grus canadensis pratensis*	N	LT	Yes[4]	Likely
Least tern	*Sterna antillarum*	N	LT	No	None[5]
Limpkin	*Aramus guarauna*	N	LS	No	None[5]
Little blue heron	*Egretta caerulea*	N	LS	Yes	Documented
Red-cockaded woodpecker	*Picoides borealis*	LE	LS	No	Likely
Snowy egret	*Egretta thula*	N	LS	No	Documented
Southeastern American kestrel	*Falco sparverius*	N	LT	No	None[5]
Tricolored heron	*Egretta tricolor*	N	LS	No	None[5]
Wood stork	*Mycteria americana*	LE	LE	Yes[4]	Documented
White ibis	*Eudocimus albus*	N	LS	Yes[4]	None
Fish					
Atlantic sturgeon	*Acipenser oxyrinchus oxyrinchus*	C	LS	No	Potential
Bluenose shiner	*Pteronotropis welaka*	N	LS	No	Likely

TABLE 3.11-5 (Continued)
ENDANGERED SPECIES ACT-LISTED AND STATE-LISTED SPECIES POTENTIALLY OCCURRING ON OR NEAR NAVY RODMAN RANGE, PUTNAM COUNTY, FLORIDA

Common Name	Species Name	ESA Status	State Listing	Documented at Rodman	FNAI Biodiversity Matrix Results[1]
Shortnose sturgeon	*Acipenser breviostrum*	LE	LE	No	Likely
Tessellated Darter	*Etheostoma olmstedi*	N	LS	No	Likely
Mammals					
Florida black bear	*Ursus americanus floridanus*	N	LT	Yes	Likely
West Indian manatee	*Trichechus manatus*	LE	LE	No	Potential[6]
Sherman's fox squirrel	*Sciurus niger shermani*	N	LS	No	Potential
Plants					
Clasping warea	*Warea amplexifolia*	LE	LE	No	Potential
Lewton's polygala	*Polygala lewtonii*	LE	LE	No	Potential
Pondberry	*Lindera melissifolia*	LE	LE	No[7]	None
Pondspice	*Litsea aestivalis*	N	LE	Yes[2]	Documented
Scrub buckwheat	*Eriogonum longifolium var. gnaphalifolium*	LT	LE	No	Potential
Southern red lily	*Lilium catesbaei*	N	LT	Yes[4]	None
Reptiles					
American alligator	*Alligator mississippiensis*	LT (SA)	LS	Yes	None
Eastern indigo snake	*Drymarchon couperi*	LT	LT	No[7]	Likely
Florida pine snake	*Pituophis melanoleucus mugitus*	N	LS	No	Likely
Gopher tortoise	*Gophreus polyphemus*	N	LS	Yes[2]	Documented
Sand skink	*Neoseps reynoldsi*	LT	LT	No	Likely

TABLE 3.11-5 (Continued)
ENDANGERED SPECIES ACT-LISTED AND STATE-LISTED SPECIES POTENTIALLY OCCURRING ON OR NEAR NAVY RODMAN RANGE, PUTNAM COUNTY, FLORIDA

Common Name	Species Name	ESA Status	State Listing	Documented at Rodman	FNAI Biodiversity Matrix Results[1]
Short-tailed snake	*Stilosoma extenuatum*	N	LT	No	Likely
Suwanee cooter	*Pseudemys concinna suwanniesis*	N	LS	No	None[5]

Key: N=not listed, LE=listed endangered, LT=listed threatened, LS=listed special concern, C=candidate, DL=de-listed (currently protected under the Bald and Golden Eagle Protection Act, LT (SA)=listed threatened for similarity of appearance, Endangered Species Act Section 7 consultation requirements do not apply.

(1) Florida Natural Area Inventory (http://www.fnai.org/biointro.cfm), Biodiversity Matrix Query Results (Unofficial Report), performed by Parsons on August 16, 2007 for Matrix Units 37497, 37498, 37499, 37500, 37852, 37853, 37854, 37855, 38209, 38210, 38,211, 38212, 38570, 38571, 38572, and 38573. Note that the database contains records for several state-listed plants that potentially occur in these Matrix Units, but are not listed in this table. Documented=There is a documented occurrence in the FNAI database of the species within one or more of the Matrix Units. Likely=The species is known to occur in this vicinity, and is considered likely within one or more the Matrix Units. Potential=One or more of the Matrix Units lies within the known or predicted range of the species based on expert knowledge and environmental variables.

(2) Species documented at Rodman Range during inventories performed by FNAI during 1996-1997 and 2003-2004 (DoN, 2002; FNAI 1997, 2004).

(3) Incidental observations. Bald eagle nesting has not been documented at Rodman Range.

(4) Species documented at Rodman Range during inventories performed by FNAI during 1996-1997 (DoN, 2002; FNAI, 1997). Wood stork nesting has not been documented at Rodman Range.

(5) Species occurring on Caravelle Ranch based on being directly observed by FFWCC staff or are suggested to be present by the Florida Department of Environmental Protection. The Caravelle Ranch lies just north of Rodman Range and is managed by the FFWCC for protection and public enjoyment of Florida wildlife species (FFWCC, 2002).

(6) Records exist for West Indian manatee in the Ocklawaha River, which runs along the southern boundary of Rodman Range.

(7) The FNAI conducted pondberry and eastern indigo snake inventories at Rodman Range in 2003-2004 and none were documented (FNAI, 2004).

TABLE 3.11-6
ENDANGERED SPECIES ACT-LISTED AND STATE-LISTED SPECIES POTENTIALLY OCCURRING ON OR NEAR NAVY LAKE GEORGE RANGE, VOLUSIA COUNTY, FLORIDA

Common Name	Species Name	ESA Status	State Listing	FNAI Biodiversity Matrix Results(1)
Amphibians				
Gopher frog	*Rana capito*	N	LS	Potential
Birds				
Bald eagle	*Haliaeetus leucocephalus*	DL	LT	Documented
Florida scrub-jay	*Aphelocoma coerulescens*	LT	LT	Likely
Florida sandhill crane	*Grus canadensis pratensis*	N	LT	Likely
Red-cockaded woodpecker	*Picoides borealis*	LE	LS	Likely
Fish				
Atlantic sturgeon	*Acipenser oxyrinchus oxyrinchus*	C	LS	Potential
Bluenose shiner	*Pteronotropis welaka*	N	LS	Potential
Shortnose sturgeon	*Acipenser breviostrum*	LE	LE	None
Mammals				
Florida black bear	*Ursus americanus floridanus*	N	LT	Likely
Florida mouse	*Podomys floridanus*	N	LS	Potential
West Indian manatee	*Trichechus manatus*	LE	LE	Potential
Sherman's fox squirrel	*Sciurus niger shermani*	N	LS	Potential

TABLE 3.11-6 (Continued)
ENDANGERED SPECIES ACT-LISTED AND STATE-LISTED SPECIES POTENTIALLY OCCURRING ON OR NEAR NAVY LAKE GEORGE RANGE, VOLUSIA COUNTY, FLORIDA

Common Name	Species Name	ESA Status	State Listing	FNAI Biodiversity Matrix Results[1]
Reptiles				
American alligator	*Alligator mississippiensis*	LT (SA)	LS	None
Eastern indigo snake	*Drymarchon couperi*	LT	LT	Likely
Florida pine snake	*Pituophis melanoleucus mugitus*	N	LS	Potential
Gopher tortoise	*Gophreus polyphemus*	N	LS	Likely
Sand skink	*Neoseps reynoldsi*	LT	LT	Likely
Short-tailed snake	*Stilosoma extenuatum*	N	LT	Likely

Key: N=not listed, LE=listed endangered, LT=listed threatened, LS=listed special concern, C=candidate, DL=de-listed (currently protected under the Bald and Golden Eagle Protection Act, LT (SA)=listed threatened for similarity of appearance, Endangered Species Act Section 7 consultation requirements do not apply.

(1) Florida Natural Area Inventory (http://www.fnai.org/biointro.cfm), Biodiversity Matrix Query Results (Unofficial Report), performed by Parsons on August 20, 2007 for 137 Matrix Units covering Lake George and its shoreline. Note that the database contains records for several listed plants that potentially occur in these Matrix Units, but are not listed in this table. Documented=There is a documented occurrence in the FNAI database of the species within one or more of the Matrix Units. Likely=The species is known to occur in this vicinity, and is considered likely within one or more the Matrix Units. Potential=One or more of the Matrix Units lies within the known or predicted range of the species based on expert knowledge and environmental variables.

Florida Scrub-jay Occurrence in Lake George Range Study Area

The Florida scrub-jay is not expected to use the open water habitats within Lake George Range, but mapping provided by FFWCC shows numerous occurrence records for this species west of Lake George. The Florida scrub-jay is not expected to occur at Lake George Range, but may occur within the Study Area.

Red-cockaded Woodpecker

The red-cockaded woodpecker is a small (18-20 cm long, 35-38 cm wingspan) woodpecker that engages in a cooperative breeding system. They live in groups containing a single breeding pair and helpers who help incubate eggs, feed nestlings and fledglings, and defend territories. The mated pairs are monogamous, though once a male attains breeding status in a group it retains the position until death. Groups maintain territories throughout the year and appear to recognize precise boundaries. Their main source of nutrition is insects, though they also feed on small amounts of berries. They use their bill and feet to pry off pieces of bark and expose the insects they feed on (USFWS, 2007c; NatureServe, 2007).

Most of the species' population lives in Florida and estimates indicate that those populations have increased by 20 percent since 1990. Red-cockaded woodpeckers inhabit open, mature pine woodlands. Optimal habitat is characterized as a broad savanna with a scattered overstory of large pines and a dense groundcover containing a diversity of grass, forb, and shrub species. Midstory vegetation is sparse or absent. This habitat is characteristic by low intensity fire, which historically occurred during the growing season at intervals of about 1-10 years. Therefore, fire suppression can have a detrimental impact on red-cockaded woodpecker populations. Landscape features, such as fragmentation of foraging habitat, total area of foraging habitat, percentage of pinewood or hardwood cover, contiguity of the canopy and forest cover, and habitat patch size and shape may affect the habitat quality (NatureServe, 2007).

Status and Management

The red-cockaded woodpecker was listed as endangered under the ESA in 1970. Critical habitat for the red-cockaded woodpecker has not been designated. Quantity and quality of suitable habitat are much reduced and still declining. There has been a population decline of about 97 percent over the last century. Short-term rotation timber management has eliminated mature diseased pines required for roosting, nesting, and foraging; fire suppression has allowed invasion of pine stands by hardwoods. However, recent management innovations have alleviated threats and resulted in population increases in some areas (NatureServe, 2007).

The USFWS Southeast Region (Region 4) is the lead region for management of the red-cockaded woodpecker (USFWS, 2007c). Management centers on maintaining old-growth pine forests and establishing an effective prescribed burning program. Burns conducted in spring and summer are most effective in controlling hardwood encroachment. Maintenance of existing nesting/roosting cavities is best accomplished by eliminating hardwoods in the vicinity of cavities, protecting trees against infestation by southern bark beetles (*Dendroctonus frontalis*), ensuring that old-growth conditions persist near cavity trees, and placing restrictor plates over cavities. Expanding the number of active cavities can be accomplished by creating artificial cavities (NatureServe, 2007).

Distribution

The red-cockaded woodpecker has a distribution range from Texas, east to the Atlantic Ocean, stretching down peninsular Florida, and up the coast to Virginia.

Red-cockaded Woodpecker Occurrence in Rodman Range Study Area

The red-cockaded woodpecker has not been observed during FNAI (1997) surveys at Rodman Range and the range generally lacks suitable open, mature pine woodland habitat for this species. Most of the pine forest habitats at the range are composed of mature slash pine plantations with a heavy saw palmetto understory (DoN, 2005). Mapping provided by FFWCC showed no occurrence records for this species at Rodman Range or in surrounding areas. The FNAI Biodiversity Matrix (FNAI, 2007) indicates that this species is likely to occur in the general vicinity of the range, but does not contain records for documented occurrences in the immediate area. The red-cockaded woodpecker is not expected to occur at Rodman Range based on lack of sightings and lack of suitable habitat. While suitable habitat may occur outside the range in the broader Study Area, information provided by FFWCC indicates no occurrence records for this species in the Study Area.

Red-cockaded Woodpecker Occurrence in Lake George Range

The red-cockaded woodpecker is not expected to use the open water habitats within Lake George Range, but mapping provided by FFWCC shows two occurrence records for this species west of Lake George in Ocala National Forest. The Ocala metapopulation contained 22 active clusters and 18 potential breeding groups in 2000 (FFWCC, 2003). The red-cockaded woodpecker is not expected to occur at Lake George Range, but may occur within the broader Study Area for this range.

Wood Stork

Wood storks are large, long-legged, wading birds, about 50 inches tall, with a wingspan of 60 to 65 inches. Wood storks inhabit chiefly freshwater marshes, swamps, lagoons, ponds, and flooded fields. The wood stork can also occur in brackish wetlands. Wood storks nest mostly in upper parts of cypress trees, mangroves, or dead hardwoods situated over water, on islands along streams, or adjacent to shallow lakes. Nesting is tied to receding water levels and concentration of food sources, regardless of the time of year. Colonies are made up of a few to thousands of nesting pairs (USFWS, 2007d; NatureServe, 2007).

Wood storks feed predominantly in the areas in which they nest. The wood stork eats mainly fish over 3.5 cm long, though it will also eat other miscellaneous small animals detected with its touch-sensitive bill. They forage mainly in shallow water and flooded fields. Areas with falling water level attract these birds as they have more highly concentrated food sources (NatureServe, 2007).

Status and Management

The wood stork is listed as endangered under the ESA in Alabama, Florida, Georgia, and South Carolina. Critical habitat for the wood stork has not been designated. The Southeast Region (Region 4) is the lead region of the USFWS for management of the wood stork (USFWS, 2007d). Data summarized in the USFWS five-year review (USFWS, 2007e) indicate that the wood stork population in the Southeast United States is increasing. The number of colonies has increased from 29 to 81 colonies since the species was listed in 1984. Synoptic surveys completed in 1999 and

2001 to 2006 documented a population ranging between 5,560 and 11,279 pairs in the Southeast United States. In 2006, 38 colonies and 4,568 nesting pairs were documented in North and Central Florida. The five-year review included a recommendation to reclassify the wood stork to threatened status (USFWS, 2007e).

Distribution

In the United States, permanent breeding populations exist mostly in Florida, Georgia, and South Carolina, but are present to some degree along the Gulf Coast. Vagrant populations occur throughout the southeastern United States and up the Atlantic coastline. Some vagrant populations are also present in the southwestern United States, including California and Arizona (USFWS, 1997).

Wood Stork Occurrence in Rodman Range Study Area

The wood stork was documented at Rodman Range during inventories performed by FNAI during 1996 - 1997 (DoN, 2005, FNAI, 1997); however, nesting has not been documented at the range. The FNAI Biodiversity Matrix also indicates that wood storks have been documented in the vicinity of Rodman Range (FNAI, 2007). No known wood stork colonies or their core foraging areas are located at Rodman Range based on mapping produced by the USFWS (2007f). Wood storks are expected to occasionally use Rodman Range for foraging, but nesting is not expected. A majority of foraging activity is expected to occur in the floodplain swamp community in the southern part of the range along the Ocklawaha River. Threatened and endangered species management, including wood storks, on Rodman Range is covered in the Naval Air Station (NAS) Jacksonville 2005 Integrated Natural Resources Management Plan (DoN, 2005).

Wood Stork Occurrence in Lake George Range Study Area

The wood stork is not expected to use the open water habitats within Lake George Range. The FNAI Biodiversity Matrix contains no records of documented, likely, or potential occurrence of wood storks in the Lake George Range (FNAI, 2007). No known wood stork colonies or their core foraging areas are located in the Lake George Range based on mapping produced by the USFWS (2007f). Despite the lack of documented occurrences at Lake George Range, it is expected that wood storks would occasionally forage or travel through the Study Area.

Federally Listed Fish

Shortnose Sturgeon

Descriptions of the shortnose sturgeon's status and management and habitat are provided in Section 3.9 – Fish and Essential Fish Habitat. Therefore, information presented here is limited to shortnose sturgeon distribution and occurrence in the Lake George Study Area (*e.g.*, St. Johns River System).

Distribution

Lake George is part of the St. Johns River system. Shortnose sturgeon were first recorded in this system around 1949 (NMFS, 1998), with only 11 specimens being positively identified from 1949 through 1999 (FFWCC, 2007b). Another shortnose sturgeon was captured in a shrimper's cast next in August 2000. This fish had been tagged by personnel from the Georgia Department of Natural Resources near St. Simon Island, Georgia in March 1996. A study specifically designed to sample shortnose sturgeon in the estuarine portion of the St. Johns River was conducted in 2002

and 2003. Only one shortnose sturgeon was captured despite nearly 4,500 hours of sampling effort. From 1980 through 1993, researches targeted other species in the same areas using nearly 21,400 hours of gill-net sampling effort, but no incidental shortnose sturgeon captures were reported (FFWCC, 2007b). These data suggest it is unlikely that any sizable population of shortnose sturgeon currently exists in the St. Johns River.

Shortnose sturgeon reproduction generally requires rocky or gravel substrate or limestone outcroppings—habitat rarely found in the St. Johns River or its tributaries. Reproduction of sturgeon in the St. Johns River has never been documented, and no large adults (maximum weight is 50 lbs) have been positively identified (all known specimens have been less than 10 lbs). In other southern rivers, the species uses thermal refuges, such as springs, but no sturgeons have been observed in the numerous springs available in the St. Johns River. Given the marginal habitat, it is possible that shortnose sturgeons have not actively spawned in the system, and that infrequent captures are transients from other river systems (FFWCC, 2007b).

Shortnose Sturgeon Occurrence in Lake George Range Study Area

Based on the information presented above, the shortnose sturgeon is not expected to occur in the Lake George Range Study Area, except as occasional transient individuals.

Federally Listed Mammals

West Indian Manatee

Descriptions of the West Indian manatee's status and management in the OPAREAs are provided in Section 3.7 – Marine Mammals. Therefore, information presented here is limited to manatee distribution and occurrence in the Rodman and Lake George Study Areas (*e.g.*, Upper St. Johns River management unit).

West Indian Manatee Critical Habitat

Critical habitat for the West Indian manatee was designated under 41 FR 41914 in 1976 with an augmentation and correction in 1977 (USFWS, 1976). The habitat extends in the state of Florida and encompasses the St. Johns River, including Lake George (Figure 3.7-2).

The designated area included the West Indian manatee's entire known range at that time (including waterways in about one-third to one-half of Florida) (Laist, 2002). This critical habitat designation has been infrequently used or referenced since it is broad in description, treats all waterways the same, and does not highlight any particular areas (Laist, 2002).

Distribution

West Indian manatees occur throughout the St. Johns River system year-round, with distinct summer and winter distribution patterns (USFWS, 2001; Volusia County Government, 2001). Manatees that use habitats in or near Lake George are generally considered part of the Upper St. Johns River Management Unit, which occurs upstream (south) of Palatka, Florida, extending to the headwaters of the river. Manatees using the St. Johns River north of Palatka are generally considered part of the Atlantic Coast Management Unit. Each of these management units is composed of individual manatees that tend to return to the same warm-water sites each winter and have similar non-wintering patterns. Limited exchange of individuals between management units

is expected during the winter, but some exchanges could occur during the warm season (USFWS, 2007g).

West Indian manatees can be found throughout the Upper St. Johns River system in summer, but during the winter months (generally December through February) animals are found in or near warm-water refuge sites (Volusia County Government, 2001; Bengtson, 1981). A network of primary and secondary warm-water refuge sites exist in the Upper St. Johns River region. Primary warm-water refuge sites have a consistent water temperature range sufficient to maintain manatees over a cold winter and/or support consistent or dependent use by 50 or more manatees. Secondary refuge sites can have variable thermal plume temperatures, sporadic manatees use, and/or are used predictably by manatees, but not consistently. Blue Spring, located approximately 22 miles upstream (south) of Lake George, is the only primary refuge site in the Upper St. Johns River region. Silver Glen Springs and Salt Springs, which discharge flow into Lake George along the western shoreline, are secondary warm-water refuge sites (USFWS, 2007g).

West Indian manatee data are limited for the St. Johns River system in comparison to some waters of the state. Overhanging vegetation and dark waters, which obscure visibility, limit the usefulness of aerial surveys (Volusia County Government, 2001). Demographic indicators summarized by USFWS (2007g) in their most recent five-year review of the West Indian manatee indicate a minimum population size of 112 for the Upper St. Johns River Management Unit and a population growth rate of 6.2 percent per year from 1990 through 1999. This is the highest population growth rate for any management unit. The number of manatees using Blue Spring has increased significantly in recent years, with 182 manatees counted during the 2005 – 2006 winter (USFWS, 2007g) compared to 11 in 1974 (Volusia County Government, 2001).

The number of West Indian manatees that use Silver Glen Springs and Salt Springs is much lower than Blue Spring and use is not as well documented. Four manatees were seen in Silver Glen Springs during a single aerial survey flown in December 2000 and an orphaned calf suffering from cold stress was rescued from the spring pool in January 2000 (FFWCC, 2006). Researchers observed 12 different manatees in the spring run during the months of January through March 2003 and reported that manatees were observed 20 to 25 percent of the time during the research period (Pandion Systems, Inc., 2003). Seven of these manatees were observed over a period of several weeks within the same two areas. Taylor (2006) observed one manatee in Silver Glen Springs during a visit in December 2005, but did not observe manatees on a visit in April 2006.

Four West Indian manatees were also seen in Salt Springs during a single aerial survey flown in December 2000. Manatees have been seen using the spring since 2000 (FFWCC, 2006). A rehabilitated manatee that was radio-tagged and released at Blue Spring visited the spring during the winter of 2002 – 2003 (FFWCC, 2006). As many as 11 animals were seen by the general public in the spring run during the 2005–2006 winter, seven of which were photo-documented (FFWCC, 2006; Taylor, 2006). Taylor (2006) did not observe manatees on two visits in December 2005 and April 2006. One animal catalogued in the Manatee Individual Photo-identification System is regularly seen at Salt Springs during the winter (Taylor, 2006). Heavy recreational use (*e.g.*, boating and swimming) could limit manatee use of Silver Glen Springs and Salt Springs (FFWCC, 2006; Taylor, 2006; Pandion Systems, Inc., 2003).

Most Upper St. Johns River West Indian manatees seek refuge in the warm waters of Blue Spring when river water temperatures drop to about 20°C in the fall or winter (Bengtson, 1981). Radio-

telemetry studies conducted by Bengtson (1981) showed that manatees must leave Blue Spring during the winter to feed, but typically stayed within 12 km of the spring and did not travel to or through Lake George to feed during winter. These studies also showed that many manatees wintering at Blue Spring moved north through Lake George as river waters warmed in spring months. They generally remained close to the shoreline during these movements and commonly traveled to areas around the Cross-Florida Barge Canal (Bengtson, 1981). Bengtson's (1981) studies also showed that manatees returned south of Lake George from the Barge Canal area during the summer. It should be noted that the number of manatees that use Blue Spring in the winter has increased substantially since Bengtson's (1981) studies were conducted and that changes in habitat use and movement patterns may have changed as well. Abundant submerged aquatic vegetation (see Section 3.11.2.2.2) is available in littoral areas of Lake George to support manatee foraging.

West Indian Manatee Occurrence in Rodman Range Study Area

West Indian manatees occur in the Ocklawaha River along the southern boundary of Rodman Range. No training operations take place in or near the river. Therefore, manatees are not addressed further for Rodman Range.

West Indian Manatee Occurrence in Lake George Range Study Area

It is likely that West Indian manatees commonly travel through and forage in Lake George during warmer months. The information presented above for Silver Glen Springs and Salt Springs indicates that manatees probably occur in Lake George in winter; at least sporadically. Manatees using Silver Glen Spring and Salt Spring as a warm-water refuge during the winter must travel through Lake George to access the springs. Manatees using these springs in the winter could also move in and out of Lake George to forage. Patterns may vary from year to year based on weather conditions. Manatees likely use the springs as stop over points when traveling to and from Blue Spring during cold weather (Calleson, 2008), indicating that manatees also move through Lake George during the winter.

The FFWCC West Indian manatee Mortality Database is another source of information regarding manatee occurrence in Lake George. The database has six records of manatee mortality in Lake George for the period of April 3, 1974 through October 31, 2007; three from unknown causes and three from watercraft (FFWCC, 2007c).

The spatial distribution of West Indian manatees in Lake George is expected to vary seasonally and may be largely driven by food availability and the presence of warm-water refuge sites on the western shoreline. Manatee foraging would be limited to littoral areas where submerged aquatic vegetation grows. Traveling manatees could occur throughout the lake, especially during warmer months, but most travel routes are expected to be relatively close to shore (Bengtson, 1981). The Lake George Range is located approximately 0.6 to 1.9 miles from the eastern shoreline and 2.4 to 4.7 miles from the western shoreline. The Lake George Range target area lacks submerged aquatic vegetation and warm-water refuge sites do not exist within the target area. While manatees probably travel through the target area occasionally, they are not expected to spend extended periods of time in the target area based on available data. Sufficient data do not exist to calculate density estimates. Nor was there was an estimate in the published literature.

Federally Listed Plants

Comprehensive plant inventories were conducted at Rodman Range by FNAI during 1996 – 1997 and no federally listed plants were documented (FNAI, 1997). Additional surveys were conducted in 2004 for pondberry (*Lindera melissifolia*), which is listed as endangered, but none were found (FNAI, 2004). Therefore, federally listed plants are not expected to occur at Rodman Range. As shown in Table 3.11-5, the FNAI Biodiversity Matrix (FNAI, 2007) indicates that clasping warea (*Warea amplexifolia*), Lewton's polygala (*Polygala lewtonii*), and scrub buckwheat *Eriogonum longifolium var. gnaphalifolium*) potentially occur in the general vicinity of Rodman Range. These species are not expected to occur at Rodman Range based on site-specific surveys, but they could occur within the broader Study Area. Training operations at Rodman and Lake George Ranges would not affect vegetation outside the range boundaries; therefore, federally listed plants are not addressed in further detail.

Federally Listed Reptiles

American Alligator

The American alligator is known to occur at in the Rodman Range and Lake George Range Study Areas and is listed as "threatened due to similarity of appearance" to other listed crocodilians. The purpose of the listing is to regulate the intentional taking of alligators and to prevent the taking of other crocodilian species. The alligator is not biologically threatened in Florida and ESA Section 7 consultation requirements do not apply to this species. Therefore, the American alligator is not addressed further.

Eastern Indigo Snake

The non-venomous eastern indigo snake is the longest North American snake, attaining a maximum length of approximately 8.5 feet. It is widely distributed throughout central and south Florida, but primarily occurs in sandhill habitats in northern Florida and southern Georgia. Eastern indigo snakes need a mosaic of habitats to complete their annual life cycle. Over most of its range, the eastern indigo snake frequents several habitat types, including pine flatwoods, scrubby flatwoods, high pine, dry prairie, tropical hardwood hammocks, edges of freshwater marshes, agricultural fields, coastal dunes, and human-altered habitats. In xeric habitats this species is closely associated with the gopher tortoise, the burrows of which provide shelter from winter cold and desiccation. Interspersion of tortoise-inhabited sandhills and wetlands improves habitat quality for this species. Eastern indigo snakes range over large areas and into various habitats throughout the year, with most activity occurring in summer and fall. Average home ranges of 183 acres and 47 acres have been reported for males and females, respectively, in south-central Florida (USFWS, 1999).

Status and Management

The eastern indigo snake was listed as threatened in 1978 under the ESA. Critical habitat for this species has not been designated. Quantitative population data are not available for the eastern indigo snake, but it is generally assumed that the population as a whole is declining because of current rates of habitat destruction and degradation (USFWS, 1999).

Distribution

Historically, the eastern indigo snake occurred throughout Florida and in the coastal plain of Georgia, Alabama, and Mississippi. It may have occurred in southern South Carolina, but occurrence there cannot be confirmed. Georgia and Florida currently support the remaining, endemic populations of the eastern indigo snake (USFWS, 1999).

Eastern Indigo Snake Occurrence in Rodman Range Study Area

Suitable eastern indigo snake habitat likely exists at Rodman Range based on the interspersion of xeric uplands with gopher tortoise burrows and wetlands. The FNAI (2004) conducted eastern indigo snake surveys at Rodman Range in 2003 – 2004 by searching gopher tortoise burrows with a burrow camera. A total of 12 burrows were identified and 11 were searched with the burrow camera (one was collapsed and could not be searched). The vicinity of each burrow also was searched for basking eastern indigo snakes. No eastern indigo snakes or signs of the snakes were found during the surveys. While these surveys indicate that eastern indigo snakes were not using the burrows surveyed at Rodman Range, they are not considered definitive in determining the absence of this species at Rodman Range. Multiple survey techniques such as pitfall trapping with drift fencing, pedestrian winter surveys, burrow camera surveys during hot and cold weather, and use of an eastern indigo snake-sniffing dog are recommended by USFWS for determining presence/probable absence of this species. Threatened and endangered species management, including eastern indigo snakes, on Rodman Range is covered in the NAS Jacksonville 2005 Integrated Natural Resources Management Plan (DoN, 2005).

The FNAI Biodiversity Matrix search indicated the eastern indigo snake is likely to occur in the vicinity of Rodman Range, but the database does not contain records for documented occurrences in the immediate area (FNAI, 2007). Although the eastern indigo snake has not been documented at Rodman Range, it may occur there and within the broader Study Area based on available data.

Eastern Indigo Snake Occurrence in Lake George Range Study Area

The eastern indigo snake does not use open water habitats. Therefore, this species does not occur within the Lake George Range boundaries. The FNAI Biodiversity Matrix search indicated the eastern indigo snake is likely to occur in the vicinity of Lake George, but the database does not contain records for documented occurrences in the immediate area (FNAI, 2007). The eastern indigo snake may occur on land areas of the Lake George Range Study Area.

Sand Skink

The sand skink is a small, nearly legless lizard that is highly adapted for life in sand. Its spend most of its time 5 to 10 cm below the surface where it burrows or "swims" through loose sand to search for prey, shelter, and mates. The sand skink is widespread in xeric uplands, but appears to be most abundant in ecotonal areas, typically between high pine and scrub. It is also found in rosemary scrub, turkey oak barrens, or sandy areas of the high pine community. Areas free from abundant plant roots, with open canopies, scatter shrubby vegetation, and patches of bare sand are optimal habitats. However, surveys have located sand skinks in areas with dense undergrowth and extensive canopy closure, indicating that extensive loose, root free may not be a requisite for this species (USFWS, 1999).

Status and Management

The sand skink was listed as threatened in 1987 under the ESA. Critical habitat has not been designated for this species. Quantitative population data are not available for the sand skink, but it is generally assumed that the population as a whole is declining because of current rates of habitat destruction and degradation. The density of the sand skink in occupied habitat varies considerably, ranging from 5 to 23 individuals per 0.06 acre. The sand skink is threatened by habitat destruction from development, agriculture, phosphate mining, and conversion of habitat to citrus production. Fire exclusion also threatens habitat. The Southeast Region of the USFWS has lead management responsibility for the sand skink (USFWS, 1999).

Distribution

The sand skink is endemic to central Florida's high sand ridges with elevations greater than 27 m. Skink habitat is located in Lake, Marion, Orange, Polk, Highlands, and Osceola counties, Florida. It was formerly widespread throughout the Lake Wales Ridge region.

Sand Skink Occurrence in Rodman Range Study Area

The sand skink was not observed at Rodman Range during surveys conducted by the FNAI (1997). The FNAI Biodiversity Matrix does not have records of documented occurrences for this species in the general vicinity, but indicates that occurrence is likely in the general area (FNAI, 2007). Correspondence from the USFWS indicates that suitable sand skink habitat may be present at the range. If present, the area of suitable habitat would be limited because about 70 percent of the range consists of wetlands (DoN, 2005). The FNAI identified about 11 acres of scrub habitat at the range. The scrub was given a good to marginal rank due to its small area and lack of burning (FNAI, 1997). The target area is not expected to provide suitable habitat for the sand skink because it is currently maintained through mowing and occasional plowing. The sand skink is not expected to occur at Rodman Range based on available survey data and the limited potential for suitable habitat to be present. The sand skink may occur outside the range boundaries, within the broader Rodman Range Study Area.

Sand Skink Occurrence in Lake George Range Study Area

The Lake George Range does not include terrestrial habitat, and as such the sand skink would not occur here. The FNAI Biodiversity Matrix (FNAI, 2007) does not have records of documented occurrences for this species in the general vicinity of Lake George, but indicates that occurrence is likely in the general area (FNAI, 2007). The sand skink may occur in terrestrial portions of Lake George Range Study Area.

State-Listed Species

Rodman Range

As shown in Table 3.11-5, state-listed species that have been documented at Rodman Range include the gopher frog, bald eagle, Florida sandhill crane, little blue heron, white ibis, Florida black bear, pondspice, southern red lily, American alligator, and gopher tortoise. The FNAI Biodiversity Matrix indicates that several state-listed species have been documented in the Rodman Range Study Area and that other state-listed species likely or potentially occur in the area (Table 3.11-5).

Lake George Range

The FNAI Biodiversity Matrix (FNAI, 2007) does not have any records of state-listed species occurring within the Lake George Range boundaries. However, the Biodiversity Matrix indicates that several state-listed species have been documented in areas surrounding Lake George and that other state-listed species likely or potentially occur in the area (Table 3.11-6).

3.11.3 Environmental Consequences

3.11.3.1 No Action Alternative

Aircraft Overflights – Rodman Range Study Area

Overview

Both fixed-wing aircraft and helicopters are used in training operations at Rodman Range. F/A-18 aircraft are used for Air-to-Ground Bombing Exercises, which may occur during the day or at night. The No Action Alternative includes 25 F/A-18 sorties per year at Rodman Range. Aircraft altitudes range from 15,000 feet AGL to no less than 1,500 feet AGL during these exercises. Aircraft approach the target area from the northwest or southeast, execute a NEPM drop over the target area, make a left or right hand turn over Ocala National Forest to the east, and repeat the process. Generalized flight tracks for this exercise are shown in Figure 3.11-1. The average time for this exercise is about one hour, with two aircraft participating in the exercise. The typical NEPM release altitude is between 3,000 and 8,000 feet AGL, but could be as low as 1,500 feet AGL. Representative noise levels for the F/A-18 are provided in Table 3.11-7.

TABLE 3.11-7
REPRESENTATIVE NOISE LEVELS FOR
F/A-18 AND P-3 AIRCRAFT AT VARIOUS ALTITUDES

Aircraft	Power	Speed (KIAs)	Altitude in Feet Above Ground Level							
			2,000 feet		3,000 feet		4,000 feet		5,000 feet	
			SEL	L_{max}	SEL	L_{max}	SEL	L_{max}	SEL	L_{max}
F/A-18E/F	83% NC	360	97	90.1	93	84.6	89	80.3	86	76.8
P-3	1400 ESHP	210	-	73.3	-	68.8	-	65.4	-	62.9

Notes:
SEL (sound exposure level) represents total noise energy produced from a single noise event.
Lmax represents the maximum noise level that occurs during an event and is the noise level actually heard during the event.
Values assume temperature of 70°F and relative humidity of 59%.
Source: Flyover Noise Calculator, Version 1.0.2, beta, USAF/AFRL/HECB, Wright-Patterson AFB, OH, May 2002.

Helicopters are used at Rodman Range during CSAR and Convoy Operations. The No Action Alternative includes a total of 191 helicopter sorties per year (including CSAR and Convoy Operations). Forty-five of these operations would involve two aircraft. Helicopters would operate at altitudes ranging from 3,000 feet AGL to tree top levels during these exercises. Sometimes helicopters hover about 20 feet above ground or land at one or more of the six designated helicopter landing zones at Rodman Range (Figure 3.11-2). These operations typically last about 1 to 1.5 hours and about 75 percent of the operations occur at night.

Wildlife

Disturbance Associated With Aircraft Overflights

The No Action Alternative would include some relatively low-altitude aircraft overflights (*i.e.*, less than 3,000 feet AGL). As a result, wildlife occurring in some parts of the Rodman Range Study Area could be exposed to noise and visual cues associated with aircraft overflights. Wildlife could also be exposed to downdrafts from helicopters.

Numerous studies have documented that wild animals respond to human-made noise, including low-altitude aircraft overflights (Larkin, 1996; National Park Service, 1994; Plumpton, 2006). The manner in animals respond to overflights depends on several factors including life-history characteristics of the species, characteristics of the noise source, loudness, onset rate, distance from the noise source, presence/absence of associated visual stimuli, and previous exposure. A primary concern is that low-altitude overflights may cause physiological and/or behavioral responses that reduce the animals' fitness or ability to survive. Researchers have documented a range of behavioral responses to overflights, ranging from indifference to extreme panic. Behavioral responses could interfere with raising young, habitat use, and physiological energy budgets. Most studies have focused on ungulates and birds, while little or no research has been conducted on carnivorous mammals, small mammals, reptiles, and amphibians (National Park Service, 1994). While difficult to measure in the field, some behavioral responses are likely accompanied by physiological responses, such as increased heart rate, or stress. Chronic stress can compromise the general health of animals, but stress is not necessarily indicative of negative consequences to individuals or to populations (Larkin, 1996; National Park Service, 1994; Bowles *et al*., 1990 in Larkin, 1996). For example, the reported behavioral and physiological responses of birds to noise exposure are within the range of normal adaptive responses to external stimuli, such as predation, that birds face on a regular basis. Unless repeatedly exposed to loud noises or simultaneously exposed to synergistic stressors, it is possible that individuals would return to homeostasis almost immediately after exposure and the individual's overall metabolism and energy budgets would not be affected. Studies have also shown that animals can become habituated to noise following frequent exposure and cease to respond behaviorally to the noise (Larkin, 1996; National Park Service, 1994; Plumpton, 2006). Little is known about physiological responses of birds that have habituated to noise.

Fixed-wing aircraft overflights under the No Action Alternative would result in short-term, localized increases in noise levels within the Study Area (Table 3.11-7). Biological receptors on the ground and directly under the flight track could be exposed to the noise levels listed in Table 3.11-7. Exposure levels would decrease with increasing distance from the flight track centerline. For example, the L_{max} for an F/A-18 at 2,000 feet AGL would decrease from 90.1 dB directly under the flight track to 89 dB at 1,000 feet from the centerline, and 71 dB at 5,000 feet from the centerline. The duration of exposure to fixed wing-aircraft noise would be very brief (seconds) as an aircraft quickly passes overhead. Exposures would be infrequent based on the low number of sorties (25 per year at Rodman Range) and the short duration of the exercises (about one hour).

Helicopter overflights under the No Action Alternative would also result in short-term, localized increases in noise levels in the Rodman Range Study Area. A hovering H-60 helicopter produces sounds levels of approximately 90 dBA at 50 feet and sound levels would decrease by about 6 dBA for each doubling of the distance from the helicopter. Unlike fixed-wing aircraft, helicopter training operations can occur near tree top level and helicopters may hover or land at Rodman

Range. In addition, some studies suggest that animals respond more to helicopter overflights than to fixed-wing aircraft overflights (Larkin, 1996; Plumpton, 2006). Areas exposed to helicopter noise, visual cues, and downdraft would be limited to areas within the Rodman Range boundaries, with the exception of transit to and from the ranges. The duration of exposure to helicopter noise could be longer than fixed-wing aircraft because helicopters typically fly at slower airspeeds and spend more time over a given area. Nonetheless, exposures would be infrequent based on the low number of sorties (191 per year at Rodman Range) and short duration of the exercises (up to 1.5 hours).

Wildlife exposed to low-altitude aircraft overflights under the No Action Alternative could exhibit short-term behavioral and/or physiological responses, but not to the extent where the general health of individuals or populations would be compromised. Aircraft overflights are not expected to result in chronic stress based on the short duration and infrequency of exposure.

In accordance with NEPA, disturbance associated with aircraft overflights in the Rodman Range Study Area would have no significant impact on wildlife. Disturbance associated with aircraft overflights would not have a significant adverse effect on migratory bird populations as defined by MBTA regulations applicable to military readiness activities. Furthermore, disturbance associated with aircraft overflights is not expected to result in take of bald eagles or to disturb bald eagles as defined by the Eagle Act.

Aircraft Strikes

Wildlife/aircraft strikes are a major concern for the Navy because they can cause harm to aircrews, damage to equipment, and injury or mortality to wildlife. From 2002 through 2004 an annual average of 596 known wildlife/aircraft strike events occurred Navy-wide and most of these events involved birds (Navy Safety Center, 2004). While all wildlife/aircraft strikes are considered serious and dangerous events, the number of animals injured or killed annually is small considering the number of Navy-wide aircraft operations. The potential for fixed-wing aircraft strikes at Rodman Range is low based the low number of sorties (25 per year), as well as the fact that these aircraft typically operate above 1,500 feet AGL and do not take off or land at this range. While helicopters operate at lower altitudes and more sorties occur (191 per year), they also fly at relatively low airspeeds during these training exercises. This increases the likelihood that wildlife could hear or see an oncoming helicopter, flee the immediate area, and avoid being struck. Lower airspeeds also provide pilots an opportunity to identify safety concerns and to avoid a strike by maneuvering the helicopter. Based on these factors, few, if any, wildlife/aircraft strikes and associated wildlife mortalities or injuries are expected to occur in the Rodman Range Study Area under the No Action Alternative.

In accordance with NEPA, aircraft strikes in the Rodman Range Study Area would have no significant impact on wildlife. Aircraft strikes would not have a significant adverse effect on migratory bird populations as defined by MBTA regulations applicable to military readiness activities. Furthermore, aircraft strikes are not expected to result in take of bald eagles or to disturb bald eagles as defined by the Eagle Act.

Florida Scrub-jay

Disturbance Associated With Aircraft Overflights

The Florida scrub-jay is not expected to occur within the Rodman Range boundaries, but is expected to occur south and west of the range in the Ocala National Forest. Therefore, Florida scrub-jays could be exposed to low altitude F/A-18 overflights. Exposure to helicopter overflights is unlikely because these operations occur within the range boundaries. The duration of exposure to fixed wing-aircraft noise would be very brief (seconds) as an aircraft quickly passes overhead. Exposures would be infrequent based on the low number of sorties (25 per year) and the short duration of the exercises (about one hour). Florida scrub-jays exposed to low-altitude aircraft overflights could exhibit short-term behavioral and/or physiological responses, but not to the extent where the fitness of individuals or populations would be compromised. Aircraft overflights are not expected to result in chronic stress based on the short duration and infrequency of exposure. Disturbance associated with aircraft overflights at the Rodman Range may affect the Florida scrub-jay.

Aircraft Strikes

The probability of an F/A-18 aircraft striking a Florida scrub-jay at Rodman Range is extremely low based on the low number of sorties and the fact that these aircraft operate above 1,500 feet AGL. The Florida scrub-jay nests and forages in scrub habitats on or near the ground. Helicopter strikes are not expected because low-altitude flights take place within the range boundaries, where the Florida scrub-jay is not expected to occur. The effects of aircraft strikes are considered discountable because they are extremely unlikely to occur. Aircraft strikes at Rodman Range may affect the Florida scrub-jay.

Wood Stork

Disturbance Associated With Aircraft Overflights

Wood storks are expected to occasionally forage or travel through Rodman Range, but nesting has not been documented in the area. If present during training operations, wood storks would be exposed to fixed-wing and helicopter overflights and could exhibit short-term behavioral and/or physiological responses, but not to the extent where the fitness of individuals or populations would be compromised. Aircraft overflights are not expected to result in chronic stress based on the short duration and infrequency of exposure. Disturbance associated with aircraft overflights at the Rodman Range may affect the wood stork.

Aircraft Strikes

The probability of an F/A-18 aircraft striking a wood stork at Rodman Range is extremely low based on the low number of sorties and the fact that these aircraft operate above 1,500 feet AGL. The wood stork uses many habitat types, but is most likely to forage in forested swamps at Rodman Range. While it is unknown if wood storks roost at Rodman Range, roosting birds could be flushed by nighttime helicopter operations and become more susceptible to an aircraft strike. Aircraft strikes at Rodman Range may affect the wood stork.

State-listed Species

Disturbance Associated With Aircraft Overflights

The effects of disturbance associated with aircraft overflights on state-listed species are expected to be similar to those described above for wildlife. Any impacts to state-listed species would be short-term, minor, and localized. In accordance with NEPA, disturbance associated with aircraft overflights in the Rodman Range Study Area would have no significant impact on state-listed species.

Aircraft Strikes

As discussed above for other species of wildlife, the probability of an aircraft striking a state-listed species in the Rodman Range Study Area is low. In accordance with NEPA, aircraft strikes in the Rodman Range Study Area would have no significant impact on state-listed species.

Aircraft Overflights – Lake George Range Study Area

Overview

At Lake George Range, P-3C aircraft are used for Mine Laying exercises, which involve dropping NEPMs in the water to simulate creating a minefield. No mines are used in this training; rather NEPMs are dropped on specified targets so the precision of the drop may be observed. The No Action Alternative includes ten P-3C sorties per year at Lake George Range. Prior to drop, a visual range clearance fly over is made to ensure the range is clear of boats or any other item that would not permit the training to be safely conducted. Because of this safety requirement, Mine Laying operations are always conducted during the day. The range requires a minimum altitude of 1,200 feet within 2 miles of the western shore; 1,500 feet over houses located on the eastern shore of Drayton Island; and 500 feet above any other building.

Typically, one P-3C aircraft would fly at a speed of between 200 and 300 knots to one of the specified targets within Lake George where the NEPMs would be dropped. To drop the NEPMs, the P-3Cs would use either a low altitude tactic from about 300 feet AGL or a high altitude tactic from about 1,000 feet AGL, but within the range's flight specifications. The aircraft would typically make one pass over the target and drop four NEPMs. Generalized flight tracks for this exercise are shown in Figure 3.11-1.

Helicopters are used at Lake George Range during Electronic Combat operations, which involve the use of systems to detect and respond to enemy threats such as a launched missile. No missiles or other types of ordnance are used during these exercises; rather a threat simulator is used to electronically simulate a missile launch. The helicopters' defense systems alert the pilot to commence evasive maneuvering and deploy flares. These flares are designed to confuse infrared homing missiles, causing them to miss the aircraft. Helicopters would operate over water during these exercises at altitudes as low as 100 feet AGL. The duration of a typical operation would be one hour. Electronic Combat training would not occur over land. The No Action Alternative includes 56 helicopter sorties per year at Lake George Range.

Wildlife

Disturbance Associated With Aircraft Overflights

The No Action Alternative would include some relatively low-altitude aircraft overflights (*i.e.*, less than 3,000 feet AGL). As a result, wildlife occurring in some parts of the Lake George Range Study Area could be exposed to noise and visual cues associated with aircraft overflights. Wildlife could also be exposed to downdrafts from helicopters. As discussed above for Rodman Range, the duration of exposure to fixed wing-aircraft noise would be very brief (seconds) as an aircraft quickly passes overhead. Exposures would be infrequent based on the low number of sorties (10 per year) and the short duration of the exercises (about one hour). Areas exposed to helicopter noise, visual cues, and downdraft would be limited to areas within the Lake George Range boundaries, with the exception of transit to and from the ranges. The duration of exposure to helicopter noise could be longer than fixed-wing aircraft because helicopters typically fly at slower airspeeds and spend more time over a given area. Nonetheless, exposures would be infrequent based on the low number of sorties (56 per year) and short duration of the exercises (about one hour).

Wildlife exposed to low-altitude aircraft overflights under the No Action Alternative could exhibit short-term behavioral and/or physiological responses, but not to the extent where the general health of individuals or populations would be compromised. Aircraft overflights are not expected to result in chronic stress based on the short duration and infrequency of exposure. In accordance with NEPA, disturbance associated with aircraft overflights in the Lake George Range Study Area would have no significant impact on wildlife. Disturbance associated with aircraft overflights would not have a significant adverse effect on migratory bird populations as defined by MBTA regulations applicable to military readiness activities. Furthermore, disturbance associated with aircraft overflights is not expected to result in take of bald eagles or to disturb bald eagles as defined by the Eagle Act.

Aircraft Strikes

The potential for fixed-wing aircraft strikes at Lake George Range is low based the low number of sorties (10 per year), as well as the fact that these aircraft typically operate above 1,500 feet AGL and do not take off or land at this range. While helicopters operate at lower altitudes and more sorties occur (56 per year), they also fly at relatively low airspeeds during these training exercises. This increases the likelihood that wildlife could hear or see an oncoming helicopter, flee the immediate area, and avoid being struck. Lower airspeeds also provide pilots an opportunity to identify safety concerns and to avoid a strike by maneuvering the helicopter. Based on these factors, few, if any, wildlife/aircraft strikes and associated wildlife mortalities or injuries are expected to occur in the Lake George Range Study Area under the No Action Alternative.

In accordance with NEPA, aircraft strikes in the Lake George Range Study Area would have no significant impact on wildlife. Aircraft strikes would not have a significant adverse effect on migratory bird populations as defined by MBTA regulations applicable to military readiness activities. Furthermore, aircraft strikes are not expected to result in take of bald eagles or to disturb bald eagles as defined by the Eagle Act.

Florida Scrub-jay, Red-cockaded Woodpecker, and Wood Stork

Disturbance Associated With Aircraft Overflights

The Florida scrub-jay, red-cockaded woodpecker, and wood stork are not expected to occur within the Lake George Range boundaries, but may occur in terrestrial portions of the Study Area south and west of the range. Therefore, these species could be exposed to low altitude P-3 aircraft overflights. Exposure to helicopter overflights is unlikely because these operations occur within the range boundaries. The duration of exposure to fixed-wing aircraft noise would be very brief (seconds) as an aircraft quickly passes overhead. Exposures would be infrequent based on the low number of sorties (10 per year) and the short duration of the exercises. In addition, the magnitude of exposure would be low because P-3 aircraft are relatively quiet (L_{max} at 2,000 feet is 73.3 dB) compared to jet aircraft. Listed birds exposed to low-altitude aircraft overflights could exhibit short-term behavioral and/or physiological responses, but not to the extent where the fitness of individuals or populations would be compromised. Aircraft overflights are not expected to result in chronic stress based on the short duration and infrequency of exposure. Disturbance associated with aircraft overflights at Lake George Range may affect the Florida scrub-jay, red-cockaded woodpecker, and wood stork.

Aircraft Strikes

The probability of a P-3 aircraft striking a listed bird at Lake George Range is extremely low based on the low number of sorties and the fact that these aircraft operate above 1,500 feet AGL when over land. Helicopter strikes are not expected because low-altitude flights take place within the range boundaries, where the listed birds are not expected to occur. The effects of aircraft strikes are considered discountable because they are extremely unlikely to occur. Aircraft strikes at Lake George Range may affect the Florida scrub-jay, red-cockaded woodpecker, and wood stork.

West Indian Manatee

Disturbance Associated With Aircraft Overflights

West Indian manatees occur in Lake George and could be exposed to aircraft overflights if they are in the vicinity of an aircraft's flight track. Some of the sound energy generated by aircraft overflights would be transmitted into the water (see Section 3.7 for information about airborne sound transmission into water). Therefore, manatees could be exposed to aircraft sound while at the surface or submerged. Manatees could exhibit short-term behavioral responses to aircraft sound, the shadow of a low-flying aircraft and, in the case of helicopters, surface disturbance from the downdraft.

Aircraft (primarily fixed-wing) are commonly used to conduct West Indian manatee surveys. Rathbun (1988) observed that manatees were disturbed by the noise from a helicopter more than from a fixed-wing airplane during a study designed to compare the effectiveness of these survey platforms. On several occasions manatees that were bottom resting on shallow ledges moved into adjacent deep water as the helicopter approached (Rathbun, 1988). Rathbun (1988) noted that unless helicopter pilots are careful to avoid "rotor-popping" and low altitude passes over manatees (328 feet) their behavior may be altered. Another study suggests that manatee habitat selection is influenced by ambient underwater sound levels (Miksis-Olds *et al.*, 2007).

The low number of aircraft overflights (10 per year) and the relatively narrow cone where noise would be transmitted into the water (see Figure 3.7-6) indicate that West Indian manatees would not be exposed to overflights very often. Available data on manatee occurrence in Lake George suggest

that the highest probability of exposure exists along the western shoreline under the P-3 flight tracks. While these flight tracks crossover potential foraging habitat, they do not crossover the two warm-water refuge sites located along the lake's western shoreline. Manatees are generally not expected to occur in the target area, with the exception of an occasional traveling animal. Therefore, the potential for exposure to helicopter overflights or P-3 overflights in the target area is low. The target area is located 0.6 to 1.9 miles off the lake's eastern shoreline and 2.4 to 4.7 miles off the western shoreline.

If West Indian manatees were exposed to low-altitude overflights they could exhibit a short-term behavioral response, but not to the extent where natural behavioral patterns would be abandoned or significantly altered. The sound exposure levels generated by P-3 aircraft are relatively low (see Table 3.11-7), so it is possible that manatees would not respond to these overflights. Fixed-wing aircraft overflights are not expected to result in chronic stress because the duration of exposure would be brief (seconds) as the aircraft quickly passes overhead. Furthermore, repeated exposure of individuals is not expected based on the short duration of the exercises and the low number of sorties.

Exposure durations for helicopter overflights could be longer because they fly at slower speeds and operate in a relatively confined area for up to one hour. West Indian manatees might avoid the target area during helicopter operations or they could leave the immediate area if they were present during helicopter operations. Such responses are not expected to result in biological consequences because the target area does not contain foraging or warm-water refuge habitat. As discussed above, exposure to helicopter overflights is unlikely because manatees are generally not expected to occur in the target area. Aircraft overflights in the Lake George Range may affect the manatee.

Lake George is designated as critical habitat for the West Indian manatee under the ESA. Other than brief and intermittent changes to ambient sound levels, aircraft overflights would have no effect on manatee habitat, including foraging habitat and warm-water refuge sites. Aircraft overflights in the Lake George Range would not adversely modify critical habitat for the manatee.

State-listed Species

Disturbance Associated With Aircraft Overflights

The effects of disturbance associated with aircraft overflights on state-listed species are expected to be similar to those described above for wildlife. Any impacts to state-listed species would be short-term, minor, and localized. In accordance with NEPA, disturbance associated with aircraft overflights in the Lake George Range Study Area would have no significant impact on state-listed species.

Aircraft Strikes

As discussed above for other species of wildlife, the probability of an aircraft striking a state-listed species in the Lake George Range Study Area is low. In accordance with NEPA, aircraft strikes in the Lake George Range Study Area would have no significant impact on state-listed species.

Land-based Training - Rodman Range Study Area

Overview

Land-based training at Rodman Range is limited to Combat Search and Rescue and Convoy Operations. The No Action Alternative includes 146 Combat Search and Rescue and Convoy

Operations combined per year. The exercise duration is typically 1 to 1.5 hours and 75 percent occur at night. During Combat Search and Rescue exercises, Naval Special Warfare personnel may disembark from a helicopter at one of six designated landing zones, "rescue" the personnel to be recovered, and return to the helicopter to be removed from the area. The land-based portion of the exercise is limited to foot traffic, typically on established trails, roads, or other open areas, and does not involve vehicles. During Convoy Operations, one or two vehicles drive along a designated road to simulate a convoy that could be attacked by an opposition force. Two helicopters fly in close support of this convoy to practice providing armed air cover with machine guns (only blanks are used).

Vegetation and Wetlands

Vehicle operations would be limited to existing roads at Rodman Range and would have no effect on vegetation, wetlands, or wildlife habitat. Foot traffic during Combat Search and Rescue exercises could result in trampling of terrestrial and wetland vegetation, but the effects would be minor, short-term, and localized. In accordance with NEPA, land-based training at Rodman Range would have no significant impact on vegetation or wetlands.

Wildlife

Vehicle operations and foot traffic would result in minor, short-term, and localized disturbance to wildlife. Animals in the vicinity of these activities might flee the immediate area while the training is occurring. These activities are not expected to result in chronic stress to wildlife based on the low number of operations that occur per year, the short duration of the exercises, and the low number of vehicles and personnel involved in the exercises. Vehicles could also incidentally strike wildlife and cause serious injury or mortality. The probability of vehicles striking wildlife is low because only two vehicles are used at a time and vehicle operations would be limited to existing roads. Furthermore, vehicles would travel at relatively slow speeds and mobile species would likely avoid the approaching vehicle by fleeing the immediate area. Slow-moving species such as the gopher tortoise would be most susceptible to ground vehicle strikes. Environmental awareness training provided to all ground-based users of Rodman Range includes measures to avoid wildlife, including the gopher tortoise (see Chapter 5). If strikes were to occur, only a small number of animals would be affected and population-level effects would not be expected.

Land-based training would have little or no effect on the bald eagle because occurrence of this species within the range boundaries is expected to limited to transient or possibly foraging individuals. Bald eagle nesting does not occur at the range and effects of land-based training are not expected to extend outside the property boundary to areas where bald eagle nesting occurs.

In accordance with NEPA, land-based training at Rodman Range would have no significant impact on wildlife. Land-based training would not have a significant adverse effect on migratory bird populations as defined by MBTA regulations applicable to military readiness activities. Furthermore, land-based training is not expected to result in take of bald eagles or to disturb bald eagles as defined by the Eagle Act.

Wood Stork

Wood storks are expected to occasionally forage at the range, but the open areas and roads used for this training do not contain suitable wood stork foraging habitat. Most of these birds are expected to use habitats in the floodplain swamp, where land-based training does not occur. It is highly

unlikely that wood storks would be exposed to more than minor disturbances associated with land-based training. Consequently, land-based training would have no effect on wood storks.

Eastern Indigo Snake

If the eastern indigo snake occurs at Rodman Range it could potentially be affected by vehicle operations. The probability of a vehicle striking this species would be extremely low based on the short duration of the exercise, the number of vehicles involved, and the use of existing roads. Furthermore, vehicles would travel at relatively slow speeds. If snakes use the roads at the range it would most likely be during the day for basking. This further reduces the probability of a strike because 75 percent of the operations occur at night. During the day drivers would be able to see and avoid snakes and/or snakes could see the oncoming vehicle and flee the area. Environmental awareness training provided to all ground-based users of Rodman Range includes measures to avoid wildlife, including the eastern indigo snake (see Chapter 5). Land-based training may affect the eastern indigo snake, but effects are considered discountable because the effects are extremely unlikely to occur.

State-listed Species

The effects of land-based training on state-listed wildlife species are expected to be similar to those described above for wildlife. As mentioned above, gopher tortoises could be more susceptible to vehicle strikes than other more mobile species. Gopher tortoises are managed and protected at Rodman Range in accordance with the Integrated Natural Resources Management Plan (DoN, 2005) and Gopher Tortoise Management Plan (NAS Jacksonville, 2006), which were developed cooperatively with the USFWS and FFWCC. In addition, environmental awareness training provided to all ground-based users of Rodman Range includes measures to avoid gopher tortoises (see Chapter 5).

Two species of state-listed plants have been found at Rodman Range; southern red lily and pondspice. Two small groups of the southern red lily were identified during the 1996 - 1997 FNAI surveys in the northwest corner of the range growing along roadsides and drainage ditches (FNAI, 1997). While vehicle use during Convoy Operations would be limited to existing roads, a remote possibility exists for individual plants growing along roadsides to be impacted if a vehicle runs off the road. The limited foot traffic associated with Combat Search and Rescue exercises could result in trampling of individual plants. Population-level effects are not expected. The southern red lily is listed a state threatened and was once considered rare, but its current ranking (G4/S4) indicates that it is apparently secure globally and in Florida (NatureServe, 2007). Pondspice occurrence is limited to two depressional wetlands surrounded by forest (FNAI, 1997; 2004), where vehicles are not operated and foot traffic is not likely. Furthermore, this woody small tree or scrub is much less susceptible to damage from foot traffic than herbaceous species. In accordance with NEPA, land-based training at Rodman Range would have no significant impact on state-listed species.

Non-Explosive Practice Munitions – Rodman Range Study Area

Overview

Machine gun blanks are occasionally fired from helicopters at Rodman Range during Combat Search and Rescue and Convoy Operations. A projectile is not fired when blanks are used, but noise is generated. This noise would co-occur with helicopter noise and is not expected to act as an independent stressor to biological resources. Therefore, firing of machine gun blanks is not

addressed in further detail. Air-to-Ground Bombing Exercises at Rodman Range involve dropping various NEPMs from fixed-wing aircraft within the designated target area. The No Action Alternative includes dropping 100 NEPMs per year at Rodman Range.

Vegetation and Wetlands

Non-explosive practice munitions would impact the ground surface within the designated target area at Rodman Range, resulting in localized disturbance to terrestrial vegetation and surface soil. Vegetation in the target area consists of grasses and other herbaceous species, which is routinely maintained by mowing and occasional plowing. Impacts to vegetation would be localized and no natural communities would be affected. In accordance with NEPA, land-based training at Rodman Range would have no significant impact on vegetation or wetlands.

Wildlife

When a NEPM makes contact with the target kinetic energy would be transferred and sound would be generated. Sound associated with the impact event is typically of low frequency (less than 250 Hz) and of a short enough duration (*i.e.*, impulsive sound) that it produces negligible amounts of acoustic energy. Wildlife in the immediate vicinity of the target might respond to this sound, but any effects would be minor and short-term.

Terrestrial wildlife could be injured or killed by a NEPM strike if they were in the target area and at the point of physical impact at the time of NEPM delivery. However, the probability of direct strikes is low based on the low number NEPMs that would be expended at the range under the No Action Alternative (100 per year). If direct strikes were to occur, only a small number of animals would be affected and no population-level effects would occur. While a remote possibility exists that some individuals of some wildlife species may be directly impacted if they are in the target area and at the point of physical impact at the time of NEPM delivery, NEPM strikes under the No Action Alternative

In accordance with NEPA, NEPM use at Rodman Range would have no significant impact on wildlife. NEPM use would not have a significant adverse effect on migratory bird populations as defined by MBTA regulations applicable to military readiness activities. Furthermore, NEPM is not expected to result in take of bald eagles or to disturb bald eagles as defined by the Eagle Act.

Wood Stork

While wood storks are occasionally observed at Rodman Range they are not expected to occur in the target area because suitable habitat is generally not present. A depressional marsh (approximately 8 acres) occurs in the vicinity of the target area and provides potentially suitable wood stork foraging habitat. The marsh is about 0.1 mile from the actual target and is outside the area that is maintained with periodic mowing and plowing. The effects of NEPM use on the wood stork would be expected to be discountable based on infrequent occurrence of wood storks at Rodman Range, the low number of NEPMs dropped (100 per year), and the fact that the habitat is adjacent to and not directly in the target area. NEPM use under the No Action Alternative may affect the wood stork.

Eastern Indigo Snake

While the eastern indigo snake was not documented at the range during surveys performed by FNAI (2004), these snakes are known to use many of the habitat types found at the range. Eastern

indigo snakes often use gopher tortoise burrows. The Navy periodically monitors the target area for gopher tortoise burrows. No burrows currently exist within the target area, but 12 burrows were present in the general vicinity during the 2004 FNAI surveys. No eastern indigo snakes or signs of snakes were found during the survey of these burrows and the surrounding area. While eastern indigo snakes could occur at the range, the survey data suggest they do not occur in the target area. The maintenance regime within the target areas could limit habitat suitability. However, eastern indigo snakes are known to use agricultural fields and human-altered habitats (USFWS, 1999). The probability of an eastern indigo snake being in the target area and at the point of physical impact at the time of NEPM delivery is extremely low. This is based on available data which suggest that eastern indigo snakes do not occur in the target area, the low number of bombing exercises (25 per year), and the low number of NEPMs dropped at the range (100 per year). NEPM use at Rodman Range may affect the eastern indigo snake. The effects of NEPM use are considered discountable because the effects are extremely unlikely to occur.

State-listed Species

The effects of NEPM on state-listed wildlife species are expected to be similar to those described above for wildlife. As mentioned above, the Navy periodically monitors the target area for gopher tortoise burrows. Gopher tortoises are managed and protected at Rodman Range in accordance with the Integrated Natural Resources Management Plan (DoN, 2005) and Gopher Tortoise Management Plan (NAS Jacksonville, 2006), which were developed cooperatively with the USFWS and FFWCC. State-listed plants do not occur in the target area; therefore NEPM use would have no effect on state-listed plants. In accordance with NEPA, NEPM use at Rodman Range would have no significant impact on state-listed species.

Non-Explosive Practice Munitions – Lake George Range Study Area

Overview

Mine Laying exercises at Lake George Range involve dropping NEPM within the designated target area. The No Action Alternative includes dropping 40 NEPMs per year in the 14.2-nm^2 (11,866-acre) range. The majority of NEPMs would be concentrated around the four Mine Laying targets. No other weapons firing or NEPM use occurs at Lake George Range.

Vegetation and Wetlands

Submerged aquatic vegetation and wetlands do not occur in the target area. NEPM use under the No Action Alternative would have no effect on vegetation and wetlands.

Wildlife

NEPM would impact the water surface within the designated target area at Lake George Range, resulting in short-term and localized disturbance to the water column. Velocity of the NEPM would decrease upon contact with the water. Nonetheless, localized disturbances to benthic habitat would be expected based on the shallow depth of Lake George (8 to 11 feet in the target area). Impact with the lake bottom could create small craters and bottom sediments would be resuspended, resulting in increased water turbidity. Bottom sediments in the target area most likely consist of sand. The effects would be short-term and localized because only four NEPMs would be released per training event. Turbidity levels would return to normal shortly after an event and benthic habitat would recover through natural sedimentation processes. The NEPM would not be

recovered from the lake bottom. As the NEPMs accumulate over time they would create structure on the lake bottom, which could attract and provide cover for certain species of fish.

Aquatic life could be injured or killed by NEPM if they were in the target area and at the point of physical impact at the time of ordnance delivery. It is likely that some fish would be in the target area at the time of ordnance delivery because some species are attracted by the structure and cover provided by the target pilings and expended bombs on the bottom. The number of fish that might be affected by direct strikes cannot be quantified, but is expected to be small based on the number of NEPMs expended (40 per year) and the "footprint" of the NEPM. These factors also indicate that the probability of a bird being struck is extremely low. The largest NEPM used at the range is a BDU-45, which is 66 inches long, 11 inches in diameter, and weighs 500 lbs. Based on the shallow depths (8 to 11 feet), benthic species such as worms, burrowing insect larvae, and possibly blue crabs could also be injured or killed by direct ordnance strikes. Long-term population-level effects would not be expected based on the small number of fish and benthic animals that would be affected.

The probability of a bird being struck by NEPM is also extremely low based on the number of NEPMs expended and the "footprint" of the NEPM. While bald eagles may soar over the Lake George Range target area, most foraging is expected to occur closer to shore. The probability of NEPM striking a bald eagle is extremely low.

In accordance with NEPA, NEPM use at Lake George Range would have no significant impact on wildlife. NEPM use would not have a significant adverse effect on migratory bird populations as defined by MBTA regulations applicable to military readiness activities. Furthermore, NEPM is not expected to result in take of bald eagles or to disturb bald eagles as defined by the Eagle Act.

West Indian Manatee

West Indian manatees occur in Lake George and could be injured or killed by a NEPM if they are in the target area and at the point of physical impact at the time of ordnance delivery. The USFWS concurrence letter indicating the propsed action may affect but would not adversely affect manatees is presented in Appendix C. The probability of a manatee being struck by a NEPM cannot be quantified because adequate data are not available to estimate animal density. Nonetheless, various factors suggest that manatees are generally not expected to occur in the target area, with the exception of an occasional animal traveling through the area. Available data indicate that most manatees are expected to occur in nearshore areas along the western shoreline, which is 2.4 to 4.7 miles from the range boundary. Food sources (aquatic vegetation) and warm-water refuge sites, which tend to concentrate manatees, do not exist in the target area. These factors, coupled with the infrequency of operations (10 sorties per year), the low number of NEPMs dropped (four per sortie, 40 per year), and the relatively small bomb "footprint," indicate that the probability of a manatee being in the target area and at the point of physical impact at the time of ordnance delivery would be extremely low. The footprint of the largest NEPM used at the range (BDU-45) is about 1.6 ft^2; therefore, a maximum of 16 ft^2 of lake surface area would be impacted per year by NEPMs. This represents an extremely small percentage of the total range surface area (0.000003%) and total lake surface area (0.0000008%).

Sound would be generated and transmitted through the water when a NEPM makes contact with the target or water surface. Sound associated with such an impact event is typically of low frequency (less than 250 Hz) and of a short enough duration (*i.e.*, impulsive sound) that it produces

negligible amounts of acoustic energy. If a West Indian manatee were in the immediate vicinity of the target area at the time ordnance delivery, this sound could elicit a short-term behavioral and/or physiological response, but not to the extent where natural behavioral patterns would be abandoned or significantly altered. Manatees may be attracted to the splash of a NEMP; however, bombs are not dropped in close proximity of space or time. In a sortie, the four NEPM bombs are dropped (one per target), seconds apart and sorties may occur hours or days apart. If a manatee were attracted to a NEPM splash it would not arrive at the drop point until after all the NEPM is delivered for that sortie.

Non-explosive practice munitions may affect the West Indian manatee. The effects of NEPM use are considered discountable because the effects are extremely unlikely to occur.

Lake George is designated as critical habitat for the West Indian manatee under the ESA. The effects of NEPM use on water column and benthic habitats in Lake George are discussed above under wildlife. NEPMs would have no effect on important manatee habitats such as foraging areas or warm-water refuge sites. Analyses presented in Section 3.3 indicate that NEPMs would have no significant impact on water quality. NEPMs would not adversely modify critical habitat for the manatee.

Military Expended Material – Rodman Range Study Area

The only expended material at Rodman Range would be non-explosive practice bombs, which would periodically cleared from the target area. Ordnance-related material would have no effect on biological resources at Rodman Range under the No Action Alternative.

Military Expended Material – Lake George Range Study Area

Overview

The only MEM used in the Lake George Range are NEPMs and self-protection flares. As discussed above 40 NEPMs would be dropped per year in the target area and they would not be recovered. The NEPMs are 12 to 66 inches long and weigh 25 to 500 lbs.

Self-protection flares are used during Electronic Combat operations at Lake George Range. Self-protection flares consist of a magnesium/Teflon formulation that, when ignited and released from an aircraft, burn for a short period of time (less than 10 seconds) at very high temperatures. Flares release heat and light to disrupt tracking of Navy aircraft by enemy infrared tracking devices or weapons. Flares are designed to burn completely. Under normal operations, the only material that would enter the water would be a small, round plastic end-cap (approximately 1.4-inch diameter) (USAF, 1997). The No Action Alternative includes the use of 1,680 self protection flares per year at the Lake George Range. The end-caps would slowly sink to the bottom. Assuming even distribution in the range area (14 nm^2 or 11,866 acres) and no migration outside the range area, the relative end-cap concentration would be about 120/nm^2 or 0.1/acre per year. Actual concentrations would vary based on factors such as distribution by wind and water currents.

Vegetation and Wetlands

Submerged aquatic vegetation does not grow in the target area. Therefore, accumulation of expended NEPM on the lake bottom would have no effect on vegetation or wetlands. While some self-protection flare end-caps could be distributed outside the target area by wind or water currents, most are expected to sink in deeper areas of the lake where submerged aquatic vegetation does not grow.

The likelihood of end-caps drifting to littoral areas where submerged aquatic vegetation grows is low based on the distance of the range from the shoreline (0.6 to 4.7 miles). Flare end-caps would have no effect on vegetation or wetlands.

Wildlife

Expended NEPM would not be recovered from the lake bottom and may result in long-term, localized changes to benthic habitat. The NEPMs are expected to stay intact and would create structure on the lake bottom as they accumulate over time (a maximum of 16 ft^2 per year). This represents an extremely small percentage of the total range bottom area (0.000003%) and total lake bottom area (0.0000008%). This structure could attract and provide cover for certain species of fish. Expended NEPM would have no adverse effect on wildlife or aquatic life.

An extensive literature review and controlled experiments conducted by the Air Force revealed that self-protection flare use poses little risk to the environment or animals (USAF, 1997). Wildlife in the area (primarily birds using open water habitats) could be exposed to light generated by the flares, but no effects are expected based on the short burn time and infrequent use (56 helicopter sorties per year). Flare end-caps would accumulate on the lake bottom and would gradually be incorporated into the lake bottom by natural sedimentation processes. Flare end-caps could potentially be ingested by benthic foraging fish. Fish ingest non-food items incidentally to normal feeding, but also commonly expel non-food items before swallowing them. The effects of end-cap ingestion on fish are unknown, but would likely vary depending on species and size of the individual. The small round end-cap could pass through the digestive track without causing harm or it could cause a digestive track blockage leading to sublethal or lethal effects. These factors and the low environmental concentration of end-caps suggest that a few individual could be affected by end-cap ingestion, but population-level effects would not be observed.

In accordance with NEPA, MEM would have no significant impact on wildlife at Lake George Range. Military expended material would not have a significant adverse effect on migratory bird populations as defined by MBTA regulations applicable to military readiness activities. Furthermore, MEM is not expected to result in take of bald eagles or to disturb bald eagles as defined by the Eagle Act.

West Indian Manatee

Expended NEPM does not present an ingestion risk to West Indian manatees based on the size of the material (66 in long and 11 in diameter). Furthermore, manatee foraging is not expected to occur in the target area based on the lack of submerged aquatic vegetation. Expended NEPM would have no effect on important manatee habitats such as foraging areas or warm-water refuge sites. Analyses presented in Section 3.3 indicate that NEPM would have no significant impact on water quality. Expended NEPM would have no effect manatees and would not adversely modify critical habitat.

The light generated by flares would have no effect on West Indian manatees based on the short burn time and infrequent use (56 helicopter sorties per year). Flare end-caps sink and could potentially be ingested by manatees while foraging on the bottom. Manatees are not expected to forage in the range area based on the lack of submerged aquatic vegetation, but some end-caps could drift outside the target area via wind and/or water currents. The likelihood of end-caps drifting to littoral areas where

submerged aquatic vegetation grows and manatees forage is low based on the distance of the range from the shoreline (0.6 to 4.7 miles).

West Indian manatees are known to ingest anthropogenic debris (USFWS, 2001), as are other marine mammals. Ingestion of foreign materials has been noted to result in negative consequences to marine mammals, including mortality due to disruption of the digestive tract and/or intestinal blockage (Stamper *et al*., 2006; Gorzelany, 1998). Documented instances of this are rare, particularly for smaller items (Laist, 1997; Walker and Coe, 1990). Walker and Coe (1990) theorized that for larger animals, such as beaked whales, it would take a high volume of foreign debris to result in death or debilitation resulting from impaction. This can be extrapolated to manatees as well. Although instances of impacts from ingestion of debris have been recorded, it is extremely unlikely that a manatee would ingest an end-cap, much less a harmful quantity. The low concentration of end-caps that could occur in manatee foraging habitat makes the potential effects discountable. Self-protection flare use at Lake George Range may affect the manatee. Flare end-caps would not adversely modify critical habitat based on the low concentration and the fact that most end-caps are expected to remain in the target area, which lacks important manatee habitats such as foraging areas or warm-water refuge sites.

3.11.3.2 Alternative 1

Rodman Range Study Area

As presented in Table 2.2-4, the number and types of training operations that would occur at Rodman Range would not change under Alternative 1. Therefore, the analyses presented above for the No Action Alternative are applicable to Alternative 1 at Rodman Range.

Lake George Range Study Area

At Lake George Range, the only proposed changes under Alternative 1 would be an increase in Electronic Combat operations (Table 2.2-4). Therefore, the analyses presented for the No Action Alternative and Mine Laying exercises, including fixed-wing aircraft overflights, NEPM, and MEM, are applicable to Alternative 1. The analysis presented here focuses on increases in helicopter overflights and self-protection flare use at Lake George Range.

Aircraft Overflights

Helicopter overflights at Lake George Range would increase from 56 to 80 sorties per year under Alternative 1. Therefore, animal exposure to helicopter noise, visual cues, and downdrafts would increase compared to the No Action Alternative. The magnitude of individual exposures would not increase because Alternative 1 does not include use of new aircraft that are louder than current equipment. Peak noise levels generated by the new MH-60R and MH-60S Multi-Mission Combat Support Helicopters would be similar to the noise levels generated by the helicopters that they would replace. Similar to the No Action Alternative, animal responses would be limited to short-term behavioral or physiological reactions and the general health of individual animals would not be compromised. Animals repeatedly exposed to aircraft noise often become habituated to the noise and do not respond behaviorally. However, habituation seems unlikely in the Study Area given the relative infrequency of the operations. The potential for bird/aircraft strikes would also increase. Overall, the effects of aircraft overflights under Alternative 1 would be very similar to the No Action Alternative based on the slight increase in helicopter sorties (24 per year).

In accordance with NEPA, aircraft overflights under Alternative 1 at Lake George Range would have no significant impact on wildlife. Aircraft overflights would not have a significant adverse effect on migratory bird populations as defined by MBTA regulations applicable to military readiness activities. Furthermore, aircraft overflights are not expected to result in take of bald eagles or to disturb bald eagles as defined by the Eagle Act. Aircraft overflights under Alternative 1 may affect the Florida scrub-jay, red-cockaded woodpecker, wood stork, and West Indian manatee.

Military Expended Material

Self-protection flare use at Lake George Range would increase from 1,680 to 2,400 flares per year under Alternative 1. Similar to the No Action Alternative, the light generated by flares would have no effect on biological resources based on short burn time and infrequent use (80 helicopter sorties per year). The relative end-cap concentration would increase slightly under Alternative 1 from about 120/nm^2 or 0.1/acre per year to 171/nm^2 or 0.2/acre per year. This change would not measurably increase the probability for end-caps ingestion of by fish or manatees. The probability of a manatee ingesting a flare end-cap would remain extremely low and the effects would be considered discountable based on the analysis presented above for the No Action Alternative.

In accordance with NEPA, MEM under Alternative 1 at Lake George Range would have no significant impact on wildlife. Military expended material would not have a significant adverse effect on migratory bird populations as defined by MBTA regulations applicable to military readiness activities. Furthermore, MEM are not expected to result in take of bald eagles or to disturb bald eagles as defined by the Eagle Act. Military expended material under Alternative 1 may affect the West Indian manatee.

3.11.3.3 Alternative 2

Rodman Range Study Area

As presented in Table 2.2-4, the number and types of training operations that would occur at Rodman Range would not change under Alternative 2. Therefore, the analyses presented above for the No Action Alternative are applicable to Alternative 2 at Rodman Range.

Lake George Range Study Area

As presented in Table 2.2-4, the number and types of training operations that would occur at Lake George Range under Alternative 2 would be the same as Alternative 1. Therefore, the analyses presented above for the Alternative 1 are applicable to Alternative 2.

3.11.4 Unavoidable Significant Environmental Effects

The analysis presented above indicates that the No Action Alternative, Alternative 1, and Alternative 2 would not result in unavoidable significant adverse effects to biological resources at Rodman and Lake George Ranges.

3.11.5 Summary of Environmental Effects

3.11.5.1 Endangered Species Act

Rodman Range Study Area

Table 3.11-8 provides a summary of the Navy's determination of effect for listed species that potentially occur in Rodman Range Study Area. The No Action Alternative, Alternative 1, and

Alternative 2 would have no effect on the sand skink and West Indian manatee. The No Action Alternative, Alternative 1, and Alternative 2 may affect the Florida scrub-jay, wood stork, and eastern indigo snake. The No Action Alternative, Alternative 1, and Alternative 2 would not adversely modify critical habitat designated for the manatee. Critical habitat has not been designated for the other species. The Navy has consulted with USFWS regarding its determination of effect for federally listed species and critical habitat in the Rodman Range Study Area. In a letter dated October 7, 2008 (Appendix C), the USFWS concurred with the Navy's determination that Alternative 2 (the Preferred Alternative) at Rodman Range would have no effect on the Eastern indigo snake, sand skink, and West Indian manatee, and may affect, but is not likely to adversely affect the Florida scrub-jay and wood stork.

TABLE 3.11-8
SUMMARY OF THE NAVY'S DETERMINATION OF EFFECT FOR FEDERALLY LISTED SPECIES THAT MAY OCCUR IN THE RODMAN RANGE STUDY AREA FOR ALL ALTERNATIVES

Stressor	Florida Scrub-jay	Wood Stork	Eastern Indigo Snake	Sand Skink	West Indian Manatee
Aircraft Overflights					
Disturbance	May Affect	May Affect	No Effect	No Effect	No Effect
Aircraft Strikes	May Affect	May Affect	No effect	No Effect	No Effect
Land-Based Training					
Vehicles	No Effect	No Effect	May Affect	No Effect	No Effect
Foot traffic	No Effect	No Effect	May Affect	No Effect	No Effect
NEPM					
Weapons Firing Disturbance	No Effect	No Effect	No Effect	No Effect	No Effect
NEPM Strikes	No Effect	May Affect	May Affect	No Effect	No Effect
MEM					
Ordnance Related	No Effect	No Effect	No Effect	No Effect	No Effect

Lake George Range Study Area

Table 3.11-9 provides a summary of the Navy's determination of effect for listed species that potentially occur at Lake George Range Study Area. The No Action Alternative, Alternative 1, and Alternative 2 would have no effect on the eastern indigo snake, sand skink, and shortnose sturgeon. The No Action Alternative, Alternative 1, and Alternative 2 may affect the Florida scrub-jay, red-cockaded woodpecker, and wood stork. The No Action Alternative, Alternative 1, and Alternative 2 may affect the West Indian manatee, but would not adversely modify critical habitat designated for the manatee (see Section 3.7 for more information on potential impacts to manatees in the OPAREAs). Critical habitat has not been designated for the other species. The

Navy has completed ESA Section 7 consultation with USFWS for the preferred alternative and has initiated consultation with NMFS (shortnose sturgeon only) regarding its determination of effect for federally listed species and critical habitat in the Lake George Range Study Area. In a letter dated October 7, 2008 (Appendix C), the USFWS concurred with the Navy's determination that Alternative 2 (the Preferred Alternative) at Lake George Range would have no effect on the Eastern indigo snake and sand skink, and may affect, but is not likely to adversely affect the Florida scrub-jay, red-cockaded woodpecker, wood stork, and West Indian manatee.

TABLE 3.11-9
SUMMARY OF THE NAVY'S DETERMINATION OF EFFECT FOR FEDERALLY LISTED SPECIES THAT MAY OCCUR IN THE LAKE GEORGE STUDY AREA FOR ALL ALTERNATIVES

Stressor	Florida Scrub-jay	Red-cockaded Woodpecker	Wood Stork	Eastern Indigo Snake	Sand Skink	Shortnose Sturgeon	West Indian Manatee
Aircraft Overflights							
Disturbance	May Affect	May Affect	May Affect	No Effect	No Effect	No Effect	May Affect
Aircraft Strikes	May Affect	May Affect	May Affect	No Effect	No Effect	No Effect	No Effect
NEPM							
Weapons Firing Disturbance	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect	May Affect
NEPM Strikes	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect	May Affect
MEM							
Ordnance Related	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect
Self-protection Flares	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect	May Affect

3.11.5.2 Migratory Bird Treaty Act and Bald and Golden Eagle Protection Act

As discussed in the analysis presented above in Section 3.11.3, the No Action Alternative, Alternative 1, and Alternative 2 would not diminish the capacity of a population of a migratory bird species to maintain genetic diversity, to reproduce, and to function effectively in its native ecosystem. The proposed action would not have a significant adverse effect on migratory bird populations. As a result and in accordance with 50 CFR Part 21, the Navy is not required confer with the USFWS on the development and implementation of conservation measures to minimize or mitigate adverse effects to migratory birds that are not listed under the ESA. Furthermore, the proposed action is not expected to result in take of bald eagles or to disturb bald eagles as defined by the Eagle Act.

3.11.5.3 National Environmental Policy Act and Executive Order 12114

As summarized in Table 3.11-10, the No Action Alternative, Alternative 1, and Alternative 2 would have no significant impact on biological resources within the Rodman and Lake George Range Study Areas.

TABLE 3.11-10
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON BIOLOGICAL RESOURCES IN THE RODMAN AND LAKE GEORGE RANGE STUDY AREAS

Alternative and Stressor	Summary of Effects and Impact Conclusion
No Action	
Aircraft Overflights	Short-term behavioral responses to overflights, primarily helicopters. Low potential for wildlife injury/mortality from aircraft strikes. No long-term population-level effects.
Land-based Training	Minor, short-term, and localized disturbance to terrestrial and wetland vegetation from foot traffic at Rodman Range. Low potential for vehicles to strike wildlife at Rodman Range. No long-term population-level effects.
NEPM	Localized disturbance to maintained terrestrial vegetation within Rodman Range target area and benthic habitat in Lake George Range target area. Long-term changes in benthic habitat (creation of structure) in Lake George Range target area from accumulation of NEPM. Low probability of direct strikes from NEPM in both target areas. No long-term population-level effects.
MEM	No effects at Rodman Range. Long-term changes in benthic habitat (creation of structure) in Lake George Range target area from accumulation of NEPM. Potential for flare end-cap ingestion at Lake George Range. No long-term population-level effects.
Conclusion	No significant impact to biological resources.
Alternative 1	
Aircraft Overflights	No change from No Action Alternative at Rodman Range. Increased exposure to helicopter overflights at Lake George Range resulting in short-term behavioral responses. Increased potential for wildlife injury/mortality from helicopter strikes at Lake George Range. No long-term population-level effects.
Land-based Training	No change from No Action Alternative.
NEPM	No change from No Action Alternative.
MEM	No change from No Action Alternative at Rodman Range. Increased potential for ingestion of flare end-caps at Lake George Range. No long-term population level effects.
Conclusion	No significant impact to biological resources.
Alternative 2	
Aircraft Overflights	No change from Alternative 1.
Land-based Training	No change from No Action Alternative.
NEPM	No change from No Action Alternative.
MEM	No change from Alternative 1.
Conclusion	No significant impact to biological resources.

3.12 LAND USE

3.12.1 Introduction and Methods

Land use is the classification of either natural or human-modified activities occurring at a given location. Land use is typically limited in offshore operations to public access and safety issues to include potential hazards inherent in flight operations, mine laying, and underwater demolition. It is the policy of the Navy to observe every possible precaution in the planning and execution of all operations that occur onshore or offshore to prevent injury to people or damage to property.

Offshore activities in the proposed action are not assessed in this section and potential impacts in non-territorial water are not relevant to this section. This section assesses potential impacts to land use from proposed activities on the inland ranges. The offshore OPAREAs are a set of operating and maneuvering areas with defined air, ocean surface, and subsurface areas described in detail in Table 2.1-1. Offshore activities are military, commercial, and recreational. Although the FAA has established warning areas for military operations, virtually all airspace and seaspace are available for co-use the majority of the time. Exclusive use of the land areas only occurs when hazardous activities are planned, and times for these activities are scheduled and broadcast through NOTMARs, issued by the USCG and NOTAMs, issued by the FAA (DoN, 2005).

3.12.1.1 Assessment Methods and Data Used

Historical Naval training and environmental studies combined with regional information obtained from the United States Department of Agriculture and the United States Forest Service contributed to the development of the land use section.

3.12.1.2 Warfare Areas and Associated Environmental Stressors

Impacts to land use are assessed in terms of a proposed action's compatibility with existing land use, continued consistency with existing land use plans and policies, and incompatibility with adjacent land use to the extent that public health or safety is threatened.

Stressors that would likely impact land use activities are identified in Table 3.12-1. These stressors were identified by conducting a detailed analysis of the warfare areas, operations, and specific activities affecting land use that were included in the Alternatives.

3.12.2 Affected Environment

Land areas of the JAX Range Complex (included in this FEIS/OEIS) are the Lake George Range and Rodman Range, located in rural north central Florida, along the northeastern end of the Ocala National Forest. The area is rural with residential land use predominantly low density with rural home sites and small incorporated communities. The economy of the area is based on agriculture, forestry, and tourism/leisure, with light manufacturing and distribution enterprises. The Ocala National Forest supports the local tourist/leisure industry as well as the forest industry. Citrus orchards, tree and ornamental plant nurseries, and sod farms characterize the agricultural production on private land bordering the Ocala National Forest (DoN, 2007a).

TABLE 3.12-1
SUMMARY OF POTENTIAL STRESSORS TO LAND USE

Warfare Area and Operation	Training Areas	Vessel Movements (Disturbance)	Aircraft Overflights (Disturbance)	Military Expended Material
Mine Warfare (MIW)				
Mine Laying	Lake George Range	✓	✓	✓
MCM	Carrier Operating Areas			
Mine Neutralization	Charleston OPAREA (North and South UNDET Boxes)			
Surface Warfare (SUW)				
MISSILEX (A-S)	W-157A (Area 4X) and W-159A (Area 5X)			
GUNEX (S-S)	W-132, W-133, W-134, W-157, W-158			
GUNEX (S-S) Boat	Charleston OPAREA (Areas 11J)			
GUNEX (S-S) Ship	JAX OPAREA (AA, BB, and CC)			
BOMBEX (A-S) (at sea)	HE, W-158 (31J); NEPM, W157A/B and W-158 A/B			
Laser Targeting	W-132, W-133, W-134, W-157, W-158			
GUNEX (S-S) (FAC/FIAC)	Amber Strait: Charleston OPAREA (Boxes Q-9&10, R-9&10)			
VBSS/MIO-Ship	JAX and Charleston OPAREAs			
VBSS/MIO-Helicopter	W-157A (Area 4X) and W-159A (Area 5X)			
Air Warfare (AW)				
ACM	W-157A (Areas 3X & 4X)			
Air Intercept Control	JAX and Charleston OPAREAs			
ACM Chaff Exercise	W-157A (Areas 3X & 4X)			
ACM Flare Exercise	W-157A (Areas 3X & 4X)			
MISSILEX (A-A)	W-132, W-133, W-134, W-157, W-158			
MISSILEX (S-A)	JAX and Charleston OPAREAs			
Detect-to-Engage	W-132, W-133, W-134, W-157, W-158			

TABLE 3.12-1 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO LAND USE

Warfare Area and Operation	Training Areas	Vessel Movements (Disturbance)	Aircraft Overflights (Disturbance)	Military Expended Material
GUNEX (Surface-to-Air)	JAX OPAREA (AA, BB, and CC)			
GUNEX (A-A)	W-157A/W-133 (Area 2X)			
Amphibious Warfare (AMW)				
FIREX with IMPASS	JAX OPAREA (BB and CC)			
Strike Warfare (STW)				
BOMBEX (A-G)	Rodman Range		✓	✓
CSAR and Convoy Operations	Rodman Range		✓	✓
Electronic Combat (EC)				
EC Operations - Aircraft	W-132, W-133, W-134, W-157, W-158			
EC Operations - Surface Ships	JAX and Charleston OPAREAs			
Chaff Exercise	JAX and Charleston OPAREAs			
Flare Exercise- Helicopter	Lake George Range	✓	✓	✓
Other Training				
SESEF Utilization	5-15 nm east of Mayport			
Precision Anchoring	NS Mayport			
Small Arms with anti-swimmer grenades (MK3A2)	Charleston OPAREA (Area 10L, 12I)			

3.12.2.1 Lake George Range and Associated Special Use Airspace Restricted Area 2907 (R-2907)

The Lake George Range is located on Lake George in north central Florida, a water body managed by the State of Florida. Putnam, Marion, and Volusia Counties share Lake George's 73.1 square miles of surface area. The range operates under a easement agreement (expiring in 2014) with the State of Florida, which has jurisdiction over the lake waters. Lake George is located on the St. Johns River and is 8 miles wide and 12 miles long with an average depth of 10 feet (DoN, 2007b). It is the second largest lake in Florida. The west side of the lake is in the Ocala National Forest. Lake George Range accommodates air-ground delivery of non-explosive practice bombs, 2.75 and 5-inch rockets with non-explosive warheads, and non-explosive mineshapes.

There are four impact target areas on the range, all of which are located on the lake surface. These consist of the North Target, Center Target, and South Target, and a set of four Mine Laying Exercise (MINEX) Splashdown Points.

- The North Target consists of a 24-foot-square reflective center surrounded by a 900-foot-diameter ring of pilings.
- The Center Target is configured as three concentric rings of pilings with diameters of 250, 500, and 1,000 feet.
- The South Target consists of six pilings in a 30-foot by 60-foot rectangle, surrounded by three concentric rings of pilings with diameters of 250, 500, and 1,000 feet.
- The MINEX Targets are four pre-planned splash points, designated just east and north of the Center Target.

There are two spotting towers on Lake George Range. Pine Island Tower and Nine Mile Tower are located on the east shore of Lake George, east of the Center Target and the MINEX Splashdown Points. The Center Target and the MINEX Splashdown Points can be electronically scored. The North Target and South Target cannot be scored. The Lake George Range is located within R-2907.

R-2907 consists of layered airspace within a larger Military Operating Area (MOA) that overlies the Lake George Range. The airspace is divided into R-2907A and R-2907B. R-2907A contains the Lake George Range targets and extends from the surface to 23,000 feet mean sea level (MSL). It is normally scheduled to 11,000 feet MSL unless otherwise requested. R-2907B consists of the target run-in. The airspace lies just west of the target and extends from the surface to 9,000 feet MSL. Both R-2907A/B are encompassed by the MOA.

3.12.2.2 Rodman Range and Associated Special Use Airspace Restricted Area 2906 (R-2906)

Rodman Range is located in north central Florida (southwest Putnam County). Rodman Range is situated in along the northeastern end of the Ocala National Forest, along the north side of the Ocklawaha River. The range property falls in Putnam County with a small portion entering the northeast corner of Marion County. Airspace for Rodman Range encompasses the southeast corner of Putnam County, the eastern third of Marion County, the north end of Lake County, and the extreme northwest corner of Volusia County. The property that became Rodman Range was condemned by the federal government in 1955. Land ownership was then transferred to the Navy.

The Rodman Range encompasses approximately 2,696 acres with 2,474 acres containing forest and 1,886 acres of wetlands. It contains approximately 1,200 acres of pristine hardwood swamp along the Ocklawaha River (DoN, 2005). The area is primarily managed for wildlife conservation as it is located north of the Ocala National Forest within the Caravelle Wildlife Management area. Hunting is allowed during state-regulated seasons.

No live ordnance or gunnery are authorized. The southwest quadrant of the range area is open and contains a single impact area. Rodman Target is configured as a 600-foot-diameter cleared area with a single surplus military vehicle at its center. The vehicle is surrounded by concentric rings of tires at 50- and 100-foot radii. The target is equipped with integral illumination and a lighted run-in line system for night ordnance delivery training.

There are six landing zones for rotary-wing aircraft operations on Rodman Range. These are situated in various open areas of the range. Rodman Range is located within R-2906. R-2906 lies

within the MOA that overlies Rodman Range. R-2906 is a 5-nm circle that extends from the surface up to 14,000 feet msl.

Although the FAA has established warning areas for military operations, virtually all the airspace is available for co-use the majority of the time. Only hazardous activities are exclusive use, and times for those activities are scheduled and broadcast through NOTAMs, issued by the FAA.

3.12.2.3 Ocala National Forest

The Ocala National Forest is managed by the U.S. Forest Service. It is located in Marion, Putnam, and Lake Counties with a total of 383,362 acres. The forest is managed for timber production, wildlife habitat, recreation, and watershed protection. The Ocala National Forest offers recreational opportunities for camping, swimming, picnicking, hiking, mountain biking, boating, canoeing, off-road trail use, horseback riding, hunting, and fishing. Camping grounds are offered through developed campgrounds, primitive camp sites, and dispersed tent camping that may be utilized year-round. Additionally, there are four group campgrounds available, one of which has a capacity of 250 persons. There are six hiking trails through the forest and a 22 mile bicycling trail. The Ocala National Forest contains approximately 600 lakes and ponds, several streams, and has two rivers along its boundary resulting in boating opportunities that range from canoeing, boating, skiing, and personal watercraft. Canoe rentals are available at six different marinas. Off road vehicle trails are not specifically designated, but there are many unnumbered roads and travel ways that do allow off road vehicles. There are four marked horseback trails. The Ocala National Forest is a wildlife management area in which hunting and fishing activities are managed by the Florida Fish and Wildlife Conservation Commission. The Ocala Rifle Range is also available to the public when classes are not scheduled.

3.12.2.4 Land Management

Forest and Vegetation

Due to afternoon thunderstorms that are part of typical summer weather in Florida, Ocala National Forest is subject to wildfires caused by lightning. Prescribed burning is a management tool vital to the preservation and diversity of habitats for animal life in the forest. Through the development of fire control lines (*e.g.,* wetlands, foam or water lines, and disked or plowed fire lines) and the development of prescribed burns, the USFS is able to avoid the complete devastation of the forest that could occur without controls and management. Prescribed burns are scheduled in advance, on a specific rotation, per ecosystem. They are identified years in advance and the USFS attempts to post signs to alert forest users who may be affected by the prescribed burns. Weather conditions, winds, and moistures can impact schedules and sometimes cause last minutes changes to the schedule (USDA, 2007).

Vegetation Management

Vegetation management at Rodman Range occurs by disc plowing around the open areas of the range. Specific measures for management of forest products and wildlife habitat and a 5-year forest management plan are detailed in the Naval Air Station Jacksonville, Florida (NAS Jacksonville, 2005) Integrated Natural Resource Management Plan (INRMP) completed in 2005. Rodman Range is not manned regularly, so fire suppression is supported by local jurisdictions and state and federal forestry agencies. There are no forest resources on the two small Navy-owned lands at the Lake George Range. Lake George Range vegetation management is restricted to mowing of the small land parcels owned by the Navy (DoN, 2005).

Recreation

Use of the Lake George Range requires aircraft to make a preliminary run-in pass, either from 090° to 180° or 129.4° (true north) from the Initial Point at Kingsley Point on the southern tip of Drayton Island to confirm that the impact areas are clear of boats. The S-3 aircraft have a minimum altitude of 1,200 feet above ground level when they are within two miles of the Lake George Range. They must maintain a minimum altitude of 500 feet over any buildings and 1,500 feet over houses on the eastern side of Drayton Island when performing multiple runs. News releases provide notification to the local community regarding scheduled exercises on the lake and, upon approach, pilots rock their wings to signal boaters to clear the area (DoN, 2007b).

Rodman Range is restricted to civilian personnel; however, it is not fenced. Range inspection at Rodman Range is conducted by Rodman Target Control. No live ordnance, strafing, or lasing is permitted at Rodman Range. All aircraft utilizing Rodman Range are required to inform Target Control of the direction they are approaching the target and then make a dry run to observe the range before dropping ordnance (DoN, 2005).

Regional Shore Installation Management Program

The Regional Shore Installation Management Program for the Southeast Region presents an overview of shore infrastructure and assesses present facility needs and future needs that arise from Navy operational or home porting changes. The current Regional Shore Installation Management Program for the Southeast Region does not identify any anticipated changes in shore installation requirements that would be reflected in the use of the JAX Range Complex (DoN, 2005).

Real Estate Use and Agreements

The boundary of the target area at Lake George Range is defined in a Sovereignty Submerged Land Easement (No. 000333[38447-64]) agreement with the state (DoN, 2005).

The Navy operates the range under easement with the State of Florida which has jurisdiction over the lake waters. The present agreement expires in 2014 (Table 2.1-2).

Range Air Installation Compatible Use Zone

A RAICUZ study is an instrument to show the modeled effects of aircraft noise, weapons noise, and weapons safety footprints in and around military ranges and to assess the compatibility of range operations with surrounding land use. The aim of a RAICUZ study is to protect public health, welfare, and safety in those areas around military ranges and to serve as a planning tool for preserving the compatibility of surround land uses with that of the ranges' military mission. Refer to Section 3.5.1.2 in Chapter 3 for a more detailed discussion of the RAICUZ study.

The primary aircraft utilizing Lake George Range are the P-3 and H-60 (DoN, 2007b). A toll-free number is publicized for noise complaints for any Florida range complex operated by the Navy, and the number of complaints received is reported to be low to non-existent (DoN, 2005). The toll free number is an automated system that is available 24 hours a day. Messages are reviewed daily and incidents are investigated by the proper Naval authorities (DoN, 2007b).

The Rodman RAICUZ Study was prepared in early 2007 to evaluate the safety hazards and noise impacts associated with Air-to-Ground ordnance delivery training operations at Rodman Range. The study found that existing land use practices in the vicinity of Rodman Range are largely consistent with range operations. Noise associated with use of Rodman Range is generated primarily by low-level

operation of rotary-wing aircraft and F/A-18 aircraft within the range boundaries. Most public and residential activities are considered compatible within a Day-Night Average Sound Level (DNL) 65 dB noise level (a land use recommendation). Recreational use has traditionally been recommended as compatible with higher noise levels; however, a more conservative view is emerging that contends that noise levels above DNL 55 dB, limits the ability to enjoy such uses. The RAICUZ study found that the 55 dB Day-Night Average Sound Level, onset-rate adjusted (L_{dnmr}) noise contour falls almost entirely within the range limits. A small portion of the noise zone extends east of the range limits, falling within an area of uninhabited woodlands (DoN, 2007a).

The Lake George RAICUZ Study was prepared in early 2007 to evaluate the safety hazards and noise impacts associated with air-to-ground ordnance delivery training operations at the Lake George Range. The study found that existing land use practices in the vicinity of the Lake George Range are largely consistent with range operations. Noise associated with weapons drop operations on Lake George Range is limited largely to the lake waters. The RAICUZ study found that the noise contours are below 55 dB L_{dnmr} (DoN, 2007a). Refer to section 3.5.1.2 in Chapter 3 for a more detailed discussion of the RAICUZ study.

Operational Range Clearance Plan

Range clearance is conducted under the Final Operational Range Clearance Plan for the Pinecastle Range and Rodman Bomb Target, Pincecastle Range Complex, Florida, which was finalized in April 2007. The typical process for operational range clearance involves three main steps; 1) clear range scrap (blue bombs, target debris, and other pieces less than 4 inches) from range areas specified in the Operational Range Clearance Plan and stage them at the Range Holding Area; 2) verify that each piece of scrap is "safe" by exposing the filler material (this may involve using explosives, torches, shears, *etc*.); and 3) demilitarization (to eliminate the military character of) by cutting, crushing, or breaking up each piece of range scrap and remove it from the site for recycling or disposal. Approximately 2,800 tons of range scraps have been cleared from the range and 1,000 tons have been actually processed (*i.e*., verified safe and demilitarized) and removed off site.

3.12.3 Environmental Consequences

3.12.3.1 No Action Alternative

Lake George Range

Aircraft overflights, vessel movements, and MEM are associated with the existing activities of mine laying (10 sorties and 40 bombs) and the use of flares during electronic combat (56 sorties and 1,680 defensive flares). Continuation of these activities will not impact compatibility with existing land use, existing land use plans and policies, and adjacent land use. Assessment of naval activities in U.S. territory would have no impact on land use at Lake George Range under the No Action Alternative.

Rodman Range

Aircraft overflights and MEM are associated with the existing activities of air-to-ground bombing (25 sorties and 100 bombs annually) and combat search and rescue activities (146 events). Continuation of these activities will not impact compatibility with existing land use, existing land use plans and policies, and adjacent land use. Assessment of naval activities in U.S. territory would have no impact on land use at Rodman Range under the No Action Alternative.

3.12.3.2 Alternative 1

Lake George Range

If Alternative 1 were chosen for implementation, Lake George Range stressors of aircraft overflight, vessel movements, and MEM would remain due to mine laying activities which would remain at 10 sorties (40 bombs) (the same level as the No Action Alternative) and electronic combat flare use would increase (from the No Action Alternative baseline [56 events, 1,680 defensive flares]) to 80 sorties (2,400 defensive flares) annually, an addition of 24 annual sorties and 720 additional defensive flares used. There would be no change in land use compatibility, compatibility with land use plans and policies, or adjacent land use. Assessment of naval activities in U.S. territory would have no impact on land use at Lake George Range under Alternative 1.

Rodman Range

If Alternative 1 were chosen for implementation, Rodman Range stressors of aircraft overflights, vessel movements, and MEM would remain the same as those for the No Action Alternative due to air-to-ground bombing exercises which would remain at 25 sorties (100 bombs) and Combat Search and Rescue activities which would remain at 146 events annually. There would be no change in land use compatibility, compatibility with land use plans and policies, or adjacent land use. Assessment of naval activities in U.S. territory would have no impact on land use at Rodman Range under Alternative 1.

3.12.3.3 Alternative 2 (Preferred Alternative)

Coastal Zone Management Consistency

In accordance with the Coastal Zone Management Act (CZMA), the Navy submitted a negative determination to North Carolina and South Carolina. Georgia and Florida were sent statements and supporting documentation indicating that the proposed action is consistent to the maximum extent practicable with the State's coastal zone enforceable policies.

Lake George Range

The proposed activities associated with Alternative 2 and Lake George Range would be the same as those assessed for Alternative 1. The stressors associated with mine laying activities remain the same as those for the No Action Alternative and Alternative 1 as they remain at the same level of 10 sorties (40 bombs). Electronic flare use remains at the same levels of those proposed for Alternative 1. There is no change to compatibility of land use, compatibility of land use plans and policies, or compatibility of adjacent land use. Assessment of naval activities in U.S. territory would have no impact on land use at Lake George Range under Alternative 2.

Rodman Range

Proposed activities and associated stressors of aircraft overflight and MEM for Rodman Range under Alternative 2 are the same as those proposed under the No Action Alternative and Alternative 1. There is no change to compatibility of land use, compatibility of land use plans and policies, or compatibility of adjacent land use. Assessment of naval activities in U.S. territory would have no impact on land use at Rodman Range under Alternative 2.

3.12.4 Unavoidable Significant Environmental Effects

Based on the preceding analysis, there are no unavoidable significant environmental impacts as a result of implementation of the No Action Alternative, Alternative 1, or Alternative 2.

3.12.5 Summary of Environmental Effects (NEPA and EO 12114)

As summarized in Table 3.12-2, there would be no impact to land use if the No Action Alternative, Alternative 1, or Alternative 2 were chosen for implementation.

TABLE 3.12-2
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES IN THE JAX RANGE COMPLEX

Alternative and Stressor	NEPA (U.S. Territory)	Executive Order 12114 (Non-Territorial Waters, >12 nm)
No Action		
Vessel Movement (Disturbance)	Continuation of activities at Lake George Range and Rodman Range will not impact compatibility with existing land use, existing land use plans and policies, and adjacent land use.	Offshore activities in the proposed action are not assessed in this section and potential impacts in non-territorial water are not relevant to this section.
Aircraft Overflight (Disturbance)		
MEM		
Conclusion	Assessment of naval activities in U.S. Territory would have no impact on land use at Lake George Range or Rodman Range under the No Action Alternative.	Offshore activities in the proposed action are not assessed in this section and potential impacts in non-territorial water are not relevant to this section.
Alternative 1		
Vessel Movement (Disturbance)	If Alternative 1 were chosen for implementation, activities at Lake George Range and Rodman Range will not impact compatibility with existing land use, existing land use plans and policies, and adjacent land use.	Offshore activities in the proposed action are not assessed in this section and potential impacts in non-territorial water are not relevant to this section.
Aircraft Overflight (Disturbance)		
MEM		
Conclusion	Assessment of naval activities in U.S. Territory would have no impact on land use at Lake George Range or Rodman Range under Alternative 1.	Offshore activities in the proposed action are not assessed in this section and potential impacts in non-territorial water are not relevant to this section.

TABLE 3.12-2 (Continued)
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES IN THE JAX RANGE COMPLEX

Alternative and Stressor	NEPA (U.S. Territory)	Executive Order 12114 (Non-Territorial Waters, >12 nm)
Alternative 2		
Vessel Movements (Disturbance)	Proposed Alternative 2 activities at Lake George Range and Rodman Range will not impact compatibility with existing land use, existing land use plans and policies, and adjacent land use.	Offshore activities in the proposed action are not assessed in this section and potential impacts in non-territorial water are not relevant to this section.
Aircraft Overflight (Disturbance)		
MEM		
Conclusion	Assessment of naval activities in U.S. Territory would have no impact on land use at Lake George Range or rodman Range under Alternative 2.	Offshore activities in the proposed action are not assessed in this section and potential impacts in non-territorial water are not relevant to this section.

3.13 CULTURAL RESOURCES

3.13.1 Introduction and Methods

3.13.1.1 Introduction

Cultural resources include prehistoric and historic sites, structures, objects, landscapes, and ethnographic resources, as well as other physical evidence of human activity considered important to a culture, subculture, or community for scientific, traditional, religious, or other reasons. Cultural resources are typically discussed in terms of archaeological sites, including both prehistoric and historical occupations, architectural resources, and locations of concern to Native American groups, including Traditional Cultural Properties. Because of the large geographic area, the JAX Range Complex has had numerous cultural resources investigations, most of which are detailed in installation-specific integrated cultural resources management plans (ICRMP). These studies and plans provide an inventory of the existing condition of the cultural resources throughout the JAX Range Complex (Versar, 2005).

There is a potential for prehistoric and historic cultural resources to occur within the offshore OPAREAs. With respect to prehistoric resources in depths of less than approximately 300 feet, archaeological sites may be present from Paleo-Indian habitation during the last ice age. However, it is likely these sites would be buried under sediments that have accumulated over time. As a result, the only cultural resources likely occurring throughout the OPAREAs would be historic in nature (namely, shipwrecks). It should be noted that due to mechanical, chemical, and biological erosion and decay, it is likely that older shipwrecks are represented by non-organic material (*e.g.*, metals, ballast stones, *etc*.) and are likely covered by sediments that have accumulated over time. For purposes of this document, shipwrecks are defined as archaeological resources. Both land-based and at-sea cultural resources for the JAX Range Complex are discussed in the following sections. No sites associated with federally recognized American Indian tribes were identified for this project (see Appendix C for contact letters).

Procedures for the identification, evaluation, and treatment of cultural resources are contained in a series of federal and state laws and regulations and agency guidelines. Archaeological, architectural, and Native American resources are protected by a variety of laws and their implementing regulations: the National Historic Preservation Act (NHPA) of 1966 as amended in 2000; the Archaeological and Historic Preservation Act of 1974; the Archaeological Resources Protection Act of 1979; the American Indian Religious Freedom Act of 1978; the Native American Graves Protection and Repatriation Act of 1990; the Submerged Lands Act of 1953; the Abandoned Shipwreck Act of 1987; the Sunken Military Craft Act; and OPNAVINST 5090.1B. The Advisory Council on Historic Preservation further guides treatment of archaeological and architectural resources through the regulations, Protection of Historic Properties (36 CFR 800). Historic properties, as defined by the NHPA, represent the subset of cultural resources listed on, or are eligible for, inclusion on the National Register of Historic Places (NRHP). Additional regulations and guidelines for shipwrecks include 10 USC 113, Title XIV for the Sunken Military Craft Act; the Abandoned Shipwreck Guidelines prepared by the National Park Service (NPS, 2007); and the Guidelines for Archaeological Research Permit Applications on Ship and Aircraft Wrecks under the Jurisdiction of the Department of the Navy (36 CFR 4, Part 767) overseen by the Naval Historical Center.

Consultation with the Florida, Georgia, North Carolina and South Carolina State Historic Preservation Offices (SHPO); American Indian tribes; and with the public and state and federal

agencies as required by Section 106 of the NHPA and by government-to-government consultation required by EO 13007, will be accomplished as part of the NEPA process for this FEIS/OEIS.

3.13.1.2 Assessment Methods and Data Used

Assessment Methods

This FEIS/OEIS evaluates project effects on significant cultural resources; *e.g.,* historic properties listed in or eligible for inclusion in the National Register of Historic Places (NRHP). (The term "historic properties" is synonymous for NRHP-eligible or listed prehistoric, historic, or traditional cultural resources.) Cultural resources that have not been formally evaluated may also be considered potentially eligible (i.e. a Consensus Determination in consultation with the SHPO) and, as such, are afforded the same regulatory consideration as listed properties.

Historic properties must meet one or more of the NRHP criteria defined at 36 CFR 60.4; that is, properties that are:

- associated with events that have made a significant contribution to the broad patterns of American history; or
- associated with the lives of persons significant in the American past; or
- embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
- yielded, or may be likely to yield, information important in prehistory or history.

A historic property must also possess integrity of location, design, setting, materials, workmanship, feeling, and association to qualify for the NRHP. Very few shipwrecks within the area of potential effect have been fully documented or evaluated for NRHP significance, so for purposes of this FEIS/OEIS, all unevaluated shipwrecks are considered potentially eligible for inclusion on the NRHP.

Data Used

Data contained in a cultural resources overview for the JAX Range Complex prepared by Trocolli, *et al*. (2005) was used to help identify significant resources within the range. This report indicates that a Phase I archaeological survey was completed at Rodman Target Range in 2001 (Johnson, 2005, cited in Trocolli, *et al*., 2005).

Information on the area's historic shipwrecks was obtained from the overview (Trocolli, *et al.,* 2005), from NOAA's on-line Automated Wreck and Obstruction Information System (NOAA, 2007), and the global maritime wrecks database (Veridian Corporation, 2001). Information on underwater archaeological resources obtained from the respective SHPOs is substantially refined and locations have been verified. This information is specifically excluded from the Freedom of Information Act in accordance with Section 304 of the NHPA. Numbers of shipwrecks used in this document are estimates, compiled from information obtained from these various sources. No comprehensive underwater surveys have been completed for the area of potential effect; however, data changes are made yearly as exploration systems become more sophisticated and additional discoveries are made. When the Navy conducts analysis of these resources in relation to Navy operations and potential mitigation measures, public disclosure of these sites will not occur unless permission is expressly given. Locations of identified shipwrecks contained in the global maritime wrecks database are shown in Figure 3.13.1.

3.13.1.3 Warfare Areas and Associated Environmental Stressors

Aspects of the proposed action likely to act as stressors to cultural resources were identified by conducting an analysis of the warfare areas, operations, and specific activities included in the alternatives. Table 3.13-1 presents operations associated with MEM, mechanical mine sweeping, live ordnance, and UNDETs that are carried forward for detailed analysis in this FEIS/OEIS.

3.13.2 Affected Environment

3.13.2.1 Jacksonville Range Complex Offshore Areas

The JAX Range Complex includes the JAX and Charleston OPAREAs, including the area from the mean high tide line up to and extending seaward from the 3 nm western boundary of the OPAREAs as well as the SUA. The Charleston OPAREA extends from just south of Camp Lejuene in North Carolina southward to the vicinity of the Townsend Range, just south of Savannah, Georgia. The adjoining JAX OPAREA continues southward along the Atlantic coast almost to Titusville, Florida.

TABLE 3.13-1
WARFARE AREAS AND ASSOCIATED ENVIRONMENTAL STRESSORS

Warfare Area and Operation	Training Areas	Towed MIW Equipment	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Material
Mine Warfare (MIW)					
Mine Laying	Lake George Range		✓		✓
MCM	Carrier Operating Areas	✓			
Mine Neutralization	Charleston OPAREA (North and South UNDET Boxes)	✓		✓	✓
Surface Warfare (SUW)					
MISSILEX (A-S)	W-157A (Area 4X) and W-159A (Area 5X)		✓	✓	✓
GUNEX (A-S)	W-132, W-133, W-134, W-157, W-158				✓
GUNEX (S-S) Boat	Charleston OPAREA (Areas 11J)		✓		✓
GUNEX (S-S) Ship	JAX OPAREA (AA, BB, and CC)				✓
BOMBEX (A-S) (at sea)	HE, W-158 (31J); NEPM, W157A/B and W-158 A/B			✓	✓

TABLE 3.13-1 (Continued)
WARFARE AREAS AND ASSOCIATED ENVIRONMENTAL STRESSORS

Warfare Area and Operation	Training Areas	Towed MIW Equipment	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Material
Laser Targeting	W-132, W-133, W-134, W-157, W-158				
GUNEX (S-S) (FAC/FIAC)	Amber Strait: Charleston OPAREA (Boxes Q-9&10, R-9&10)				
VBSS/MIO-Ship	JAX and Charleston OPAREAs				
VBSS/MIO-Helicopter	W-157A (Area 4X) and W-159A (Area 5X)				
Air Warfare (AW)					
ACM	W-157A (Areas 3X and 4X)				
Air Intercept Control	JAX and Charleston OPAREAs				
ACM Chaff Exercise	W-157A (Areas 3X and 4X)				✓
ACM Flare Exercise	W-157A (Areas 3X and 4X)				✓
MISSILEX (A-A)	W-132, W-133, W-134, W-157, W-158			✓[1]	✓
MISSILEX (A-A)	JAX and Charleston OPAREAs				✓
Detect-to-Engage	W-132, W-133, W-134, W-157, W-158				
GUNEX (S-A)	JAX OPAREA (AA, BB, and CC)				✓
GUNEX (A-A)	W-157A/W-133 (Area 2x)				✓
Amphibious Warfare (AMW)					
FIREX with IMPASS	JAX OPAREA (BB and CC)			✓	✓
Strike Warfare (STW)					
BOMBEX (A-G)	Rodman Range		✓		✓
CSAR and Convoy Operations	Rodman Range				
Electronic Combat (EC)					
EC Operations - Aircraft	W-132, W-133, W-134, W-157, W-158				
EC Operations - Surface Ships	JAX and Charleston OPAREAs				

TABLE 3.13-1 (Continued)
WARFARE AREAS AND ASSOCIATED ENVIRONMENTAL STRESSORS

Warfare Area and Operation	Training Areas	Towed MIW Equipment	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Material
Chaff Exercise	JAX and Charleston OPAREAs				✓
Flare Exercise- Helicopter	Lake George Range				✓
Other Events					
SESEF Utilization	5-15 nm east of Mayport				
Precision Anchoring	NS Mayport				
Small Arms with anti-swimmer grenades (MK3A2)	Charleston OPAREA (Area 10L, 12I)			✓	✓

[1] Missile explodes in air, no explosive sound in the water.

The JAX Range Complex includes large areas of the continental shelf and also fronts the state waters of Florida, Georgia, South Carolina, and a short segment of coastal North Carolina. These OPAREA waters figure prominently in the maritime history of the United States. The Gulf Stream, which cuts across the OPAREAs, provided the main shipping thoroughfare along the east coast since the earliest Spanish exploration. Vessels sailing from Europe would take advantage of the prevailing winds to carry them across the Atlantic to the Caribbean. From the Caribbean, ships would ride the Gulf Stream north along the coast to reach major colonial ports. Ships would return to Europe by sailing the prevailing westerly wind across the North Atlantic. Historical trade along this triangular route between Europe, the Caribbean, and the American East Coast was central to the world economy of the time, and to eventual colonization and development of the New World.

Florida was originally settled by the Spanish and remained in Spain's possession until 1763 when it was ceded to the British. Following the Revolutionary War, Florida territory was alternately controlled by competing interests but was soon taken over by the new U.S. Government. Florida formally became a state in 1845. Following the Civil War, Jacksonville grew in importance as a port. Vast volumes of timber were shipped out of northeast Florida through Jacksonville to support a rebuilding and rapidly growing nation. The port of Savannah, Georgia on Savannah River was of key importance to the southern colonies as it was a main export point for cotton.

Thousands of submerged cultural resources, principally shipwrecks, are located along the South Atlantic continental shelf, including the JAX Range Complex. Early history of the coastal areas of individual states, such as North and South Carolina and Georgia, is closely linked to maritime activities because colonial settlement and commerce in these states were made possible by shipping. Shipwrecks occurred in these areas throughout the historic period, which may be

considered as beginning with the earliest European exploration of the area during the 16th century, and continuing until after World War II (prior to 1960).

Most of the approximately 900 shipwrecks in the Study Area are along the coastline, with approximately 200 shipwrecks scattered in offshore waters (Figure 3.13-1). Over the past four centuries, ships have wrecked along these coasts as a result of strong currents, treacherous seas, wind, shoals, violent storms, and past military activities such as the Civil War and World War II. Shipwrecks are not randomly located, but are often associated with prominent capes such as Cape Fear in North Carolina, or with areas such as Port Royal Sound in Georgia and the Broad River near Hilton Head in South Carolina, or shoals along the northern Florida coast. These shipwrecks represent a wide variety of vessel types, including homeward bound Spanish sailing merchant vessels that followed the Gulf Stream through the Straits of Florida and up the coast of North America before heading east for the Azores and Spain. Other ships include commercial transport and passenger vessels, Civil War and World War II military vessels and submarines, tugs, tankers, and barges. Additional shipwrecks are certain to lie uncharted within the OPAREAs.

As a result of German submarine activity during WW II, ships were torpedoed and sunk in the JAX and Charleston OPAREAs. Some of these ships, such as the *Esparta*, *Esso Gettysburg*, and the *GulfAmerica*, were associated with loss of life. As these shipwrecks may contain human remains, they are considered war grave sites.

A literature review was undertaken for the two UNDET areas (10L-UNDET North and 12I-UNDET South) in the Charleston OPAREA (Southeastern Archaeological Research, Inc. [SEARCH] 2008). Review of available databases identified no known wreck sites, obstructions, or hangs within UNDET North. Only one obstruction (an artificial reef/fish haven) has been identified within UNDET South (SEARCH 2008:18). Application of the predictive model indicates that both Potential Bottom Impact Areas have a low potential to contain submerged cultural resources. Of the two areas, only UNDET South is considered a slightly higher probability area to contain submerged cultural resources due to the plotted obstruction in the northwest corner of the Training Area (SEARCH 2008). Although both areas are considered low probability for the occurrence of shipwrecks, the predictive model is not definitive and previously unrecorded shipwrecks may occur in these areas.

3.13.2.2 Rodman Range

A Phase I archaeological survey was completed in 2001 for portions of the Rodman Range established for bombing training activities (Johnson, 2005, cited in Trocolli, et al., 2005). Twelve archaeological sites were identified but only two were found eligible for the NRHP. Both eligible sites are prehistoric mound sites but are located outside the target area, in the Oklawaha River floodplain. No permanent structures are present on the facililty, and no historic properties, buildings or structures were identified (Johnson 2005:81). No Traditional Cultural Resources have been identified for the Rodman Range.

3.13.2.3 Lake George Range

A literature review was conducted for the Lake George Range (SEARCH 2008). No archaeological surveys have been conducted for the Lake George Range and vicinity. No known archaeological sites are located within the Lake George Range; however, a total of 12 archaeological sites have been recorded within ½ mile of the extant shoreline of Lake George. These archaeological sites consist of 8 prehistoric middens, 2 archaic sites, 1 burial mound, and 1 historic bridge (SEARCH

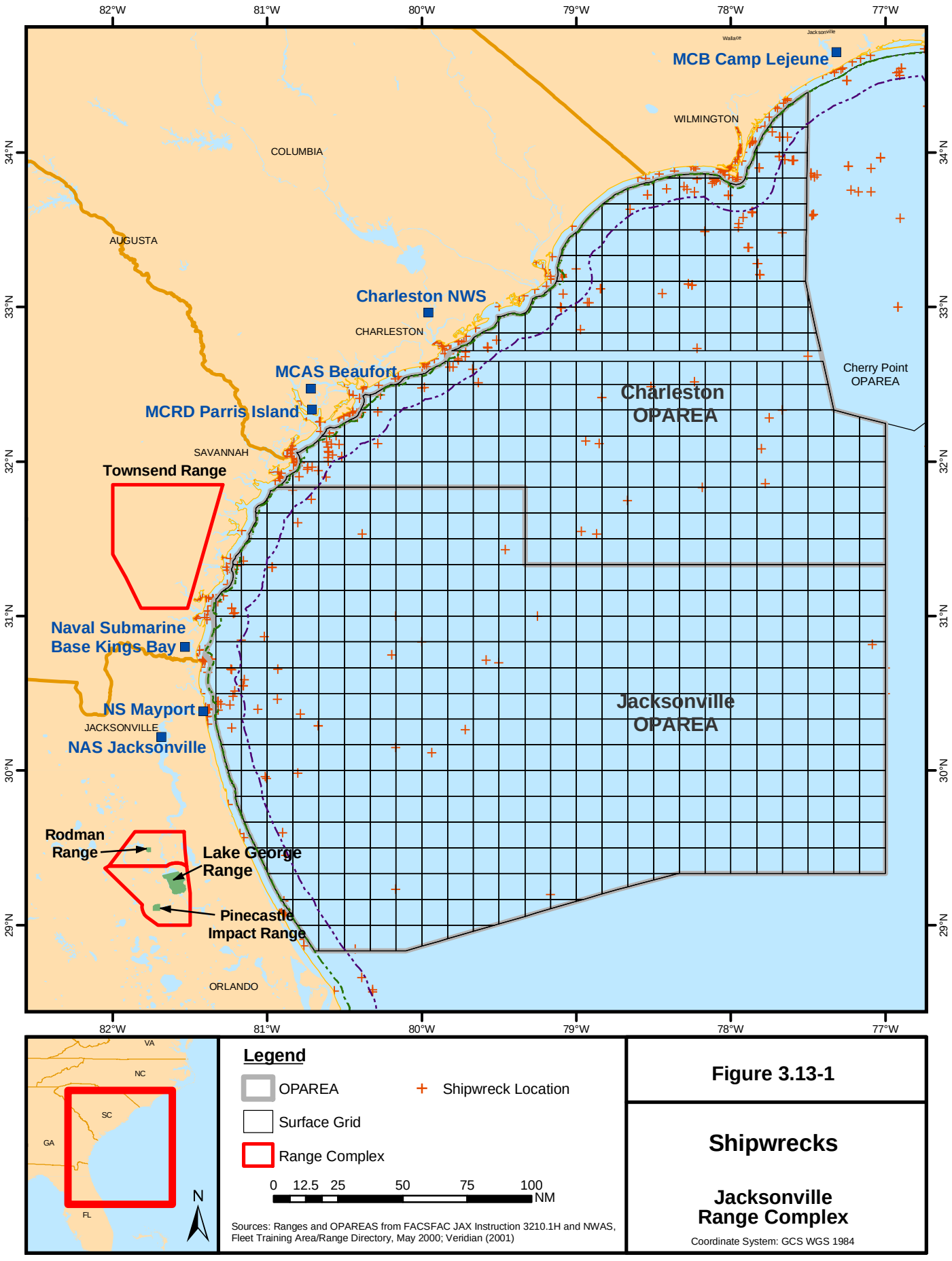


Figure 3.13-1

Shipwrecks

Jacksonville Range Complex

Coordinate System: GCS WGS 1984

2008: 15). Thirty-three navigation aids are documented within Lake George; however, all occur west of the Range (SEARCH 2008:12). A review of secondary sources indicates only one known shipwreck within Lake George, the *Isis*, a sternwheel steamer built in 1870 (SEARCH 2008: 15). The Isis foundered in a storm in 1882 with three lives lost. The locational information indicates the wreck of the Isis is likely located north of the Lake George Range near Drayton Island. No historic standing structures occur on the Lake George Range and no Traditional Cultural Resources have been identified in the area.

3.13.3 Environmental Consequences

An undertaking is considered to have an effect on a historic property when the undertaking may alter characteristics of the property that may qualify it for inclusion in the NRHP. An effect is considered adverse when it diminishes the integrity of the property's location, design, setting, materials, workmanship, feeling, or association.

Adverse effects as defined by Section 106 of the NHPA include, but are not limited to:

1. Physical destruction, damage, or alteration of all or part of the property;
2. Isolation of the property from or alteration of the character of the property's setting when that character contributes to the property's qualification for the National Register;
3. Introduction of visual, audible, or atmospheric elements that are out of character with the property or alter its setting;
4. Neglect of a property resulting in its deterioration or destruction; and
5 Transfer, lease, or sale of the property (36 CFR 800.5 (a)(2)).

For the purposes of this FEIS/OEIS, a significant impact under NEPA is defined as an unresolvable "adverse effect" under Section 106 of the NHPA. Section 106 criteria of adverse effect were applied to cultural resources that could be affected by the project, and ways were considered to avoid, minimize, or mitigate adverse effects as described below.

Note that adverse effects under the National Historic Preservation Act (NHPA) also include reasonably foreseeable effects caused by the alternatives, and those that would occur later in time, be farther removed in distance, or be cumulative (36 CFR 800.5(a)(1)). Because cultural resources are nonrenewable, all adverse effects on NRHP-eligible cultural resources in the JAX Study Area, as addressed in this FEIS/OEIS, would be long term.

Impacts to archaeological sites, specifically shipwrecks, may include, but not be limited to, physical disturbance through collision impacts from underwater equipment, vibration from HE detonations, and removal of shipwreck features and artifacts Any physical disturbance in the area of an NRHP-eligible or potentially eligible archaeological site, or modification to such a site, can affect the physical integrity of that cultural resource, resulting in alteration or destruction of those characteristics or qualities which make it potentially eligible for inclusion in the NRHP and thus, would be an adverse effect under Section 106 of the NHPA.

Previous research indicates that aircraft noise vibration on historic structures would have little potential for structural damage to historic structures (FAA, 1985). Also, because the Navy does not allow jets to travel over land at speeds that could cause sonic booms, the potential for damage

is further reduced. Thus, the topic of noise vibration on cultural sites was not evaluated under "Cultural Resources."

3.13.3.1 No Action Alternative

Mine Countermeasures (MCM) Exercises generally involve a helicopter with minesweeping and mine hunting gear using one of several systems. Typically the helicopter would fly within 50 to 75 feet of the water while towing the appropriate system, which may be towed on the surface and down to a depth of 150 feet or less. The towed system (which may include such systems as sonar, laser, mechanical, acoustic, magnetic, sweeping, or a combination thereof) generally is streamed and recovered by the helicopter.

There are a variety of MCM systems available for use by the Navy, including mechanical mine sweeping systems, systems used to counter acoustic influencing mines, and combined systems (see Appendix D for descriptions of each of these systems). The various systems help identify the mine and its location so it can be destroyed. Some systems also have mine neutralization capabilities.

These various mine identification and location events that utilize mechanical mine sweeping have the potential to damage shipwrecks. For example, if operators are unaware of the locations of shipwrecks in the OPAREAs, the towed system and attachment cable could inadvertently encounter, snag, and damage a shipwreck situated in relatively shallow water and/or at low tide. A total of 78 MCM events are conducted annually for the JAX Range Complex. Negligible to minor impacts would be expected from continuation of mine identification and location activities (*no adverse effect* under Section 106).

Mine Neutralization activities that utilize underwater detonations (UNDET) also have the potential to affect shipwrecks. Mine Neutralization activities occur in designated UNDET areas, North and South Underwater Detonation Areas (10L and 12I), within the Charleston OPAREA. Figure 3.13-2 illustrates the locations of the UNDET areas. Explosive Ordnance Disposal units use underwater explosive charges to destroy or neutralize simulated mines in these areas, and may involve the detonation of explosive charges with 20 lbs NEW. There are two shipwrecks located on the boundary of Area 12I. Because of the properties that allow water to rapidly transmit shock waves; such charges could damage cultural sites in the general vicinity, depending on the distance from the detonation and the topography of the sea floor. However, the Navy does not set explosive charges within 1,000 m of known shipwrecks. Under the No Action Alternative, the current level of 18 mine neutralization events per year would continue, resulting in negligible impacts to historic properties (*no adverse effect* under Section 106).

Bombing exercises, surface-to-surface gun exercises, and sinking targets at sea can deposit debris on the ocean bottom in the vicinity of shipwrecks. However, even if bomb fragments sink to the ocean bottom, it is unlikely they would come into contact with a wreck. However, if they sink in the vicinity of a wreck, the expended material would not affect the historic characteristics of the shipwreck, and eventually all would be covered by sediment. Thus, these operations would not have any adverse effects on shipwrecks (*no adverse effect* under Section 106).

Airborne mine laying activities involve aircraft sortie(s) dropping wholly inert training mineshapes into the water or on land. Mine laying operations typically occur at the Lake George Range where four impact targets are located on the lake surface. Even though no archaeological surveys have been conducted in this area, it is unlikely that any archaeological resources occur in the lake deposits. Currently, these operations appear to cause little disturbance to the lake bottom. The

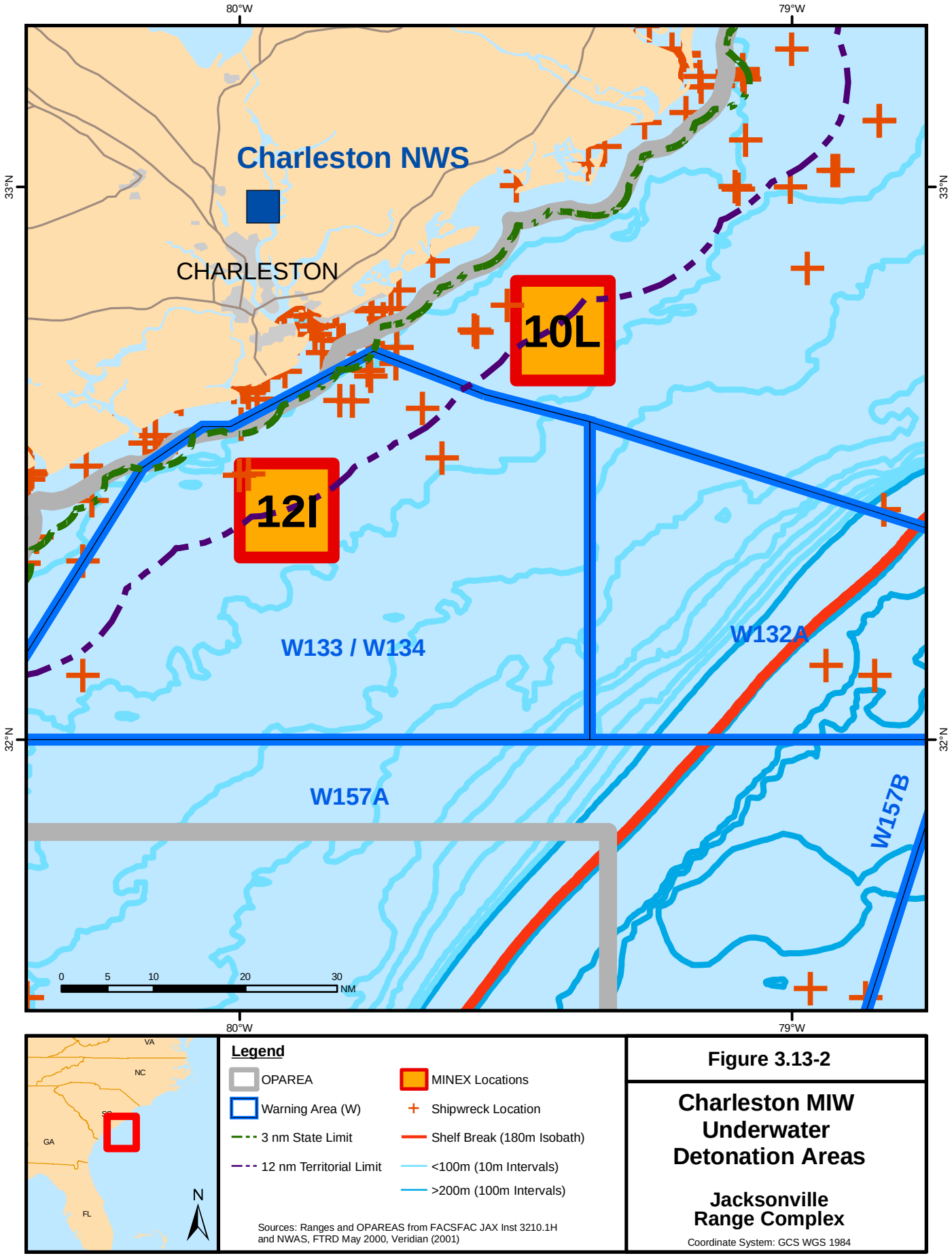


Figure 3.13-2

Charleston MIW Underwater Detonation Areas

Jacksonville Range Complex

Coordinate System: GCS WGS 1984

RAICUZ study for Lake George Range indicates that the probability of ordnance landing outside Range Safety Zone A is nil. Refer to Section 3.5.1.2 in Chapter 3 for a more detailed discussion of the RAICUZ study. Thus, there would be negligible effects on archaeological resources from MINEX activities ("no historic properties affected" under Section 106). No NHRP-eligible sites, no historic standing structures, and no Traditional Cultural Resources have been identified for the Rodman Range, although Rodman Mound A and Rodman Mound B (eligible for the NHRP) are located in the general vicinity of the range. Although it is conceivable that NEPM could miss their target and land on or near these sites, this would be an uncommon occurrence. Also, because NEPM is used, little if any damage to the sites would be expected (negligible effect or *no historic properties affected* under Section 106).

Under the No Action Alternative, training operations and major range events would continue at current levels. On-going EOD activities would have the advantage of past experience with known locations of shipwrecks, so operators should be able to avoid damage to cultural resources in these areas. The areas in which MCM operations occur would be pre-screened to help ensure nothing is in the training area that would be problematic for the towed system. Because of required preplanning of MCM operations, and implementation of described mitigation measures (especially avoidance of shipwrecks or land-based resources), continuation of on-going training activities in the JAX Study Area is unlikely to result in any significant disturbance to cultural resources (*no adverse effect* under Section 106).

3.13.3.2 Alternative 1

As described above for the No Action Alternative, MCM and mine neutralization exercises could damage shipwrecks; however, the Navy does not set explosive charges within 1,000 m of known shipwrecks. Under Alternative 1, MCM and mine neutralization exercises would increase. OASIS is a towed body that can be entangled in shipwrecks, but Navy operators would know where shipwrecks are located from NOAA's on-line system and avoid the areas. OASIS is sent in after a suspect mine shape has been found by another system such as AQS-14. RAMICS/ALMDS is similar in that it is used after another system has identified a possible mine shape, which would also allow Navy operators to avoid shipwrecks using this system. Implementation of required pre-planning of MCM operations and mitigation measures such as avoidance of shipwrecks or land-based resources, continuation of MCM and mine neutralization exercises would be unlikely to result in any significant disturbance to shipwrecks ("no adverse effect" under Section 106).

Land bombing exercises at Rodman Range would remain the same as the No Action Alternative under Alternative 1, not changing the potential for any effects to the two archaeological sites in the general vicinity. No significant effects on archaeological resources would be expected under Alternative 1 (*no historic properties afected* under Section 106).

At Lake George Range, mine laying training events also would also remain the same as the No Action Alternative, resulting in no change in potential for impacts to archaeological resources.

Under Alternative 1, many training operations and major range events would continue at current levels; some, as discussed above, would increase. On-going activities would have the advantage of past experience with known locations of shipwrecks, so operators should be able to avoid damage to cultural resources in these areas. Because of required preplanning of MCM operations, and implementation of described mitigation measures (especially avoidance of shipwrecks or land-based resources), implementation of Alternative 1 for the JAX Study Area is unlikely to result in any significant disturbance to cultural resources (*no adverse effect* under Section 106).

3.13.3.3 Alternative 2 (Preferred Alternative)

The Preferred Alternative 2 includes implementation of Alternative 1 plus enhanced mine warfare training capabilities in the JAX and Charleston OPAREAs during major exercises. Under Alternative 2, the Navy proposes to eliminate all BOMBEX training events that involve dropping HE ordnance on at-sea targets. The number of MCM and mine neutralization exercises would increase above the No Action Alternative and Alternative 1, increasing the potential for effects to shipwrecks. Mine hunting and sweeping operations would be conducted in the same general area used for other major exercises. Mine neutralization operations using OASIS, AMNS, RAMICS, and ALMDS would be conducted in the areas currently designated for UNDET training. Given these measures of using existing training areas, along with preplanning, knowledge of locations of shipwrecks, and mitigation measures such as avoidance, MIW would have no significant effects on shipwrecks (*no adverse effect* under Section 106).

With implementation of preplanning and mitigating measures such as avoidance, bombing exercises at Rodman Range would have little potential to impact known resources in the general vicinity (*no historic properties affected* under Section 106).

Training activities (mine laying) on Lake George Range would remain the same as the No Action Alternative, and therefore, would not result in appreciable disturbance to the lake bottom or ground disturbance on the shore or at the spotting towers tracts. Therefore, no significant effects to cultural resources would be expected as a result of training activities on the Lake George Range ("no adverse effect" under Section 106).

3.13.4 Unavoidable Significant Environmental Effects

The analysis presented above indicates that the No Action Alternative, Alternative 1 or Alternative 2 would not result in unavoidable significant effects to historic properties.

3.13.5 Summary of Environmental Effects (NEPA and EO 12114)

Discarded training material would be deposited in offshore areas, most of which would become buried in the sea floor sediment, and would have no substantial environmental effects. There is a remote possibility that discarded training material would settle on or near offshore shipwrecks. The overall volume of expended training items would increase in Alternative 1 and the Preferred Alternative (Alternative 2) in correlation to changes in operations. Mine warfare activities would be limited to the existing UNDET areas within the Charleston OPAREA. The analysis of environmental stressors indicated that implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in unavoidable significant effects to cultural resources. The analysis of environmental stressors and alternatives indicated no significant impact to cultural resources in U.S. territorial waters; likewise no significant harm in non-territorial waters would be expected. Table 3.13-2 provides a summary of the operation, proximity of the operation to the U.S. shoreline and, hence, whether the expended training item associated with the operation falls within the U.S. territory (NEPA) or outside U.S. waters in the global commons.

TABLE 3.13-2
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON CULTURAL RESOURCES IN THE JAX RANGE COMPLEX STUDY AREA

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	NEPA (U.S. Territory)	Executive Order 12114 (Non-Territorial Waters, >12 nm)
No Action		
Towed MIW Equipment	Limited potential for a towed array to disturb a shipwreck	Limited potential for a towed array to disturb a shipwreck
NEPM	Localized disturbance to land area or sea bottom; limited potential to strike a cultural resource or strike a shipwreck.	Localized disturbance to sea bottom; limited potential to strike a shipwreck.
UNDETS and HE Ordnance	Localized disturbance to land or sea; limited potential for explosions to occur at the location of a cultural resource or shipwreck.	Localized disturbance to sea bottom; limited potential for explosions to occur at the location of a shipwreck.
MEM	Localized accumulation of expended material at range or on sea bottom; limited potential for expended material to accumulate at the location of a cultural resource or shipwreck.	Localized accumulation of expended material on sea bottom; limited potential for expended material to accumulate at the location of a shipwreck.
Conclusion	Less than significant impacts to cultural resources with implementation of mitigation measures (avoidance of known shipwreck locations).	Less than significant harm to cultural resources with implementation of mitigation measures (avoidance of known shipwreck locations).
Alternative 1		
Towed MIW Equipment	Limited potential for a towed array to disturb a shipwreck	Limited potential for a towed array to disturb a shipwreck
Non-Explosive Practice Munitions	Localized disturbance to land area or sea bottom; limited potential to strike a cultural resource or strike a shipwreck.	Localized disturbance to sea bottom; limited potential to strike a shipwreck.
UNDETs and HE Ordnance	Localized disturbance to land or sea; limited potential for explosions to occur at the location of a cultural resource or shipwreck.	Localized disturbance to sea bottom; limited potential for explosions to occur at the location of a shipwreck.
MEM	Localized accumulation of expended material at range or on sea bottom; limited potential for expended material to accumulate at the location of a cultural resource or shipwreck.	Localized accumulation of expended material on sea bottom; limited potential for expended material to accumulate at the location of a shipwreck.

TABLE 3.13-2 (Continued)
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON CULTURAL RESOURCES IN THE JAX RANGE COMPLEX STUDY AREA

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	NEPA (U.S. Territory)	Executive Order 12114 (Non-Territorial Waters, >12 nm)
Conclusion	Less than significant impacts to cultural resources with implementation of mitigation measures (avoidance of known shipwreck locations).	Less than significant harm to cultural resources with implementation of mitigation measures (avoidance of known shipwreck locations).
Alternative 2		
Towed MIW Equipment	Limited potential for a towed array to disturb a shipwreck	Limited potential for a towed array to disturb a shipwreck
Non-Explosive Practice Munitions	Localized disturbance to land area or sea bottom; limited potential to strike a cultural resource or strike a shipwreck.	Localized disturbance to sea bottom; limited potential to strike a shipwreck.
UNDETs and HE Ordnance	Localized disturbance to land or sea; limited potential for explosions to occur at the location of a cultural resource or shipwreck.	Localized disturbance to sea bottom; limited potential for explosions to occur at the location of a shipwreck.
MEM	Localized accumulation of expended material at range or on sea bottom; limited potential for expended material to accumulate at the location of a cultural resource or shipwreck.	Localized accumulation of expended material on sea bottom; limited potential for expended material to accumulate at the location of a shipwreck.
Conclusion	Less than significant impacts to cultural resources with implementation of mitigation measures (avoidance of known shipwreck locations).	Less than significant harm to cultural resources with implementation of mitigation measures (avoidance of known shipwreck locations).

3.14 TRANSPORTATION

3.14.1 Introduction and Methods

Traffic issues refer to transportation and circulation of vehicles within an organized framework. This discussion addresses the marine and air traffic within the vicinity of the Jacksonville Range Complex. Military and civilian use of the offshore sea and air areas is compatible, with Navy ships accounting for three percent of the total ship presence out to 200 nm (CNA, 2001). Where naval vessels and aircraft are conducting operations that are not compatible (*e.g.*, hazardous weapons firing), they are confined to OPAREAs away from shipping lanes and inside SUA. Hazardous operations are communicated to all vessels and operators by use of NOTMARs, issued by the USCG, and NOTAMs, issued by the FAA.

Ocean Traffic. Ocean traffic is the transit of commercial, private, or military vessels at sea, including submarines. Ocean traffic flow in congested waters, especially near coastlines, is controlled by the use of directional shipping lanes for large vessels (cargo, container ships, and tankers). Traffic flow controls are also implemented to ensure harbors and ports-of-entry remain as uncongested as possible. There is less control on ocean traffic involving recreational boating, sport fishing, commercial fishing, than activity by naval vessels. In most cases, the factors governing shipping or boating traffic include the following: adequate depth of water, weather conditions (primarily affecting recreational vessels), the availability of fish of recreational or commercial value, and water temperature.

Exclusive Economic Zones are sea zones that were established by the Third United Nations Convention on the Law of the Sea in 1982. Part V, Article 55 of the Convention establishes that the Exclusive Economic Zone is "an area beyond and adjacent to the territorial sea, subject to the specific legal regime established in this Part, under which the rights and jurisdiction of the coastal State and the rights and freedom of other States are governed by the relevant provisions of this Convention" (UN, 1982). The Exclusive Economic Zones extend 200 nm from the coastal baseline (the baseline usually follows the low-water line). Within the Exclusive Economic Zones, the coastal nation has sole exploitation rights over all natural resources; however, foreign nations have the freedom of navigation and over-flight, subject to the regulation of the reigning coastal state (NOAA, 2007). The Exclusive Economic Zone was established by Presidential Proclamation in 1983 (NOAA, 2007).

Internal waters are those waters and waterways on the landward side of the baseline. U.S. territorial waters extend from the baseline to 12 nm. These areas were defined by the 1982 Law of the Sea Convention and established the coastal state's right to establish laws, regulate use and have use of any resource in internal and territorial waters (NOAA, 2007).

Air Traffic. Air traffic refers to movements of aircraft through airspace. Safety and security factors dictate that use of airspace and control of air traffic be closely regulated. Accordingly, regulations applicable to all aircraft are promulgated by the FAA to define permissible uses of designated airspace, and to control that use. These regulations are intended to accommodate the various categories of aviation, whether military, commercial, or general aviation. The regulatory scheme for airspace and air traffic control varies from highly controlled to uncontrolled. Less controlled situations include flight under Visual Flight Rules (VFR) or flight outside of U.S.-controlled airspace (*e.g.*, flight over international waters off the East Coast). Examples of highly controlled air traffic situations are flights in the vicinity of airports, where aircraft are in a critical

phase of flight, either take-off or landing, and flight under Instrument Flight Rules (IFR), particularly flight on high or low altitude airways.

The FAA owns and operates the air traffic control system. The system of airspace designation makes use of various definitions and classifications of airspace in order to facilitate control. "Controlled Airspace" is a generic term that covers different classes of airspace. The controlling agency of any airspace is the FAA Air Traffic Control facility that exercises control of the airspace when SUA is not active. SUA is specially designated airspace used for a specific purpose and controlled by the military unit or other organization whose activity established the requirement for the SUA (FAA, 2006). SUA includes restricted areas, military operations areas, as well as warning, prohibited, alert, and controlled firing areas.

- Airways are established routes used by commercial aircraft, general aviation, and military aircraft. There are two types of airway route structures: low altitude routes (those below 18,000 feet MSL) and high altitude routes (those above 18,000 feet MSL).
- "Victor Routes" are the network of airways serving commercial aviation operations up to 18,000 MSL.
- Class A extends from 18,000 MSL up to and including 60,000 MSL and includes designated airways for commercial aviation operations at those altitudes.
- Class B airspace extends from the ground to 10,000 MSL surrounding the nation's busiest airports.
- Class C and D airspace are defined areas around certain airports, tailored to the specific airport.
- Class E is controlled airspace not included in Class A, B, C, or D.
- Class G is uncontrolled airspace (*i.e.,* not designated as Class A-E).

SUA refers to areas with defined dimensions where flight activities are confined due to their nature and the need to restrict or limit non-participating aircraft. SUA is established under procedures outlined in 14 CFR Part 73. The majority of SUA is established for military activities, and may be used for commercial or general aviation when not reserved for military activities. There are multiple types of SUA. A Restricted Area is a type of SUA within which non-military flight activities are closely restricted. Other types of SUA include MOAs, alert areas, and controlled firing areas; each SUA designation carries varying restrictions on the types of military and non-military activities that may be conducted. One type of SUA of particular relevance to the JAX EIS/OEIS Study Area, is a Warning Area, which is defined in 14 CFR Part 1 as follows:

"A warning area is airspace of defined dimensions, extending from 3 nm outward from the coast of the United States that contains activity that may be hazardous to nonparticipating aircraft. The purpose of such warning areas is to warn nonparticipating pilots of the potential danger. A warning area may be located over domestic or international waters or both."

Warning Areas are established to contain a variety of aircraft and non-aircraft activities, such as aerial gunnery, air and surface missile firings, bombing, aircraft carrier operations, surface and subsurface operations, and naval gunfire. Warning areas contain hazardous activities; where these activities are conducted mainly in international airspace, the FAA regulations may warn against, but do not have the authority to prohibit, flight by nonparticipating aircraft.

Land Transportation. Transportation on land refers to the movement of vehicles on roadway networks from one place to another. Primary roads, such as major interstate highways, are designed to move traffic and do not necessarily provide access to all adjacent areas. Secondary roads, commonly referred to as surface streets, are used to gain access to residential and

commercial areas, hospitals, and schools. The Study Area for transportation includes Rodman Range. Lake George is not included in the land transportation analysis as the Lake George Range components are located on a water body (Lake George).

3.14.1.1 Assessment Methods and Data Used

The Center for Naval Analysis studies (2001, 2004, 2006) were used to look at non-Navy ship traffic in the vicinity of the JAX Range Complex. In 2001 the Chief of Naval Operations (CNO-N45) initiated a study that, amongst other things, sought to determine the contribution of the Navy to coastal ship traffic. This study utilized the Historical Temporal Shipping database[48] and daily listings of Navy ship traffic. Regarding "traffic" issues, the 2001 Center for Naval Analysis study concluded that Navy ships were a small fraction of the coastal ship presence ($1/30^{th}$) and comparisons of naval and commercial traffic is difficult due to naval traffic being "patchy" in both time and space while commercial traffic is more uniform.

The 2004 Center for Naval Analysis study concentrated more on the Navy OPAREAs and, due to the difficulties in estimating small commercial vessels and recreational boats, the Center for Naval Analysis was asked to establish a method for estimating the small boat and craft traffic in a given ocean area. Additionally, the Historical Temporal Shipping data used in the 2001 study had been developed in 1993 and had not been updated so, using sporadic vessel position data, the 2004 study developed a tool for comparing relative densities of large vessels, by vessel type, region, and time to compare Navy and non-Navy traffic levels (CNA, 2004).

The 2006 Center for Naval Analysis study concentrated more on information concerning Navy and non-Navy vessel traffic and speed patterns due to increasing concerns regarding proposed speed restriction. The study concluded that estimates of vessel speed could be calculated from positional data and that, while Navy ships were capable of transiting at higher speeds than most large commercial vessels, they generally do not do so (CNA, 2006).

Information regarding personal watercraft was obtained in part from the USCG. In addition to its national defense role as one of the five U.S. Armed Services, the USCG is charged with a broad scope of regulatory, law-enforcement, humanitarian, and emergency-response duties. In addition to ensuring maritime safety and security, the USCG focuses on personal watercraft and boating. State tourism and parks and recreation divisions also provided sources for state-specific personal watercraft and recreational boating data.

Sport diving industry statistics are not maintained for numbers of individuals participating in specific regions of the country or for sites commonly used (Davison, 2007; DEMA, 2006). Dive locations identified in this document were established through the use of the a survey of state dive

[48] The Historical Temporal Shipping (HITS) data are a 1993 database developed by the Naval Oceanographic Office that describes the number of ships expected in each region of the ocean for five types of ships: fishing, merchant, tanker, large tanker, and supertanker. While ship types other than those included in the HITS database may also transit the site, the selected ship types are expected to be representative of major commercial shipping in the region. Traffic density was determined for this study by isolating 1-degree latitude by 1-degree longitude boxes. For each box, ship-hour estimates were divided by box area. This calculation is useful when comparing relative densities between East Coast Navy OPAREAs and ship types (CAN, 2001).

charter company websites, Veridian Corporation's 2001 Global Maritime Wrecks Database, and state tourism and parks and recreation information.

3.14.1.2 Warfare Areas and Associated Environmental Stressors

Impacts to transportation are assessed in terms of anticipated levels of disruption or improvement of current transportation patterns and systems; deterioration or improvement of existing levels of service; and changes in existing levels of transportation safety. Impacts may arise from physical changes to circulation (*i.e.,* closing, rerouting, or creation of new traffic patterns), or changes in daily or peak-hour traffic volumes created either by direct or indirect changes to transportation activities. Stressors that would likely impact transportation activities are identified in Table 3.14-1. These stressors were identified by conducting a detailed analysis of the warfare areas, operations, and specific activities included in the Alternatives.

TABLE 3.14-1
SUMMARY OF POTENTIAL STRESSORS TO TRANSPORTATION RESOURCES

Warfare Area and Operation	Training Areas	Vessel Movements (Disturbance)	Aircraft Overflights (Disturbance)	Military Expended Material
Mine Warfare (MIW)				
Mine Laying	Lake George Range		✓	✓
MCM	Carrier Operating Areas	✓	✓	✓
Mine Neutralization	Charleston OPAREA (North and South UNDET Boxes)	✓	✓	✓
Surface Warfare (SUW)				
(A-S)	W-157A (Area 4X) and W-159A (Area 5X)	✓	✓	✓
GUNEX) (A-S)	W-132, W-133, W-134, W-157, W-158	✓	✓	✓
GUNEX (S-S) Boat	Charleston OPAREA (Areas 11J)	✓		✓
GUNEX (S-S) Ship	JAX OPAREA (AA, BB, and CC)	✓	✓	✓
Bombing Exercise (A-S) (at sea)	HE, W-158 (31J); NEPM, W157A/B and W-158 A/B	✓	✓	✓
Laser Targeting	W-132, W-133, W-134, W-157, W-158	✓	✓	
GUNEX (S-S) (FAC/FIAC)	Amber Strait: Charleston OPAREA (Boxes Q-9&10, R-9&10)	✓		
VBSS/MIO-Ship	JAX and Charleston OPAREAs	✓		
VBSS/MIO-Helicopter	W-157A (Area 4X) and W-159A (Area 5X)		✓	

TABLE 3.14-1 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO TRANSPORTATION RESOURCES

Warfare Area and Operation	Training Areas	Vessel Movements (Disturbance)	Aircraft Overflights (Disturbance)	Military Expended Material
Air Warfare (AW)				
ACM	W-157A (Areas 3X & 4X)		✓	
Air Intercept Control	JAX and Charleston OPAREAs		✓	
ACM Chaff Exercise	W-157A (Areas 3X & 4X)		✓	✓
ACM Flare Exercise	W-157A (Areas 3X & 4X)		✓	✓
MISSILEX (A-A)	W-132, W-133, W-134, W-157, W-158	✓	✓	✓
MISSILEX (S-A)	JAX and Charleston OPAREAs			✓
Detect-to-Engage	W-132, W-133, W-134, W-157, W-158		✓	
GUNEX (S-A)	JAX OPAREA (AA, BB, and CC)	✓	✓	✓
GUNEX (A-A)	W-157A/W-133 (Area 2X)			✓
Amphibious Warfare (AMW)				
FIREX (Surface-to-Surface) with IMPASS	JAX OPAREA (BB and CC)	✓	✓	✓
Strike Warfare (STW)				
BOMBEX (A-G)	Rodman Range		✓	✓
CSAR and Convoy Operations	Rodman Range		✓	✓
Electronic Combat (EC)				
EC Operations - Aircraft	W-132, W-133, W-134, W-157, W-158		✓	
EC Operations - Surface Ships	JAX and Charleston OPAREAs		✓	
Chaff Exercise	JAX and Charleston OPAREAs		✓	✓
Flare Exercise- Helicopter	Lake George Range		✓	✓
Other Training				
SESEF Utilization	5-15 nm east of Mayport	✓		
Precision Anchoring	NS Mayport	✓		
Small Arms with anti-swimmer grenades (MK3A2)	Charleston OPAREA (Area 10L, 12I)	✓		✓

3.14.2 Affected Environment

3.14.2.1 Ocean Traffic

Military

The JAX and Charleston OPAREAs, within the JAX Range Complex, cover an area of 50,090 nm^2 off the coast of North Carolina, South Carolina, Georgia, and Florida (Figure 1.1-1). The Navy operates for 1,000 steaming days[49] per year within the JAX and Charleston OPAREAs (Table 2.2-5). The volume of undersea space varies greatly based on the sea floor depth. The OPAREAs undersea space is summarized as having the following:

- shallow littoral waters less than 60 feet;
- shallow offshore waters less than 600 feet;
- deepwater sloping sea floor and canyons to 9,600 feet;
- deepwater ocean areas to 13,000 feet.

The Submarine areas cover all the deepwater portions of the OPAREAs extending south and north and offshore to the range complex limits. Subsurface/surface mutual use is from the surface to a depth of 98 feet. Submerged operations cover the area from a depth of 98 feet to the sea floor. Surface and subsurface operations, including transits in the OPAREAs, require prior authorization and clearance by FACSFAC JAX. Clearance for a surface area does not include the airspace above or the subsurface below. Requests for clearance for operations by submarines shall be addressed to the appropriate submarine exercise area coordinator. The submarine exercise area coordinator must obtain clearances from FACSFAC JAX and promulgate the clearance to the individual units and/or commands.

Units are required to obtain clearance for all hazardous or exclusive operations within the OPAREAs. Any operations involving the use of live or non-explosive ordnance must be authorized by FACSFAC JAX. Weapons firings, including small arms and chaff use by surface units, require coordination with airspace controlling procedures.

Civilian

The East Coast of the United States is heavily traveled by marine vessels, with several commercial ports occurring near Navy OPAREAs. The inshore areas of the JAX Range Complex, near the Jacksonville commercial port, are particularly heavily traveled. Recreational activities consist primarily of motorboating, game and sport fishing, jetskiing, waterskiing, shellfishing/shrimping, sailing, sport diving, and bird and whale watching. Recreational boats range throughout the coastal waters, depending on season and weather conditions. The South Atlantic Region (from Delaware to Florida) maintained 2.5 million registered boats in 2001 (Fishing News, 2002). The following lists the number of registered recreational boats and their nationwide ranking for each state bordering the OPAREAs:

- North Carolina – 362,784 (ranking 11th nationwide in registered recreational boats)
- South Carolina - 416,763 (ranking 8th nationwide in registered recreational boats)
- Georgia - 318,212 (ranking 14th nationwide in registered recreational boats)

[49] Steaming days are a measurement of time; a single vessel within a 24 hour timeframe.

- Florida - 973,859 (ranking 1st nationwide in registered recreational boats) *(NMMA, 2006; USCG, 2005)*

Sailboats in the 75-foot and larger class, and cruising vessels transiting ocean passages (*e.g.*, from some ports to the Bahamas or Bermuda), might favor courses through the vicinity of the OPAREAs. Commercial waterways do traverse the JAX Range Complex, but are controlled by the use of directional commercially used waterways for large vessels (cargo, container ships, and tanker) (Figure 3.14-1). Traffic flow controls are also implemented to ensure harbors and ports-of-entry remain as uncongested as possible. Military and civilian use of the offshore areas is compatible as naval vessels conducting operations that are potentially dangerous are confined to areas away from commercially used waterways. Potentially dangerous operations are communicated to all vessels and operators by use of NOTMARs published by the USCG.

Popular sport diving sites within the Study Area consist of natural and artificial reefs. Off the South Carolina coast these include shipwrecks (with about 30 in the Charleston OPAREA), as well as artificial and natural reefs. Angel's Ledge live-bottom reef ranges in depth from 39 to 98 feet. Popular shipwreck and submerged artificial reefs can be found in various depth levels from 43 to over 98 feet of water, both close to shore (*e.g.*, The Sherman at 6 miles offshore) and at farther distances (*e.g.* The City of Houston at 55 miles offshore) (Coastal Scuba, 2007). One of the most popular dive sites off the Georgia coast is Gray's Reef. The area is one of the largest near-shore live-bottom reefs of the southeastern United States (Dive Training Magazine Online, 2007). The associated Gray's Reef National Marine Sanctuary, which is exposed to limited use by divers due to depth, strong current, and frequent turbidity (NOAA, 2006), is 17.5 nm off Sapelo Island, Georgia, and encompasses 17 nm^2 of live-bottom habitat. Divers access the reef from numerous facilities between Savannah and Brunswick, Georgia (Dive Training Magazine Online, 2007). Diving and swimming account for 32 percent of all boating activities in the State of Florida (USCG, 2003).

Requests to schedule the airspace, surface, and subsurface training areas, and hazardous events (those involving firing or dropping ordnance) are coordinated directly with FACSFAC JAX. The FACSFAC JAX operations schedule is published weekly and lists assigned radio frequencies and area assignment times for events controlled by FACSFAC JAX or that involve commercial aircraft. Full and specific guidelines, procedures, and restrictions are provided in FACSFAC JAX Instruction 3120.1 Series.

3.14.2.2 Air Traffic

The JAX and Charleston OPAREAs contain warning areas and a range composed of large blocks of SUA generally overlaying the OPAREAs from the surface to an unlimited altitude. Operations conducted in these Warning Areas include all weather flight training, refueling, test flights, rocket and missile firing, bombing, fleet training, independent unit training, ASW, aircraft carrier, ship and submarine operations, and anti-air and surface gunnery. The total fixed-wing sorties per year in the JAX and Charleston OPAREAs is 1,642 and the number of annual helicopter sorties is 734. The Warning Areas of the JAX Range Complex include W-132A/B, W-133, W-134, W-157A/B/C, W-158A/B/CE/F, and W-159A/B (Figure 1.1-1).

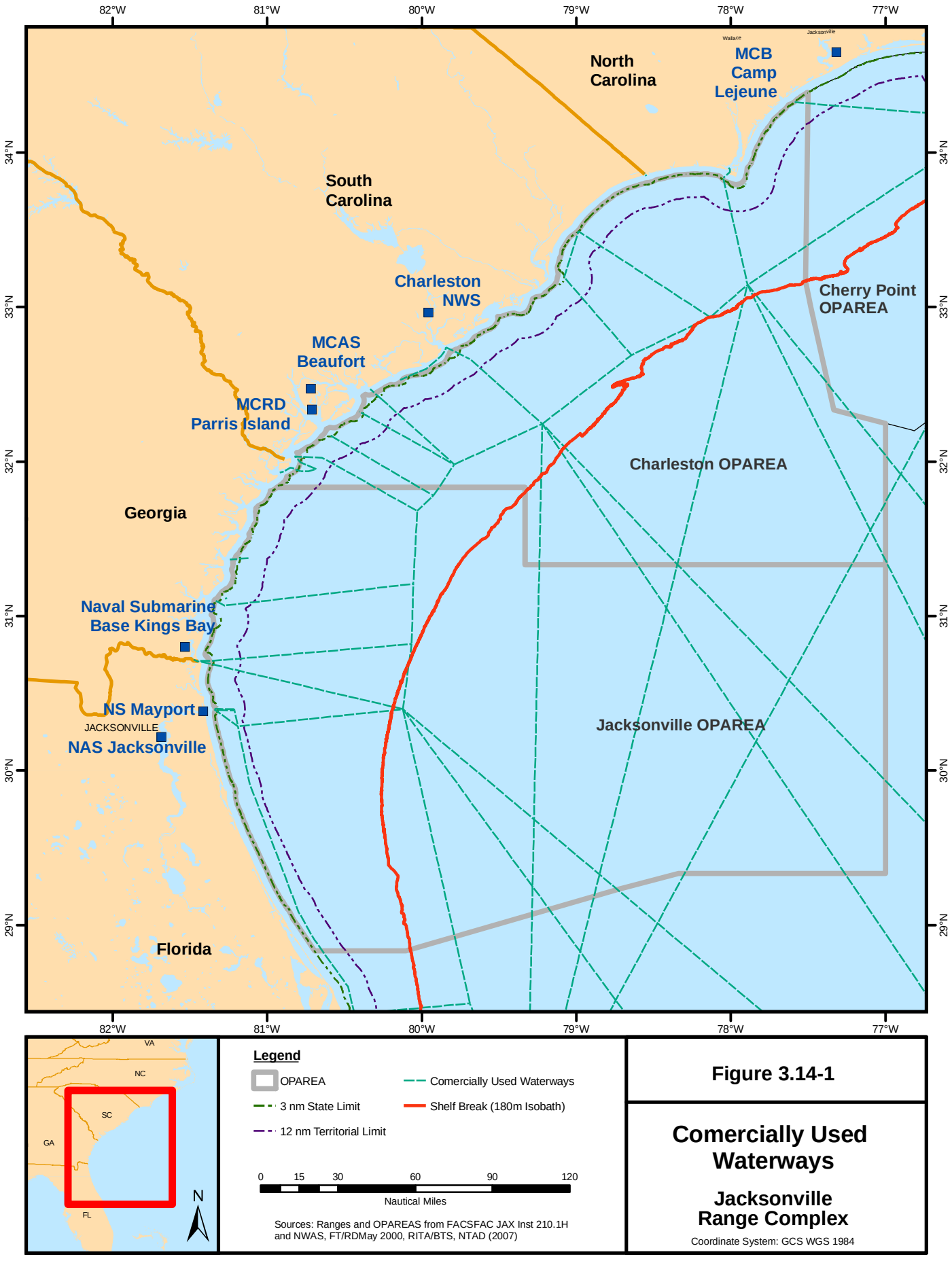


Figure 3.14-1

Comercially Used Waterways

Jacksonville Range Complex

Coordinate System: GCS WGS 1984

Military

FACSFAC JAX is a designated air traffic control (ATC) facility and as such is required to provide air traffic separation consistent with FAA guidelines to ensure the safe, efficient and expeditious flow of air traffic. Radar surveillance and radio communications provide air traffic control separation between high-performance military aircraft and the large volume of commercial aircraft transiting the numerous jet routes off the southeast coast of the United States.

The FACSFAC JAX ATC is located on NAS Jacksonville and is staffed continuously. In addition to air traffic control services, the facility is responsible for other missions including fleet support and search and rescue. Pilots planning to penetrate warning area airspace must contact FACSFAC JAX ATC for airspace clearance and SUA assignments. While within a warning area, pilots must remain on FACSFAC JAX ATC assigned frequencies. When possible, FACSFAC JAX provides altitude blocks in accordance with pilot requests; however, assignments of altitude blocks do not preclude private and commercial aircraft from entering an SUA.

FACSFAC JAX advises flights entering warning areas of other flight operations that may affect airspace use, and provides data on known aircraft carrier operations in the area. FACSFAC JAX also provides VRF advisory service to aircraft proceeding to/from or operating inside an SUA or warning area, when able. Specific traffic information is provided as radar coverage permits.

Civilian

FACSFAC JAX is the principal controlling authority for the JAX Range Complex. FACSFAC JAX controls SUA, which consists of warning areas and restricted areas, MOAs, and surface/subsurface OPAREAs. FACSFAC JAX has shared responsibility for air traffic control assigned airspace associated with the range complex use. All airspace outside the territorial limits is located in international airspace. Because the offshore airspace use study area is in international airspace, the procedures outlined in International Civil Aviation Authority Document 444, *Rules of the Air and Air Traffic Services* are followed.

During space launches at Cape Canaveral, the FAA closes the southern portions of the JAX OPAREA and associated airspace, depending on launch parameters. On occasion, the FAA closes the majority of the JAX OPAREA airspace for air corridors. The FAA occasionally takes control of coastal areas of the warning areas for routing of civilian airline traffic due to weather.

3.14.2.3 Range Safety Procedures

All range safety precautions and regulations contained in Commander, in Chief, U.S. Atlantic Fleet (CINCLANTFLT) Instruction 3120.26, "Atlantic Fleet Operating Areas and Warning Areas," apply in the Charleston and JAX OPAREAs. Specific safety procedures and requirements for both land and sea ranges are set forth in FACSFAC JAX 3000.1D (DoN, 2001). The following general rules apply to area clearances within FACSFAC JAX-controlled OPAREAs:

- Dropping any ordnance, live or non-explosive, or live-fire is considered a hazardous event. All hazardous operations and exercises conducted in FACSFACJAX OPAREAs require clearance from FACSFACJAX.
- The firing or dropping of ordnance, including small arms, must be scheduled with FACSFACJAX. Firing exercises are not authorized without prior FACSFACJAX approval. The unit conducting small arms fire is responsible for the safety clearance of their area.

- Non-hazardous/concurrent air, surface and subsurface operations, such as Independent Steaming Exercise transits, navigation drills, Deck Landing Qualifications, and helicopter operations do not require a specific clearance/message request.
- Flare drops are considered a non-hazardous event, but all airborne/surface units must contact FACSFAC JAX prior to dropping flares to prevent errant search-and-rescue reporting.
- It is the responsibility of individual unit's and/or group's officer in tactical command and/or officer conducting exercise to remain clear of hot and exclusive areas.
- Publications of NOTMARs and NOTAMs by the USCG and FAA. The Navy provides information about potentially hazardous activities planned for the JAX Range Complex.
- Within the OPAREAs and warning areas, all units conducting firing or other hazardous activity must comply with Section 8, Chapter 1 of CINCLANTFLTINST 3120.26 and all Fleet Exercise Publication.
- FACSFACJAX promulgates NOTAMs as applicable.
- Officers in charge of the exercise are not permitted to fire or jettison aerial targets unless the area is confirmed to be clear of nonparticipating civilian and military targets.
- Range inspection at Rodman Range is conducted by Rodman Target Control. Aircraft using the range are required to inform Target Control of run-in heading prior to dropping. No live ordnance, strafing, or lasing is permitted at Rodman Range. All aircraft utilizing Rodman Range are required to make a dry run to observe the range before dropping ordnance.
- Use of the Lake George Range requires aircraft to make a preliminary run-in pass to confirm the impact areas are clear of boats.

Inland Ranges

Rodman Range

Rodman Range is located in north central Florida, approximately 57.5 miles south of Jacksonville. Rodman Range is situated in along the northeastern end of the Ocala National Forest, along the north side of the Ocklawaha River. The Ocala National Forest offers recreational opportunities to camp, swim, picnic, hike, mountain biking, boating, canoeing, off-road trails, horseback riding, hunting and fishing. Camping grounds are offered through developed campgrounds, primitive camp sites, and dispersed tent camping that may be utilized year-around. There are six hiking trails through the forest and a 22-mile long bicycling trail. The Ocala National Forest contains approximately 600 lakes and ponds, several streams and has two rivers along its boundary resulting in boating opportunities that range from canoeing, boating, skiing, and personal watercraft. Canoe rentals are available at six different marinas. Off road vehicle trails are not specifically designated, but there are many unnumbered roads and travel ways that do allow off road vehicles. There are four marked horseback trails.

There are 31 recreation areas within the Ocala National Forest and four National Wilderness Areas (Alexander Springs, Billies Bay, Juniper Prairie, and Little Lake George). The FAA issued a non-mandatory guidance (Advisory Circular AC 91-36) requesting pilots to maintain an altitude of 2,000 feet AGL in wilderness areas administered by the U.S. Forest Service.

State Route (SR) 19 crosses the eastern edge of the Ocala National Forest in a north to south direction and is the nearest state highway to Rodman Range. In 2006 the nearest segment of SR 19 to Rodman Range experienced 9,200 vehicles, computed AADT, two-way reported.

Lake George Range

Lake George Range is located within Lake George, located within the Ocala National Forest, Lake George Range District, 15 miles west of Crescent City (on U.S. 17) (USDA, 2008). Lake George Range is located within the Lake along the East-Central portion of the Lake. Lake George is the second largest lake in Florida. It is located along the St. Johns River and contains three major salt spring groups; Salt Springs (entering the lake from the northwest), Silver Glen (entering the lake from the center-west side), and Juniper Creek (enter the lake from the southwest). Drayton Island is the largest island in the lake and is on the north side of the Lake. The waters of the St. Johns River and the three creeks contribute to the salt content of the lake. The Lake contains high enough salinity to support salt-water fish and plants, to include a blue crab fishery. The lake is surrounded by camp grounds and fishing camps, particularly along the upper northeast, south, and east sides of the Lake. Boat rental are available for houseboats, ski boats, pontoon boats, and lip rentals. The Forest Service offers scenic trails and educational programs that include flora and fauna identification. All types of water sports and outdoor lodging that ranges from the "primitive" to group cabins that hold up to 21 people (LG, 2008).

3.14.3 Environmental Consequences

The traffic analysis addresses air, ocean, and land traffic in the JAX EIS/OEIS Study Area. The principal issue is the potential for existing or proposed military air, vessel, or vehicular traffic to affect existing transportation and circulation conditions. Impacts on traffic are considered with respect to the potential for disruption of transportation pattern and systems, and changes in existing levels of transportation safety.

Impacts to air traffic might occur if an alternative has potential to result in an increase in the number of flights that could be accommodated within established operational procedures and flight patterns; requires airspace modification; or results in an increase in air traffic that might increase collision potential between military and non-participating civilian operations.

Impacts to ocean vessel traffic might occur if the extent or degree to which an alternative would seriously disrupt the flow of commercial surface shipping or recreational fishing or boating. A serious disruption occurs when a vessel is unable to proceed to its intended destination due to exclusion from areas in the JAX Range Complex. However, the need to use alternative routes during the time of exclusion does not constitute a serious disruption. Impacts to transportation and circulation on land might occur if the proposed action changed the extent or degree of effects on safety,, the capacity of roads on or near the training area, increased the potential for traffic disruption, or increased congestion along regional and local transportation corridors.

3.14.3.1 No Action Alternative

Both military and non-military entities have shared the use of the airspace, ocean, and land surface encompassing the JAX Range Complex for more than 30 years. Military, commercial, and general aviation activities have established an operational co-existence consistent with federal, state, and local plans and policies and compatible with each interest's varying objectives. Activities under the No Action Alternative include activities that are and have been routinely conducted in the area for decades. Ongoing continuing operations identified in this FEIS/OEIS will continue to use the existing offshore OPAREAs and Warning Areas. Although the nature and intensity of use varies over time and by individual area, the continuing training operations represent precisely the kinds of operations for which these areas were created (*i.e.*, those that present a conflict with other vessels).

Currently the Navy uses the JAX and Charleston OPAREAs for 1,000 steaming days per year. There are 1,642 annual fixed-wing and 734 helicopter sorties in the OPAREAs. None of the alternatives include proposed airspace modifications and would not change the existing relationship of the Navy's SUA with federal airways, uncharted visual flight routes, and airport related air traffic operations.

FACSFACJAX is the principal controlling authority for activities within the JAX Range Complex and associated airspace components. Through close coordination with the FAA, FACSFACJAX ensures hazardous activities are carefully scheduled to avoid conflicts with civilian activities and safety standards are maintained while allowing the maximum amount of civilian access to airspace and sea space.

The stressors from proposed activities likely to impact transportation activities stem from increases in vessel movements, aircraft overflights, MEM, and the associated increase in training activities; however, conflicts in the JAX Range Complex are handled through a single point of contact system that ensures the needs of both the military and civilian sectors are met. Military activities are either scheduled or announced ahead of execution or take place in an area designated for the exclusive use of military activities.

Land transportation activities are minimal and are not anticipated to increase or change; therefore, proposed activities associated with the No Action Alternative will have no impact on transportation resources at Lake George and Rodman Ranges.

The proposed activities associated with the No Action Alternative have no impact on transportation resources. Implementation of the No Action Alternative would have no impact on transportation resources in U.S. territory. Further, implementation of the No Action Alternative would not cause harm to transportation resources in non-territorial waters.

3.14.3.2 Alternative 1

The Navy can accomplish the proposed activities associated with Alternative 1 without modifications or need for additional designated ocean or airspace. The proposed operations would not require either: (1) a change to an existing or planned IFR minimum flight altitude, a published or special instrument procedure, or an IFR departure procedure; or (2) a VFR operation to change from a regular flight course or altitude. As such, the increased training operations do not conflict with any airspace use plans, policies, and controls. Operations involving steaming days would increase by approximately 10 percent (1,050) if this alternative were implemented, the fixed wing sorties would increase by approximately eight percent (1,773), and the helicopter sorties are anticipated to increase by approximately 25 percent (916).

The proposed increase in training operations, force structure changes, and enhanced range capabilities related to sea, ocean, and land space (as detailed in Chapter 2) does not impact use of the JAX Range Complex in areas analyzed in this FEIS/OEIS. The potential impacts to transportation assets associated with Alternative 1 would otherwise be similar to those described for the No Action Alternative.

Land transportation activities are minimal and are not anticipated to increase or change. Alternative 1 proposes to increase the number of sorties (from 56 to 80) associated with flare exercises at Lake George Range; thus increasing the use of flares from the No Action Alternative level of 1,680 flares to 2,400 flares. There are no other changes anticipated at Lake George Range or Rodman Range as a result of implementation of Alternative 1; therefore, proposed activities

associated with Alternative 1 would have no impact on transportation resources at Lake George and Rodman Ranges.

Implementation of Alternative 1 would have no impact on transportation resources in U.S. territory. Further, implementation of Alternative 1 would not cause harm to transportation resources in non-territorial waters.

3.14.3.3 Alternative 2 (Preferred Alternative)

The Navy can accomplish the proposed activities associated with Alternative 2 without modifications or need for additional designated ocean or airspace. The proposed operations would not require either: (1) a change to an existing or planned IFR minimum flight altitude, a published or special instrument procedure, or an IFR departure procedure; or (2) a VFR operation to change from a regular flight course or altitude. As such, the increased training operations do not conflict with any airspace use plans, policies, and controls. Operations involving steaming days would increase by approximately 10 percent (1,050) above those proposed for the No Action Alternative if this alternative were implemented, the fixed wing sorties would increase by approximately eight percent (1,773) above those proposed for the No Action Alternative, and the helicopter sorties are anticipated to increase by approximately 71 percent (1,258) above those proposed for the No Action Alternative.

The proposed increase in training operations, force structure changes, and enhanced range capabilities related to sea, ocean, and land space (as detailed in Chapter 2) do not impact use of the JAX Range Complex in areas analyzed in this FEIS/OEIS. The potential impacts to transportation assets associated with Alternative 2 would otherwise be similar to those described for Alternative 1.

Land transportation activities are minimal and are not anticipated to increase or change at either Lake George Range or Rodman Range. The proposed activities associated with Alternative 2 are the same as those proposed for Alternative 1; therefore, proposed activities associated with Alternative 2 would have no effect on transportation resources at Lake George and Rodman Ranges. Implementation of Alternative 2 would have no impact on transportation resources in U.S. territory. Further, implementation of Alternative 2 would not cause harm to transportation resources in non-territorial waters.

3.14.4 Unavoidable Significant Environmental Effects

Based on the preceding analysis, there are no unavoidable significant environmental impacts as a result of implementation of the No Action Alternative, Alternative 1, or Alternative 2.

3.14.5 Summary of Environmental Effects (NEPA and EO 12114)

As summarized in Table 3.14-2, the environmental effects of the No Action Alternative, Alternative 1, and Alternative 2 on transportation would have no impact. Implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in significant impacts to transportation in territorial waters. Implementation of the No Action Alternative, Alternative 1 or Alternative 2 would not result in significant harm to transportation in the global commons.

TABLE 3.14-2
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON TRANSPORTATION IN THE JAX RANGE COMPLEX

Alternative and Stressor	NEPA (U.S. Territory)	EO 12114 (Non-Territorial Waters, >12 nm)
No Action		
Vessel Movements (Disturbance)	Military, commercial, and general transportation activities have established an operational co-existence consistent with federal, state, and local plans and policies and remain compatible. Activities under the No Action Alternative include activities that are and have been routinely conducted in the area for decades.	Military, commercial, and general transportation activities have established an operational co-existence consistent with federal, state, and local plans and policies and remain compatible. Activities under the No Action Alternative include activities that are and have been routinely conducted in the area for decades.
Aircraft Overflights (Disturbance)		
MEM		
Conclusion	Implementation of the No Action Alternative would have no impact on transportation resources in U.S. territory.	Implementation of the No Action Alternative would not cause harm to transportation resources in non-territorial waters.
Alternative 1		
Vessel Movements (Disturbance)	The Navy can accomplish the proposed activities associated with Alternative 1 without transportation system modifications or need for additional designated ocean, airspace, or land. The increased training operations do not conflict with any public transportation use plans, policies, and controls.	The Navy can accomplish the proposed activities associated with Alternative 1 without transportation system modifications or need for additional designated ocean or airspace. The increased training operations do not conflict with any public transportation use plans, policies, and controls.
Aircraft Overflights (Disturbance)		
MEM		
Conclusion	Implementation Alternative 1 would have no impact on transportation resources in U.S. territory.	Implementation of Alternative 1 would not cause harm to transportation resources in non-territorial waters.
Alternative 2		
Vessel Movements (Disturbance)	The Navy can accomplish the proposed activities associated with Alternative 1 without transportation system modifications or need for additional designated ocean, airspace, or land. The increased training operations do not conflict with any public transportation use plans, policies, and controls.	The Navy can accomplish the proposed activities associated with Alternative 2 without transportation system modifications or need for additional designated ocean or airspace. The increased training operations do not conflict with any public transportation use plans, policies, and controls.
Aircraft Overflights (Disturbance)		
MEM		
Conclusion	Implementation Alternative 2 would have no impact on transportation resources in U.S. territory.	Implementation of Alternative 2 would not cause harm to transportation resources in non-territorial waters.

3.15 DEMOGRAPHICS

3.15.1 Introduction and Methods

Demographic statistics are assessed through identification and evaluation of socioeconomic factors such as population characteristics, which may include population growth, distribution, age, education, and race and ethnicity; household characteristics, which may include size, special needs, type, and vacancy; and employment rates and trends. The Study Area for demographics includes the coastal counties of the States of North Carolina, South Carolina, Georgia, and Florida; as well as the Florida inland county of Marion. Marion County is included in the Study Area due to the location of George and Rodman Ranges.

3.15.1.1 Assessment Methods and Data Used

This section was prepared primarily by compiling and evaluating existing information supplied by the U.S. Census Bureau (USCB) and state and local governmental agencies and local organizations as indicated with reference citations; full reference information is provided in References, Chapter 7.

3.15.1.2 Warfare Areas and Associated Environmental Stressors

Impacts to demographics are assessed in terms of their direct effects on the local economy and related effects on other socioeconomic resources (for example, housing). The level of importance of these impacts can vary depending on the location of the proposed action. If potential stressors would result in substantial shifts in population trends, or adversely affect regional spending and earning patterns, they would be indicative of impact.

Aspects of the proposed action likely to act as stressors to demographics were identified by conducting a detailed analysis of the warfare areas, operations, and specific activities included in the alternatives. Due to the lack of any component within any of the alternatives that requires home basing of permanent personnel or a reduction of permanent personnel in the Study Area, there were no potential stressors to demographics identified.

3.15.2 Affected Environment

Population Characteristics

During the period from April 1, 2000 to July 1, 2006 the population of North Carolina increased by 10.1 percent, South Carolina increased by 7.7 percent, Georgia increased 14.4 percent, and Florida increased 13.2 percent, while the population of the United States experienced a 6.5 percent increase (USCB, 2007). In the United States there were 355,866 Navy and Marine Corps personnel in activity duty military installations in 2002 (the latest year reported by the USCB). North Carolina reported 43,522, South Carolina had 18,279, Georgia reported 4,814, and Florida had 27,570. Civilian personnel, affiliated with the Navy and Marine Corps, on military installations in 2002 included 177,695 in the United States. There were 7,281 civilian personnel on military installations in North Carolina, 3,625 in South Carolina, 3,883 in Georgia, and 1,266 in Florida (USCB, 2003).

Age Structure

The latest year for which data are available is 2005. During that period, 7 percent of North Carolina's population was under the age of five, 24.7 percent were under the age of 18, and 12.1 percent were over the age of 65. South Carolina had 6.6 percent of the population under the age of

five, 24.1 percent were under the age of 18, and 12.6 percent were over the age of 65. Georgia had 7.6 percent of the population under the age of five, 26 percent under the age of 18, and 9.6 percent over the age of 65. Florida had 6.3 percent of the population under the age of five, 22.9 percent under the age of 18, and 16.8 percent over the age of 65. These percentages are consistent with the age distribution of the United States as a whole: 6.8 percent, 24.8 percent, and 12.4 percent, respectively (USCB, 2007).

Race and Ethnicity

Table 3.15-1 depicts a comparison of the race and ethnicity percentages of the States of North Carolina, South Carolina, Georgia, and Florida compared to the United States. Percentages exceed 100 due to individuals reporting race and ethnicity in multiple categories (*i.e.*, reporting in both "white" and "white, not Hispanic").

TABLE 3.15-1
RACE AND ETHNICITY COMPARISON

Race/Ethnicity	North Carolina Percentage	South Carolina Percentage	Georgia Percentage	Florida Percentage	United States Percentage
White	74.1	68.4	66.1	80.4	80.2
Black	21.8	29.2	29.8	15.7	12.8
American Indian & Alaska Native	1.3	0.4	0.3	0.4	1.0
Asian	1.8	1.1	2.7	2.1	4.3
Native Hawaiian & Other Pacific Islander	0.1	0.1	0.1	0.1	0.2
Person Reporting Two Or More Races	1.0	0.8	1.0	1.2	1.5
Hispanic or Latino Origin	6.4	3.3	7.1	19.5	14.4
White, Not Hispanic	68.3	65.5	59.6	62.1	66.9

Note: All numbers are percentages from 2005
Source: USCB, 2007

Poverty Level

A comparison of the poverty level in the United States as a whole and the States of North Carolina, South Carolina, Georgia, and Florida is provided in Table 3.15-2.

TABLE 3.15-2
POVERTY LEVEL COMPARISON

North Carolina	South Carolina Percentage	Georgia Percentage	Florida Percentage	United States Percentage
13.8	15.0	13.7	11.9	12.7

Note: All numbers are percentages from 2004
Source: USCB, 2007

Education

In the year 2000, the percentage of North Carolina households that spoke a language other than English was eight percent, South Carolina households that spoke a primary language other than English was 5.2 percent, Georgia was 9.9 percent, and Florida was 23.1 percent. The percentage of homes in the United States that speak a language other than English as the primary household language was 17.9 percent.

In North Carolina, 78.1 percent of the population graduated from high school and 22.5 percent of the population achieved a Bachelor's degree or higher. In South Carolina, 76.3 percent of the population graduated from high school and 20.4 percent of the population achieved a Bachelor's degree or higher. In Georgia, 78.6 percent of the population graduated from high school and 24.3 percent of the population achieved a Bachelor's degree or higher. In Florida, 79.9 percent of the population graduated from high school and 22.3 percent of the population achieved a Bachelor's degree or higher. Comparatively, in the United States, 80.4 percent of the population graduated from high school and 24.4 percent of the population achieved a Bachelor's degree or higher.

3.15.3 Environmental Consequences:

Impacts to demographics are assessed in terms of their direct impacts on the local economy and related impacts on population and expenditure within the Study Area. Demographic impacts would be considered important if the alternative chosen for implementation resulted in a substantial shift in population trends, spending and earning patterns, or community resources (notably housing and education).

3.15.3.1 No Action Alternative

Implementation of the No Action Alternative would not result in a change in the demographics within the Study Area of the coastal counties of the States of North Carolina, South Carolina, Georgia, and Florida; and the Florida inland county of Marion. Under the No Action Alternative training operations and major range event would continue at current levels as depicted in Table 2.2-2. Under this alternative, the JAX Range Complex would not accommodate an increase in training operations due to proposed force structure changes, and it would not implement enhancements identified in the Range Complex Management Plan. Therefore, if the No Action Alternative were selected for implementation, there would not be any impacts to demographics.

3.15.3.2 Alternative 1

The Alternative 1 proposed action includes increases and modification to operational training, expansion of warfare missions, and accommodation of force structure changes. The Alternative 1 proposed change is depicted in Tables 2.2-3 and 2.2-4. Force structure changes (new platforms) to be implemented would include the introduction of the MH-60R and MH-60S Seahawk Multi-Mission Helicopter. Force structure changes, mine countermeasures, associated with new weapons systems would also include limited capability to support new weapon systems. Alternative 1 would not require the basing or relocation of additional personnel within the Study Area. Therefore, implementation of Alternative 1 would not result in impacts to demographics.

3.15.3.3 Alternative 2 (Preferred Alternative)

If Alternative 2 were chosen for implementation, the elements of the No Action Alternative, Alternative 1, and designation of mine warfare training areas in the JAX and Charleston OPAREAs would be implemented. There would be no impacts on demographics within the Study Area as there

are no proposed increases or movement of personnel as a result of the proposed action; therefore, there would be no impacts to demographics.

3.15.4 Unavoidable Significant Environmental Effects

Based on the preceding analysis, there are no unavoidable significant environmental impacts as a result of implementation of the No Action Alternative, Alternative 1, or Alternative 2.

3.15.5 Summary of Environmental Effects (NEPA and EO 12114)

Table 3.15-3 summarizes the fact that there are no aspects of the proposed action likely to act as stressors to demographics; thus, there are no NEPA impacts on demographics. Proposed actions would have no impact on demographics in U.S. territory. Non-territorial waters are outside the Study Area for demographics; therefore, there are no EO 12114 impacts on demographics.

TABLE 3.15-3
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON DEMOGRAPHICS IN THE JAX RANGE COMPLEX

Alternative and Stressor	NEPA (U.S. Territory)	EO 12114 (Non-Territorial Waters, >12 nm)
No Action Alternative		
No Stressors Identified	The No Action Alternative would not require the basing or relocation of additional personnel within the Study Area.	Non-territorial waters are outside the Study Area for demographics; therefore, there are no EO 12114 impacts on demographics.
Conclusion	Implementation of the No Action Alternative would have no impact on demographics in U.S. territory.	Non-territorial waters are outside the Study Area for demographics; therefore, there are no EO 12114 impacts on demographics.
Alternative 1		
No Stressors Identified	Alternative 1 would not require the basing or relocation of additional personnel within the Study Area.	Non-territorial waters are outside the Study Area for demographics; therefore, there are no EO 12114 impacts on demographics.
Conclusion	Implementation of Alternative 1 would have no impact on demographics in U.S. territory.	Non-territorial waters are outside the Study Area for demographics; therefore, there are no EO 12114 impacts on demographics.
Alternative 2		
No Stressors Identified	Alternative 2 would not require the basing or relocation of additional personnel within the Study Area.	Non-territorial waters are outside the Study Area for demographics; therefore, there are no EO 12114 impacts on demographics.
Conclusion	Implementation of Alternative 2 would have no impact on demographics in U.S. territory.	Non-territorial waters are outside the Study Area for demographics; therefore, there are no EO 12114 impacts on demographics.

3.16 REGIONAL ECONOMY

3.16.1 Introduction and Methods

Regional economy is assessed through evaluation of economic factors including industry, commercial fishing, tourism, and recreational fishing. The Study Area for assessment of the regional economy includes the States of North and South Carolina, Georgia, and Florida.

3.16.1.1 Assessment Methods and Data Used

This section was prepared primarily by compiling and evaluating existing information supplied by the USCB, NOAA, NMFS, state and local governmental agencies, and local organizations as shown in the references section (Chapter 7). Data were collected on commercial fisheries landings, types of fishing gear used, and fishing effort. NMFS collects data regarding national fisheries, target species, landed tonnage, and gear types by state. It is important to note that the state boundaries and borders of the JAX and Charleston OPAREAs are not congruent and as a result, some state information is not relevant to the discussion of the individual OPAREAs.

3.16.1.2 Warfare Areas and Associated Environmental Stressors

Impacts to the regional economy are assessed in terms of their direct effects on the local economy and related effects on other socioeconomic resources (for example, earning and income). If potential impacts would result in substantial shifts in earning or spending trends, or adversely affect regional spending and earning patterns, they would be important. Potential impacts might be experienced if commercial or recreational activities were denied access to areas where they previously had occurred.

Stressors to the regional economy would include changes in the intensity or duration of training activities that directly affect the abilities of recreational or commercial fishers to harvest in areas where they have traditionally done so. Table 3.16-1 depicts aspects of the proposed action that are likely to act as stressors to the regional economy. These stressors were identified by conducting a detailed analysis of the warfare areas, operations, and specific activities included in the Alternatives.

3.16.2 Affected Environment

3.16.2.1 Industry

The 2002 U.S. Census indicates that the greatest number of establishments in the United States was in the retail trade industry. The States of North Carolina, South Carolina, Georgia, and Florida reflected that trend with the retail trade industry leading the states with the greatest number of establishments (35,851, 18,416, 34,050, and 69,543 respectively) (USCB, 2002). Information services contained the least amount of establishments for all the states with 3,150, 1,221, 4,081, and 7,758 respectively.

The commercial fishing industry is included in the category of "other services (except public administration)." The fishing industry, which is most likely to be affected by the alternatives analyzed in this FEIS/OEIS, is not the most lucrative industry in the Study Area. Of the top ten industries for all states in the Study Area, "Other Services" (of which commercial fishing is a sub-section) consistently placed fifth in the top ten industries with 13,826 in North Carolina, 6,979 in South Carolina, 13,137 in Georgia, and 28,053 in Florida (USCB, 2007).

TABLE 3.16-1
SUMMARY OF POTENTIAL STRESSORS TO REGIONAL ECONOMY RESOURCES

Warfare Area and Operation	Training Areas	Vessel Movements (Disturbance)	Aircraft Overflights (Disturbance)	Military Expended Material
Mine Warfare (MIW)				
Mine Laying	Lake George Range	✓	✓	✓
MCM	Carrier Operating Areas	✓	✓	✓
Mine Neutralization	Charleston OPAREA (North and South UNDET Boxes)	✓	✓	✓
Surface Warfare (SUW)				
MISSILEX (A-S)	W-157A (Area 4X) and W-159A (Area 5X)	✓	✓	✓
GUNEX (A-S)	W-132, W-133, W-134, W-157, W-158	✓	✓	✓
GUNEX (S-S) Boat	Charleston OPAREA (Areas 11J)	✓	✓	✓
GUNEX (s-S) Ship	JAX OPAREA (AA, BB, and CC)	✓	✓	✓
BOMBEX (A-S) (at sea)	HE, W-158 (31J); NEPM, W157A/B and W-158 A/B	✓	✓	✓
Laser Targeting	W-132, W-133, W-134, W-157, W-158	✓	✓	
GUNEX (S-S) (FAC/FIAC)	Amber Strait: Charleston OPAREA (Boxes Q-9&10, R-9&10)	✓		
VBSS/MIO-Ship	JAX and Charleston OPAREAs	✓		
VBSS/MIO-Helicopter	W-157A (Area 4X) and W-159A (Area 5X)		✓	
Air Warfare (AW)				
ACM	W-157A (Areas 3X & 4X)		✓	
Air Intercept Control	JAX and Charleston OPAREAs		✓	
ACM Chaff Exercise	W-157A (Areas 3X & 4X)		✓	✓
ACM Flare Exercise	W-157A (Areas 3X & 4X)		✓	✓

TABLE 3.16-1 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO REGIONAL ECONOMY RESOURCES

Warfare Area and Operation	Training Areas	Vessel Movements (Disturbance)	Aircraft Overflights (Disturbance)	Military Expended Material
MISSILEX (A-A)	W-132, W-133, W-134, W-157, W-158	✓	✓	✓
MISSILEX (S-A)	JAX and Charleston OPAREAs			✓
Detect-to-Engage	W-132, W-133, W-134, W-157, W-158		✓	
GUNEX (S-A)	JAX OPAREA (AA, BB, and CC)	✓	✓	✓
GUNEX (A-A)	W-157A/W-133 (Area 2X)			✓
Amphibious Warfare (AMW)				
FIREX (S-S) with IMPASS	JAX OPAREA (BB and CC)	✓	✓	✓
Strike Warfare (STW)				
BOMBEX (A-G)	Rodman Range		✓	✓
CSAR and Convoy Operations	Rodman Range		✓	✓
Electronic Combat (EC)				
EC Operations - Aircraft	W-132, W-133, W-134, W-157, W-158		✓	
EC Operations - Surface Ships	JAX and Charleston OPAREAs		✓	
Chaff Exercise	JAX and Charleston OPAREAs		✓	✓
Flare Exercise- Helicopter	Lake George Range		✓	✓
Other Training				
SESEF Utilization	5-15 nm east of Mayport	✓		
Precision Anchoring	NS Mayport	✓		
Small Arms with anti-swimmer grenades (MK3A2)	Charleston OPAREA (Area 10L, 12I)	✓		✓

The United States cruise industry has experienced steady growth in numbers of passengers with an average, annual growth from 1980-2004 of 8.2 percent (CLIA, 2005). The cruise industry contributed $35.7 billion to the United States economy in 2006. The total income realized from the

cruise industry in 2006 included purchases of goods and services (air transportation, food and beverage, ship maintenance and refurbishment) and cruise line and port operations. North Carolina realized a total income of $108 million, South Carolina gained $46 million, Georgia gained $422 million, and Florida gained $5.023 billion[50] (CLIA, 2006).

3.16.2.2 Commercial Fishing

Both the Mid-Atlantic Fishery Management Council and the South Atlantic Fishery Management Council manage fisheries in federal waters off the coast of North Carolina. Fishery Management Plans (FMP) are in effect for several fisheries and regulate both commercial and recreational fishing. The objectives of the plans vary, but are generally geared toward ensuring the long-term sustainability of the subject fish species and meeting specific management goals. Fishery Management Plans generally utilize geographic and seasonal fishery closures, catch limits and quotas, size and age limits, gear restrictions, and access controls to manage the fishery resources. The Mid-Atlantic Fishery Management Council has developed six FMPs to promote the long-term health and stability of the managed fisheries (MAFMC, 2007). These Fishery Management Plans address the following species:

- Atlantic mackerel, squid, and butterfish
- Bluefish
- Dogfish
- Atlantic surf clam and ocean quahog
- Summer flounder, scup, and black sea bass
- Tilefish

The South Atlantic Fishery Management Council is responsible for the conservation and management of fish stocks within the federal 200 mile limit of the coast of North Carolina, South Carolina, Georgia, and Florida. Fishery Management Plans developed by the South Atlantic Fishery Management Council (SAFMC, 2007) address the following species for all states in the JAX EIS/OEIS Study Area:

- South Atlantic Snapper/Grouper
- Coastal Migratory Pelagics (Mackerel)
- Shrimp Fishery
- Spiny Lobster
- Golden Crab
- Coral, coral reefs, and live/hard bottom habitat
- *Sargassum*
- Dolphin/Wahoo
- Habitat for all species

Additional Fishery Management Plans are in place for certain highly migratory species and are applicable in federal waters off the North Carolina, South Carolina, Georgia, and Florida coasts (NMFS, 2007d):

[50] Florida accounts for 56 percent of all United States embarkations. The port of Jacksonville accounts for less than three percent of the Florida total with the majority of cruises embarking out of Miami, Port Canaveral, Port Everglades, and Tampa.

- Atlantic Swordfish
- Atlantic Sharks
- Atlantic Tuna
- Atlantic Billfish

In 1998 NMFS estimated that 569 commercial fishing vessels operated out of South Carolina ports with five processing plants, and 28 wholesale operations employing 194 workers (Ehler and Leeworthy, 2002). Georgia ports had an estimated 350 commercial fishing vessels operating with eight processing plants, and 66 wholesale operations, employing 1,259 and 586 workers, respectively (Ehler and Leeworthy, 2002). Florida had an estimated 2,384 commercial fishing vessels operating out of Florida ports with 108 processing plants and 374 wholesale operations employing 3,142 and 2,984 workers, respectively (Ehler and Leeworthy, 2002).

3.16.2.3 State Commercial Landings

The NMFS incorporates commercial landing data into the NMFS Statistics and Economics Division databases through data collected by comprehensive surveys of all coastal states landings through a system of cooperative state and federal collection systems. The data include landing weighout reports, state-mandated fishery or mollusk trip-tickets from seafood dealers, shipboard and portside interviews, federal logbooks of fishery catch and effort, and biological sampling of catches (NMFS, 2007d). The Fisheries Statistics Division collects data and coordinates data collection efforts with state and federal agencies. Data are collected through a multi-survey method that includes telephone surveys of households and for-hire boat operators, shore fishers, and state and federal data collection programs. Collected statistics are then integrated and disseminated through databases that are made available to other agencies and the public. Landing data do not indicate location of harvest, as species may be taken offshore of another state but reported in the state in which the fishermen landed.

North Carolina

Over the five-year period ending in 2005, North Carolina commercial landings ranged between a high of 160,276,917 lbs in 2002 and a low of 79,152,597 lbs in 2005 (Table 3.16-2). The five year average was 130,635,166 lbs. Over the same period the ten non-shellfish species that generated the most poundage of harvest were approximately 60 percent of the total annual landings. Landings of these species averaged about 77,028,836 lbs annually. Shellfish comprised almost 32 percent of the total 130,635,166 annual average of North Carolina East Coast commercial landings, with an average 42,407,685 annual lbs during the period 2001-2005.

TABLE 3.16-2
NORTH CAROLINA COMMERCIAL LANDINGS (2001-2005), ALL SPECIES

YEAR	POUNDS	DOLLARS
2001	137,893,280	85,971,487
2002	160,276,917	92,260,783
2003	139,401,486	84,925,717
2004	136,451,548	77,138,498
2005	79,152,597	59,823,025
TOTAL	653,175,828	400,119,510

NOTES: Numbers may not total exactly due to rounding.

Source: NMFS, 2007e.

The North Carolina annual commercial harvest experienced large fluctuations that resulted in a definite decrease in production and revenue from 2001-2005. The 2001 harvest was 137,893,280 lbs, which decreased to 79,152,597 lbs by 2005. Likewise, revenues dropped from $85,971,487 in 2001 to $59,823,025 in 2005. Due to large annual fluctuations in the harvest, the five year average was 130,635,166 lbs while the five year average revenue was $80,023,902.

During the five year period, the top ten commercial species experienced highs of 50,753,782 lbs in 2003 and a low harvest of 30,202,784 in 2005. Revenues experienced extreme fluctuations as well with a high revenue of $25,978,411 in 2002 and a low annual revenue of $18,330,120 in 2005. Shellfish harvests during 2001-2005 experienced large fluctuations as well with a high harvest of 50,753,782 lbs during 2003 and a low of 30,202,784 lbs in 2005. Revenues followed the trend with a high of $57,478,501 in 2002 and a low of $28,422,869 in 2005 (NMFS, 2007b).

The major ports that report commercial fishery landings for the State of North Carolina include Beaufort-Morehead City, Elizabeth City, Oriental-Vandemere, Sneads Ferry-Swansboro, and Wanchese-Stumpy Point. In 2006 Beaufort-Morehead City reported 6.7 million lbs of commercial harvest with revenue of $10.9 million. The 2001 harvest was 67.5 million lbs with revenue of $17.9 millions. The last year Elizabeth City had a reportable commercial harvest was 1996, and the harvest was 6.5 million lbs with revenue of $5.4 million. Oriental-Vandemere had a 2006 commercial harvest of 4.3 million lbs and revenue of $5.5 million; in 2001 it was 4.9 million lbs with revenue of $6.9 million. Sneads Ferry-Swansboro reported 2.6 million lbs in 2006 and revenue of $5.5 million. In 2001 the harvest was 2.8 million lbs with revenue of $5.6 million. The first reportable commercial harvest for Sneads-Ferry was in the year 2000 and there was not sufficient commercial harvest to report in the years 2004 or 2005. Wanchese-Stumpy Point reported 26.5 million lbs and revenue of $21.7 million in 2006 and 31.9 million lbs and $26.1 million revenue in 2001 (NMFS, 2007a).

North Carolina fish harvest in the 0-3 miles zone from shore in 2006 was 12,375,000 lbs ($10,487,000) and the shellfish harvest was 31,851,000 lbs ($35,766,000). The 3-200 miles zone from shore fish harvest was 23,201,000 lbs ($24,164,000) and the shellfish harvest was 1,214,000 lbs ($1,468,000). Neither fish nor shellfish had a reportable harvest on the High Seas (the ocean space beyond 200 miles from shore).

South Carolina

The annual commercial landings and associated revenues in South Carolina have been subject to a steady, slow decline since the 14,272,651 lbs ($23,907,674) produced in 2001 to the low of 10,458,468 lbs ($16,236,649) in 2005 (Table 3.16-3). The resultant average over the five year period was 12,891,494 lbs and $20,253,500. The decline in poundage of harvest and revenue from 2001 to 2005 is reflected in the annual harvests for both the top ten commercial species landings and the shellfish harvest. Price per pound fluctuations remained consistent.

The major ports that reported commercial fishery landings for the State of South Carolina were Charleston-Mt. Pleasant and Georgetown. In 2006 Charleston-Mt. Pleasant reported a harvest of 2.7 million ($4.7 million). Georgetown, South Carolina reported a high commercial harvest of 4.0 million in 1995 and 2003 for revenue of $6 million each of those years. The low harvest was in 1998 with a reported 2.9 million lbs that resulted in $5.3 million (NMFS, 2007b).

TABLE 3.16-3
SOUTH CAROLINA COMMERCIAL LANDINGS (2001-2005), ALL SPECIES

YEAR	POUNDS	DOLLARS
2001	14,272,651	23,907,674
2002	13,559,224	21,339,718
2003	13,728,356	21,241,571
2004	12,438,628	18,541,887
2005	10,458,609	16,236,649
TOTAL	64,457,468	101,267,499

NOTES: Numbers may not total exactly due to rounding.
Source: NMFS, 2007e.

South Carolina fish harvest in the 0-3 miles zone from shore in 2006 was 450,000 lbs ($374,000) and the shellfish harvest was 8,237,000 lbs ($14,658,000). The 3-200 miles zone from shore fish harvest was 2,323,000 lbs ($4,742,000) and the shellfish harvest was 102,000 lbs ($4,313,000). Neither fish nor shellfish had a reportable harvest on the High Seas (the ocean space beyond 200 miles from shore).

Georgia

Georgia commercial harvests and associated revenues have maintained consistent harvests during the period 2001-2005. The high harvest of 9,697,064 lbs ($13,464,627) experienced in 2005 is close to the low experienced in 2002 of 9,106,187 ($14,549,082) (Table 3.16-4). The resultant five year average is 9,421,323 lbs ($14,247,513). Shellfish harvest remained fairly consistent with highs of $14,212,446 in 2001 and a low of $12,735,866 in 2005.

TABLE 3.16-4
GEORGIA COMMERCIAL LANDINGS (2001-2005), ALL SPECIES

YEAR	POUNDS	DOLLARS
2001	9,207,725	15,164,445
2002	9,106,187	14,549,082
2003	9,436,937	13,685,304
2004	9,658,703	14,374,108
2005	9,697,064	13,464,627
TOTAL	47,106,616	71,237,566

NOTES: Numbers may not total exactly due to rounding.
Source: NMFS, 2007e.

The major ports that reported commercial fishery landings for the State of Georgia include Brunswick, Darien-Bellville, and Savannah. Brunswick's only reportable harvest was in 2000, with 1.9 million lbs ($5.1 million). Darien-Bellville reported a high harvest of 7.1 million lbs ($7.9 million) in 1982 and a low of 3.3 million lbs ($5 million) in 2004. Savannah's last reportable commercial harvest was in 1998 with 2.5 million lbs ($5 million) (NMFS, 2007b).

Georgia's fish harvest in the 0-3 miles zone from shore in 2006 was 102,000 lbs ($148,000) and the shellfish harvest was 4,993,000 lbs ($5,503,000). The 3-200 miles zone from shore fish harvest was 158,000 lbs ($382,000) and the shellfish harvest was 2,494,000 lbs ($4,765,000). Neither fish nor shellfish had a reportable harvest on the High Seas (the ocean space beyond 200 miles from shore).

Florida

Florida commercial harvests and associated revenues have experienced a gradual, but definite decline during the period 2001-2005, with the exception of a significant, but singular jump of both harvest and revenue during 2004. The result is an annual average harvest of all species of approximately 24,853,615 lbs and $37,184,234 (Table 3.16-5).

TABLE 3.16-5
FLORIDA (EAST COAST) COMMERCIAL LANDINGS (2001-2005), ALL SPECIES

YEAR	POUNDS	DOLLARS
2001	27,343,703	42,866,092
2002	21,672,676	34,374,689
2003	23,432,068	33,111,351
2004	28,706,868	39,978,293
2005	23,113,058	35,590,747
TOTAL	124,268,373	185,921,172

NOTES: Numbers may not total exactly due to rounding.

Source: NMFS, 2007e.

Conversely, the annual commercial landings of the top 10 producing species remained consistent during the period 2001-2005. However, the shellfish harvest during this period fluctuated widely from year to year. This trend was further seen in the price per pound changes annually. The top ten non-shellfish prices remained relatively consistent whereas the shellfish harvest experienced some extreme changes such as the Quahog Clam high of $9.03 per pound in 2004 and the five year low of $2.67 per pound in 2005 (NMFS, 2007b).

The only fishing port on the East Coast of Florida to report commercial harvest was Mayport. In 2004 Mayport reported a high harvest of 7.2 million lbs ($7.9 million). Mayport's lowest reported commercial harvest was in 1998 with 3.5 million lbs ($7.3 million) (NMFS, 2007a). Florida East Coast fish harvest in the 0-3 miles zone from shore in 2006 was 5,295,000 lbs ($5,224,000) and the shellfish harvest was 6,381,000 lbs ($12,244,000). The 3-200 miles zone from shore fish harvest was 8,252,000 lbs ($12,523,000) and the shellfish harvest was 6,415,000 lbs ($13,116,000). Neither fish nor shellfish had a reportable harvest on the High Seas (the ocean space beyond 200 miles from shore).

3.16.2.4 Fishing Gear

North Carolina

The principal gear used to harvest the fish and shellfish landed on the North Carolina coast are pots and traps, otter trawl, and gill nets. Between 2001 and 2005, almost 37 percent of the commercial harvest landed in the state was captured using pots and traps, while otter trawl and gill nets were used to capture 26 and 12 percent, respectively (Table 3.16-6).

TABLE 3.16-6
2001-2005 AVERAGE ANNUAL
COMMERCIAL LANDINGS BY GEAR TYPE – NORTH CAROLINA

GEAR TYPE	REVENUE	PERCENT OF TOTAL
Pots & Traps	$29,370,184	37
Otter Trawl	20,817,604	26
Gill Nets	9,359,565	12
Hand Lines	3,620,112	5
Seines	3,262,239	4
Troll Lines	2,398,540	4
By Hand	1,875,530	3
Pound Nets	1,741,803	3
Rakes	1,517,657	2
Dredge	1,489,505	2
Tongs & Grabs	497,397	1
Bag Nets	352,149	1
Spears	146,225	1
Other Gear Types	788,931	1
Total All Gear	80,023,938	100

NOTES: Numbers may not total exactly due to rounding.
Source: NMFS, 2007c.

South Carolina

The principal gear used to harvest the fish and shellfish landed on the South Carolina coast are otter trawl, pots and traps; harvesting is also done by hand. Between 2001 and 2005, almost 39 percent of the commercial harvest landed in the state was captured using otter trawl, while pots and traps and manual methods were used to capture 24 and 9 percent, respectively (Table 3.16-7).

TABLE 3.16-7
2001-2005 AVERAGE ANNUAL
COMMERCIAL LANDINGS BY GEAR TYPE – SOUTH CAROLINA

GEAR TYPE	REVENUE	PERCENT OF TOTAL
Otter Trawl	$7,845,354	39
Pots & Traps	4,725,739	24
By Hand	1,750,697	9
Long Lines	1,214,874	6
Hand Lines	358,246	2
Rakes	305,632	2
Gill Nets	274,957	2
Dredge	185,076	1
Tongs & Grabs	112,918	1
Bag Nets	111,801	1
Other Gear Types	3,368,206	17
Total All Gear	20,253,500	100

NOTES: Numbers may not total exactly due to rounding.
Source: NMFS, 2007c.

Georgia

The principal gear used to harvest the fish and shellfish landed on the Georgia coast is otter trawl. Between 2001 and 2005, almost 74 percent of the commercial harvest landed in the state was captured using otter trawl. Pots and traps were used to capture 18 percent of the harvest (Table 3.16-8).

TABLE 3.16-8
2001-2005 AVERAGE ANNUAL
COMMERCIAL LANDINGS BY GEAR TYPE - GEORGIA

GEAR TYPE	REVENUE	PERCENT OF TOTAL
Otter Trawl	$10,416,494	74
Pots & Traps	2,538,719	18
Hand Lines	557,773	4
By Hand	307,580	3
Electric or Hydraulic Reel	170,999	2
Cast Nets	47,966	1
Gill Nets	30,757	1
Other Gear Types	177,225	2
Total All Gear	14,247,513	100

NOTES: Numbers may not total exactly due to rounding.

Source: NMFS, 2007c.

Florida

The principal gear used to harvest the fish and shellfish landed on the Florida east coast are otter trawl, pots and traps, and long lines. Between 2001 and 2005, almost 38 percent of the commercial harvest landed in the state was captured using otter trawl, while pots and traps and long lines were used to capture 15 and 10 percent, respectively (Table 3.16-9).

TABLE 3.16-9
2001-2005 AVERAGE ANNUAL
COMMERCIAL LANDINGS BY GEAR TYPE – FLORIDA (EAST COAST)

GEAR TYPE	REVENUE	PERCENT OF TOTAL
Otter Trawl	$13,880,737	38
Pots & Traps	5,440,715	15
Hand Lines	4,832,329	13
Long Lines	3,429,005	10
Cast Nets	2,312,074	7
Gill Nets	803,072	3
Other Gear Types	6,476,303	18
Total All Gear	37,184,235	100

NOTES: Numbers may not total exactly due to rounding.

Source: NMFS, 2007c.

3.16.2.5 Tourism

North Carolina

In 2005, 45 million visitors to North Carolina contributed $15 billion to the state economy (North Carolina Department of Commerce, 2007). Tourism is more important to Dare County than to any other county in North Carolina, with half of all jobs in the county directly dependent on tourist spending. Half of all lodging sales occur in this area in the months of June, July, and August (Palmquist, *et al*., 2002). Only 5 percent of domestic visitors to the coastal regions of the State polled in a visitor profile survey cited boating or sailing as the reason for their visit, but nearly 10 percent visited to hunt or fish. North Carolina ranks 11th nationwide for registered recreational boats (USCG, 2005). Spring and summer months accounted for the highest rate of visitation to this area, with 61 percent of coastal visits occurring during this time (North Carolina Division of Tourism, Film and Sports Development, 2005).

South Carolina

Travelers to South Carolina number 32 million annually, with 15 million of these visitors traveling to coastal areas of the state (South Carolina Department of Parks, Recreation, and Tourism, 2007). Tourists spent $16 billion in 2005, supporting 118,000 jobs (TIA, 2007). Between two and 8 percent of visitors participated in water sports or boating while on travel in the state, with 35 percent of these travelers visiting in June, July, or August (South Carolina Department of Parks, Recreation, and Tourism, 2007).

South Carolina ranks 8th in the nation for the number of recreational boats registered in the state (USCG, 2005). Recreational boats range throughout the South Carolina coastal waters, depending on season and weather conditions. In a statewide survey, over one-third of respondents claimed to participate in motorboating during the year. Saltwater fishing, jetskiing, waterskiing, shellfishing/shrimping, bird watching, and sailing were other nearshore and offshore activities performed by residents (USCG, 2003).

Travel between the most popular cruising destinations along the South Carolina coast does not require traversing Navy OPAREAs. However, larger recreational vessels, in particular sailboats and motor cruisers in the 50-foot and larger class, do travel considerable distances offshore. Diving sites off the South Carolina coast include shipwrecks, artificial, and natural reefs. Angel's Ledge live-bottom reef ranges in depth from 40 to 100 feet. Popular shipwreck and submerged artificial reefs can be found in various depth levels from 60 to over 100 feet of water, both close to shore (*i.e*., The Sherman 6 miles offshore), and at farther distances (*i.e*., The City of Houston at 55 miles offshore) (Coastal Scuba, 2007).

Georgia

Tourism in Georgia supported 217,000 jobs in 2005 and sustained an economic impact to the state of $28.2 billion (GA, 2006). In 2006 Georgia hosted 61.7 million domestic visitors (a 1% decrease from 2005) (GA, 2007a); 49 percent of those visitors were Georgia residents and 20 percent were from Florida (GA, 2007b). The coastal area had 13 percent of the visitors to the State and the greatest number traveled during the third quarter of the year. The largest proportion of visitors in the State went to the mountains and historic south areas (GA, 2007b). In the 2007 Tourism Year in Review report, the State of Georgia reported that the coastal area had generated $557 million in 2007. Georgia ranks 14th in the nation for the number of recreational boats registered in the state (USCG, 2005). Georgia is ranked 9th in the United States for international visitors and in 2007 the

number of international visitors increased by 10 percent with spending by international visitors 13 percent higher than in 2006 (GA, 2008).

Florida

Annual numbers of tourists visiting Florida has increased over several years and with 84.6 million visitors in 2006, Florida is the top travel destination in the world. Tourism is Florida's top revenue grossing industry, contributing $62 billion (2005) to Florida's economy and employing nearly a million people. Seasonality of visitation by quarter is relatively consistent. Most domestic and international visitors site leisure as their primary purpose for visiting (VISIT FLORIDA research, 2007), with 3.6 percent of the 2005 domestic visitors to Florida participating in boat or sail activities and 2.3 percent participating in hunting and/or fishing activities (NOAA, 2007).

Recreational activities offshore of these areas primarily comprise game and sport fishing, charter boat fishing, sport diving, sailing, power cruising, whale watching, and other recreational boating activities. Florida ranks first in the nation for the number of recreational boats registered in the state (USCG, 2005). Recreational boats range throughout the Florida coastal waters, depending on season and weather conditions. Travel between the most popular cruising destinations along the Florida coast does not require traversing Navy OPAREAs. However, larger recreational vessels, in particular sailboats and motor cruisers in the 50-foot and larger class, do travel considerable distances offshore. Florida ranks first in the nation for the number of recreational boats registered in the state (USCG, 2005). Recreational boats range throughout the coastal waters, depending on season and weather conditions.

Lake George and Rodman Ranges

Lake George Range is located on the east side of Lake George, the second largest fresh water lake in Florida. The Ocala National Forest is on the west side of Lake George and the southwest corner of Rodman Range. The Ocala National Forest offers recreational opportunities for camping, swimming, picnicking, hiking, mountain biking, boating, canoeing, off-road trail use, horseback riding, hunting, and fishing. Camping is offered through developed campgrounds, primitive camp sites, and dispersed tent camping that may be utilized year-round. Additionally, there are four group campgrounds available, one of which has a capacity of 250 persons. There are six hiking trails through the forest and a 22-mile bicycling trail. The Ocala National Forest contains approximately 600 lakes and ponds, several streams, and has two rivers along its boundary resulting in boating opportunities that include canoeing, boating, skiing, and personal watercraft. Canoe rentals are available at six different marinas. Off road vehicle trails are not specifically designated, but there are many unnumbered roads and travel ways that do allow off road vehicles. There are four marked horseback trails. The Ocala National Forest is a wildlife management area in which hunting and fishing activities are managed by the Florida Fish and Wildlife Conservation Commission. The Ocala Rifle Range is also available to the public when classes are not scheduled.

Since 1878, Silver Springs has been the largest attraction in the area. This tourist park offers live animals, safaris, boat tours, live music, a toddler playland, and a water park. Many small towns are in the region and offer a wide variety of entertainment, mainly centered on the many natural springs found in the area (Visitflorida.com, 2007).

3.16.2.6 Recreational Fishing

National Marine Fisheries Service is required to collect statistics on marine recreational fishing. The NMFS 2006 preliminary report on commercial and recreational landings indicates that, in

2005, 7.8 million residents participated in marine recreational fishing in the Atlantic Ocean. These visitors took over 52 million trips and caught a total of almost 243 million fish (NMFS, 2007a). Almost 30 percent of the total Atlantic catch resulted from saltwater trips that fished primarily in the state territorial seas, and 60 percent came from trips that fished primarily in inland waters. In conjunction with state agencies, the Division of Marine Fisheries, the South Atlantic Fishery Management Council, and the Atlantic States Marine Fisheries Commission, the U.S. Department of Commerce and the National Oceanic and Atmospheric Administration began publishing state specific recreational informational brochures in April 2007. Through the state brochures, the following recreational fishing statistics were reported:

- The State of North Carolina reports that 37 percent of the recreational anglers lived outside the State of North Carolina, 35 percent of the saltwater fishing trips were taken via private or rental boat, and 61 percent of the recreational fishing was conducted from the shore. Four percent of the saltwater fishing trips were taken by charter boat. Ten percent were in federal waters, 65 percent were in state waters, and 25 percent were inland.
- The State of South Carolina reports that 28 percent of the recreational anglers lived outside the State of South Carolina, 47 percent of the saltwater fishing trips were taken via private or rental boat, and 50 percent of the recreational fishing was conducted from the shore. Two percent of the saltwater fishing trips were taken by charter boat. Five percent were in federal waters, 54 percent were in state waters, and 41 percent were inland.
- The State of Georgia reports that 7 percent of the recreational anglers lived outside of the State of Georgia, 59 percent of the saltwater fishing trips were taken via private or rental boat, and 83 percent of the recreational fishing was conducted from the shore. Three percent of the saltwater fishing trips were taken by charter boat. Six percent were in federal waters, 11 percent were in state waters, and 83 percent were inland.
- The Florida Atlantic Coast reports that 14 percent of the recreational anglers lived outside of the State of Florida, 53 percent of the saltwater fishing trips were taken via private or rental boat, and 53 percent of the recreational fishing was conducted from shore. Three percent of the saltwater fishing trips were taken by charter boat. Nine percent were in federal waters, 38 percent were in state waters, and 53 percent were inland.

Favored fishing areas change over time with changes in fish populations and communities, changes in preferred target species, or changes in fishing modes and styles. Popular fishing sites are characterized by relative ease of access, ability to anchor or secure the boat, and abundant presence of target fishes. Fishermen focusing on areas of bottom relief not only catch reef-associated fishes but also coastal pelagic species that may be attracted to the habitat.

3.16.3 Environmental Consequences

The environmental consequences of the regional economy are assessed in terms of the direct effect impacts have on the local economy. Regional economy impacts could occur if the Alternative chosen for implementation resulted in a substantial shift in regional employment and spending or earning patterns.

3.16.3.1 No Action Alternative

The No Action Alternative would continue current Navy practices; training operations and major range events would continue at current levels; it would not result in any impacts to the regional economy. Under this alternative, the JAX Range Complex would not accommodate an increase in training operations due to proposed force structure changes, and it would not implement

enhancements identified in the Range Complex Management Plan. Implementation of the No Action Alternative would not result in a substantial shift in regional employment or spending and earning patterns; therefore, there would be no impacts. The environmental effects of the No Action Alternative in U.S. territory on regional economy would have no impact. In non-territorial waters, the environmental effects of the No Action Alternative would not cause harm to regional economy resources.

3.16.3.2 Alternative 1

Implementation of Alternative 1 would result in accommodating training operations currently conducted (*i.e.*, the No Action Alternative), training operations would be increased or modified, and force structure changes such as introduction of MH-60R/S and Organic Mine Countermeasure systems would be accommodated due to MH-60R/S beddown, and range complex capabilities would be enhanced under this alternative. Training and research, development, testing, and evaluation operations would be increased or modified as identified in Tables 2.2-3 and 2.2-4.

The stressors to the regional economy are vessel movements, aircraft overflights, and MEM. Under Alternative 1, Increases to steaming days[51] (10%), fixed wing or helicopter overflights (8% and 25%), towed mine warfare devices (92%), non-explosive practice munitions use (no more than 10% of any type), high explosive ordnance (105% in missile use), and no more than 13 percent of any types of expended material (with the exception of defensive flares which would increase by 42%) would not be expected to impact what are primarily land based industries. Training missions containing components that are potentially incompatible with civilian commercial or recreational interests are conducted in restricted areas designed for that activity. The Navy has established procedures to ensure users of joint use areas that are not participating in exercises are notified of the exercise before it is executed and the areas are cleared before exercises begin. These procedures would ensure that the proposed action associated with Alternative 1 would not result in impact to industry, state landings, fishing gear, tourism, or recreational fishing in the Study Area.

Industry – The industries assessed for regional economy were primarily land based. According to the USCB, the fishing industry is included in the category of "Other Services (except Public Administration)." Of the 537,576 industries in this category in the United States, 61,995 (8%) are found in the Study Area for the JAX Range Complex FEIS/OEIS. The leading industry in the Study Area is retail trade. Given the fact that the majority of the industries are not directly related to any of the Alternatives or possible associated impacts, there would be no impacts to these industries if Alternative 1 were implemented.

State Landings – The magnitude of potential impacts can vary greatly depending on the location of a proposed action. Given the size of the Study Area and the limited number of operations within this area, the likelihood of possible contact with a non-Navy vessel or impact to commercial fishing practices would be negligible. The greatest number of state landings occurs within the zone 0-200 miles from shore and the majority of the actions proposed in the alternatives occur in the established training areas more than 200 miles from the shore. None of the States in the Study Area had reportable harvests in the zone classified as the "high seas;" *i.e.*, the zone beyond 200

[51] Steaming days are a measurement of time; a single vessel within a 24 hour timeframe.

miles from shore. The training areas are not proposed to change with implementation of any of the alternatives; therefore, the areas that traditionally produce state landings are not expected to change.

Fishing Gear – Fishing activities have the potential to interact with equipment used during the proposed Navy training operations. Commercial bottom fishing activities have the greatest potential for negative effects. Interaction with bottom-fishing gear could result in the loss of or damage to both commercial and naval hardware and fishing gear. The commercial gear for these enterprises comprises approximately 47 percent of the gear types utilized in the Study Area. Given the size of the Study Area in which the Navy has proposed to introduce or increase operations, and the fact that the area is substantially the same as it has been for many years, it is unlikely that fishing gear interaction with naval gear in the OPAREAs would realize an impact since the existing areas that are productive for recreational or commercial fishing are unlikely to change or experience any impact. Naval activities that would have the greatest potential of conflict with fishing gear (MIW activities) occur in areas designed for those activities where fishing is not likely to occur.

Tourism – Tourism in the Study Area encompasses many activities that do not involve boating or sailing. While tourism is an important economic activity in the Study Area, only a small percentage of visitors (less than 5%) report coming to the area for boating or sailing activities (North Carolina Division of Tourism, Film and Sports Development, 2005). Tourism activities could be affected by Navy activities on a short-term and infrequent basis, mostly with prior notice of the activities; therefore, minimizing any potential impacts to tourism.

Recreational Fishing - Popular fishing sites are characterized by relative ease of access, ability to anchor or secure the boat, and abundant presence of target fishes. For all states in the Study Area, at least 25 percent of recreational fishing occurs inland and 10 percent or less of recreational fishing occurs in federal waters or beyond, which is the area where most of the OPAREAs training occurs. Given the size of the OPAREAs, the opportunities for Navy activities to interfere with recreational fishing are minimal as the majority of recreational fishing would occur closer to the shore.

The environmental impacts of Alternative 1 on the regional economy in U.S. territory would have no impact. In non-territorial waters, the environmental effects of Alternative 1 would not cause harm to regional economy resources.

3.16.3.3 Alternative 2 (Preferred Alternative)

The assessment of impacts to industry, commercial fishing, fishing gear, or recreational fishing with implementation of Alternative 2 is the same as those described in Alternative 1, described in Section 3.16.3.2. The proposed action in Alternative 2 would include all the proposed actions associated with Alternative 1 plus designation of Mine Warfare training areas in the JAX and Charleston OPAREAs (see Figure 2.2-1). This designation would result in a greater proposed use of helicopter sorties (71% annually) and a 485 percent greater number of towed mine warfare sorties (over the No Action Alternative). However, this designation would mean that these increases of sorties would be experienced only in those areas designated as a Mine Warfare training area. The impact would be realized only in these areas and would not be expected to impact the industry, state landings, fishing gear, tourism, or recreational fishing in the Study Area overall. The environmental impacts of Alternative 2 in U.S. territory on regional economy would have no

impact. In non-territorial waters, the environmental effects of Alternative 2 would not cause harm to regional economy resources.

3.16.4 Unavoidable Significant Environmental Effects

Based on the preceding analysis, there are no unavoidable significant environmental impacts as a result of implementation of the No Action Alternative, Alternative 1, or Alternative 2.

3.16.5 Summary of Environmental Effects (NEPA and EO 12114)

Table 3.16-10 shows a summary of the environmental impacts of the alternatives on the regional economy. The environmental impacts of the No Action Alternative, Alternative 1, and Alternative 2 in U.S. territory on regional economy would have no impact. In non-territorial waters, the environmental impacts of the No Action Alternative, Alternative 1, and Alternative 2 would not cause harm to the regional economy.

TABLE 3.16-10
SUMMARY OF ENVIRONMENTAL IMPACTS OF THE ALTERNATIVES ON THE REGIONAL ECONOMY IN THE JAX RANGE COMPLEX

Alternatives and Stressors	NEPA (U.S. Territory)	EO 12114 (Non-Territorial Waters, >12 nm)
No Action		
Vessel Movements Aircraft Overflights MEM	The No Action Alternative would continue current Navy practices; it would not result in any impacts to the regional economy. Implementation of the No Action Alternative would not result in a substantial shift in regional employment or spending and earning patterns.	The No Action Alternative would continue current Navy practices; it would not result in any impacts to the regional economy. Implementation of the No Action Alternative would not result in a substantial shift in regional employment or spending and earning patterns.
Conclusion	The No Action Alternative would have no impact on regional economy in U.S. Territory	In non-territorial waters, the environmental effects of the No Action Alternative would not cause harm to regional economy resources.

TABLE 3.16-10 (Continued)
SUMMARY OF ENVIRONMENTAL IMPACTS OF THE ALTERNATIVES ON THE REGIONAL ECONOMY IN THE JAX RANGE COMPLEX

Alternatives and Stressors	NEPA (U.S. Territory)	EO 12114 (Non-Territorial Waters, >12 nm)
Alternative 1		
Vessel Movements Aircraft Overflights MEM	Industry closest to the Study Area is primarily land based and not affected by the Proposed Actions in Alternative 1. The likelihood of possible contact with a non-Navy vessel or impact to commercial or recreational fishing practices would be negligible. Commercial bottom fishing activities have the greatest potential for negative effects due to fishing gear interaction with naval gear. It is unlikely that fishing gear interaction with naval gear in the OPAREAs would realize an impact since the existing fishing areas that are productive for recreational or commercial fishing are unlikely to change. Tourism activities could be affected by Navy activities on a short-term and infrequent basis, mostly with prior notice of the activities provided through NOTAMs and NOTMARs.	Industry closest to the Study Area is primarily land based and not affected by the Proposed Actions in Alternative 1. The likelihood of possible contact with a non-Navy vessel or impact to commercial or recreational fishing practices would be negligible. Commercial bottom fishing activities have the greatest potential for negative effects due to fishing gear interaction with naval gear. It is unlikely that fishing gear interaction with naval gear in the OPAREAs would realize an impact since the existing fishing areas that are productive for recreational or commercial fishing are unlikely to change. Tourism activities could be affected by Navy activities on a short-term and infrequent basis, mostly with prior notice of the activities provided through NOTAMs and NOTMARs.
Conclusion	The environmental effects of Alternative 1 in U.S. Territory on regional economy would have no impact. Implementation of Alternative 1 would not result in any impacts to the regional economy or a shift in regional employment or spending and earning patterns.	In non-territorial waters, the environmental effects of Alternative 1 would not cause harm to regional economy resources.
Alternative 2		
Vessel Movements Aircraft Overflights MEM	Industry closest to the Study Area is primarily land based and not affected by the Proposed Actions in Alternative 2. The likelihood of possible contact with a non-Navy vessel or impact to commercial or recreational fishing practices would be negligible. Commercial bottom fishing activities have the greatest potential for negative effects	Industry closest to the Study Area is primarily land based and not affected by the Proposed Actions in Alternative 2. The likelihood of possible contact with a non-Navy vessel or impact to commercial or recreational fishing practices would be negligible. Commercial bottom fishing activities have the greatest potential for negative effects

TABLE 3.16-10 (Continued)
SUMMARY OF ENVIRONMENTAL IMPACTS OF THE ALTERNATIVES ON THE REGIONAL ECONOMY IN THE JAX RANGE COMPLEX

Alternatives and Stressors	NEPA (U.S. Territory)	EO 12114 (Non-Territorial Waters, >12 nm)
	due to fishing gear interaction with naval gear. It is unlikely that fishing gear interaction with naval gear in the OPAREAs would realize an impact since the existing fishing areas that are productive for recreational or commercial fishing are unlikely to change. Tourism activities could be affected by Navy activities on a short-term and infrequent basis, mostly with prior notice of the activities provided through NOTAMs and NOTMARs.	due to fishing gear interaction with naval gear. It is unlikely that fishing gear interaction with naval gear in the OPAREAs would realize an impact since the existing fishing areas that are productive for recreational or commercial fishing are unlikely to change. Tourism activities could be affected by Navy activities on a short-term and infrequent basis, mostly with prior notice of the activities provided through NOTAMs and NOTMARs.
Conclusion	The environmental effects of Alternative 2 in U.S. Territory on regional economy would have no impact. Implementation of Alternative 2 would not result in any impacts to the regional economy or a shift in regional employment or spending and earning patterns.	In non-territorial waters, the environmental effects of Alternative 2 would not cause harm to regional economy resources.

3.17 RECREATION

3.17.1 Introduction and Methods

The recreation section refers to non-commercial activities that occur in the Study Area. Commercial recreation activities are addressed in the regional economy section of this FEIS/OEIS. Offshore areas of the east coast are in use by both military and civilian interests. These activities are compatible with Navy ships, accounting for three percent of the total ship presence out to 200 nm (CNA, 2001). Where naval vessels and aircraft are conducting operations that are not compatible (*e.g.*, hazardous weapons firing), they are confined to OPAREAs away from shipping lanes and inside Special Use Airspace. Hazardous operations are communicated to all vessels and operators by use of NOTMARs, issued by the USCG, and NOTAMs, issued by the FAA. NOTMARs can be found on the internet at www.nga.mil/portal/site/maritime and NOTAMs are available on the internet at https://www.notams.jcs.mil.

Advance notice of scheduled operation times are made available to the public via NOTMARs. These provide recreational boaters and other users notice that the military will be operating in a specific area, and will allow them to plan their own activities accordingly. Schedules will be updated when changes occur up to the date of the operation. If operations are cancelled at any time, this information will be posted and the area will again be identified as clear for public use. NOTMARs advise the public, fishermen, and divers in advance of ongoing military activities that may temporarily relocate civilian/recreational activities. To minimize potential military/civilian interactions, the Navy will continue to publish NOTMARs on a weekly basis.

3.17.1.1 Assessment Methods and Data Used

Information regarding personal watercraft was obtained, in part, from the USCG. In addition to its national defense role as one of the five U.S. Armed Services, the USCG is charged with a broad scope of regulatory, law enforcement, humanitarian, and emergency response duties. In addition to ensuring maritime safety and security, the USCG focuses on personal water craft and boating. The National Marine Manufacturers Association statistical data were also consulted, as this organization maintains a vast array of industry data specific to recreational boating. State tourism and parks and recreation divisions also provided sources for state-specific personal watercraft and recreational boating data.

Sport diving industry statistics are not maintained for numbers of individuals participating in specific regions of the country or for sites that are commonly used (Davison, 2007; DEMA, 2006). Dive locations identified in this document were established through the use of the National Oceanic and Atmospheric Administration Office of Coast Survey's Automated Wreck and Obstruction Information System, a survey of state dive charter company websites, and state tourism and parks and recreation information.

The NMFS is required to collect statistics on marine recreational fishing. The information is obtained through recreational fishing participant telephone surveys, Access Site Angler Intercept Surveys, a sampling of angler trips, and voluntary sampling of angler trips by participants. Additionally, through survey, the number of boat trips and catch per trip are compiled to contribute to the total catch conclusions.

Areas that consistently provide good catches of sport fishes are considered hotspots or fish havens. Favored fishing hotspots change over time with changes in fish populations and communities, changes in preferred target species, or changes in fishing modes and styles. Popular fishing sites

are characterized by relative ease of access, ability to anchor or secure the boat, and abundant presence of target fishes. Fishermen focusing on areas of bottom relief not only catch reef-associated fishes, but also coastal pelagic species that may be attracted to the habitat.

3.17.1.2 Warfare Areas and Associated Environmental Stressors

Impacts to recreation are assessed in terms of anticipated levels of disruption or improvement of current levels of access to recreational areas. Impacts may arise from physical restriction of recreational areas and, as a result, stressors that would likely impact recreational interests are increases in ship and aircraft operations and their associated increases in training operations and expended material, and thus, increases in military use of restricted areas for exclusive use of military training. Table 3.17-1 identifies stressors to recreation resources. Stressors were identified by conducting a detailed analysis of the warfare areas, operations, and specific activities included in the Alternatives.

TABLE 3.17-1
SUMMARY OF POTENTIAL STRESSORS TO RECREATION RESOURCES

Warfare Area and Operation	Training Areas	Vessel Movements (Disturbance)	Aircraft Overflights (Disturbance)	Military Expended Material
Mine Warfare (MIW)				
Mine Laying	Lake George Range	✓	✓	✓
MCM	Carrier Operating Areas	✓	✓	✓
Mine Neutralization	Charleston OPAREA (North and South UNDET Boxes)	✓	✓	✓
Surface Warfare (SUW)				
MISSILEX (A-S)	W-157A (Area 4X) and W-159A (Area 5X)	✓	✓	✓
GUNEX (A-S)	W-132, W-133, W-134, W-157, W-158	✓	✓	✓
GUNEX (S-S) Boat	Charleston OPAREA (Areas 11J)	✓		✓
GUNEX (S-S) Ship	JAX OPAREA (AA, BB, and CC)	✓	✓	✓
BOMBEX (A-S) (at sea)	HE, W-158 (31J); NEPM, W157A/B and W-158 A/B	✓	✓	✓
Laser Targeting	W-132, W-133, W-134, W-157, W-158	✓	✓	
GUNEX (S-S) (FAC/FIAC)	Amber Strait: Charleston OPAREA (Boxes Q-9&10, R-9&10)	✓		
VBSS/MIO-Ship	JAX and Charleston OPAREAs	✓		

TABLE 3.17-1 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO RECREATION RESOURCES

Warfare Area and Operation	Training Areas	Vessel Movements (Disturbance)	Aircraft Overflights (Disturbance)	Military Expended Material
VBSS/MIO-Helicopter	W-157A (Area 4X) and W-159A (Area 5X)		✓	
Air Warfare (AW)				
ACM	W-157A (Areas 3X & 4X)		✓	
Air Intercept Control	JAX and Charleston OPAREAs		✓	
ACM Chaff Exercise	W-157A (Areas 3X & 4X)		✓	✓
ACM Flare Exercise	W-157A (Areas 3X & 4X)		✓	✓
MISSILEX (A-A)	W-132, W-133, W-134, W-157, W-158	✓	✓	✓
MISSILEX (A-A)	JAX and Charleston OPAREAs			✓
Detect-to-Engage	W-132, W-133, W-134, W-157, W-158		✓	
GUNEX (S-A)	JAX OPAREA (AA, BB, and CC)	✓	✓	✓
GUNEX (A-A)	W-157A/W-133 (Area 2X)		✓	✓
Amphibious Warfare (AMW)				
FIREX (S-S) with IMPASS	JAX OPAREA (BB and CC)	✓	✓	✓
Strike Warfare (STW)				
BOMBEX (A-G)	Rodman Range		✓	✓
CSAR and Convoy Operations	Rodman Range		✓	✓
Electronic Combat (EC)				
EC Operations - Aircraft	W-132, W-133, W-134, W-157, W-158		✓	
EC Operations - Surface Ships	JAX and Charleston OPAREAs		✓	
Chaff Exercise	JAX and Charleston OPAREAs		✓	✓
Flare Exercise- Helicopter	Lake George Range		✓	✓

TABLE 3.17-1 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO RECREATION RESOURCES

Warfare Area and Operation	Training Areas	Vessel Movements (Disturbance)	Aircraft Overflights (Disturbance)	Military Expended Material
Other Training				
SESEF Utilization	5-15 nm east of Mayport	✓		
Precision Anchoring	NS Mayport	✓		
Small Arms with anti-swimmer grenades (MK3A2)	Charleston OPAREA (Area 10L, 12I)	✓		✓

3.17.2 Affected Environment

In 2005, 7.8 million residents participated in marine recreational fishing in the Atlantic Ocean. These visitors took more than 52 million trips and caught a total of almost 243 million fish. Of that total, approximately 30 percent came from the Study Area for the JAX FEIS/OEIS. Almost 30 percent of the total Atlantic catch came on saltwater trips that fished primarily in the state territorial seas, and 60 percent came on trips that fished primarily in inland waters. Assuming the distribution between saltwater and inland waters, Table 3.17-2 shows the 2005 number of trips (not the number of fisherman actually participating) and percentage calculated for inland and saltwater trips for the states in the JAX EIS/OEIS Study Area.

TABLE 3.17-2
RECREATIONAL ANGLER TRIPS IN THE JAX EIS/OEIS STUDY AREA

State	Number of Trips	Percentage of Inland Trips (60%)	Percentage of Saltwater Trips (30%)
North Carolina	6,823	4,094	2,047
South Carolina	2,188	1,313	656
Georgia	859	515	258
Florida	27,697	16,618	8,309

NMFS, 2007c
Note: Numbers are in thousands

North Carolina

Recreational Boating and Diving. Recreational activities offshore comprise game and sport fishing, charter boat fishing, sport diving, whale watching, sailing, power cruising, and other recreational boating activities. North Carolina ranks 11th in the nation for the number of recreational boats registered in the state (USCG, 2005), with 362,784 boats registered (NMMA, 2007). Recreational boats range throughout the North Carolina coastal waters, depending on season and weather conditions.

Travel between the most popular cruising destinations in the Study Area includes some recreational vehicles traversing the JAX Range Complex; larger recreational vessels such as sailboats and motor cruisers in the 50-foot and larger class may travel considerable distances offshore. In particular, sailboats in the 75-foot and larger class, and cruising vessels transiting ocean passages (*e.g.,* from some North Carolina ports to the Bahamas or Bermuda), might favor courses through the vicinity of the OPAREAs.

Shipwrecks provide habitat suitable for development of artificial reefs, and are popular destinations for divers, with some wrecks extending as far as 75 miles offshore.

Recreational Fishing. Table 3.17-3 provides North Carolina fish catch recreational landings for years 2002-2006.

TABLE 3.17-3
NORTH CAROLINA RECREATIONAL LANDINGS

MONTHS	2006	2005	2004	2003	2002
Jan-Feb	70,128	26,061	26,698	0	0
Mar-Apr	502,123	1,806,782	1,236,176	675,188	876,752
May-Jun	5,326,483	2,129,716	4,517,388	5,415,552	5,447,372
Jul-Aug	3,719,142	6,097,507	3,195,412	5,761,653	2,183,770
Sep-Oct	4,664,639	2,160,146	1,205,901	1,441,839	1,762,664
Nov-Dec	2,914,161	1,243,464	1,648,644	987,098	1,486,112
Year Total	17,196,676	13,463,676	11,830,219	14,281,330	11,756,670

1. Numbers represent the total of all species and all methods of harvest in the Federal Exclusive Economic Zone, which for most states is the state boundary (3 nm) out to 200 nm.

2. Due to data collection problems, months that indicate zero (0) did not have data available.

Source: NMFS, 2007b.

South Carolina

Recreational Boating and Diving. South Carolina ranks 8th in the nation for the number of recreational boats registered in the state (USCG, 2005), with 417,763 registered in 2005 (NMMA, 2007). Recreational boats range throughout the South Carolina coastal waters, depending on season and weather conditions. In a statewide survey, over one-third of respondents claimed to participate in motorboating during the year. Saltwater fishing, jetskiing, waterskiing, shellfishing/shrimping, and sailing were other nearshore and offshore activities performed by residents (Table 3.17-4).

TABLE 3.17-4
OFFSHORE RECREATION ACTIVITIES, SOUTH CAROLINA RESIDENTS (2005)

Activity	Percent of Residents Participating Annually	Average Number of Times Per Year Activity Performed
Motorboating	34.1	6
Saltwater Fishing	19	1.3
Jetskiing	11.8	1
Waterskiing	6.1	1
Shellfishing/Shrimping	7.1	1
Sailing	2.7	1

Source: South Carolina Department of Parks, Recreation, and Tourism, 2007

Travel between the most popular cruising destinations along the South Carolina coast includes some recreational vessels traversing Navy OPAREAs. Some recreational vessels, in particular sailboats and motor cruisers in the 50-foot and larger class, do travel considerable distances offshore.

Diving sites off the South Carolina coast include shipwrecks (including about 30 in the Charleston OPAREA), artificial reefs, and natural reefs. Angel's Ledge live-bottom reef ranges in depth from approximately 39 to 98 feet. Popular shipwreck and submerged artificial reefs can be found in various depth levels from approximately 59 to over 98 feet of water, both close to shore (*e.g.,* The Sherman at 6 miles offshore), and at farther distances (*e.g.,* The City of Houston at 55 miles offshore) (Coastal Scuba, 2007). Refer to Figure 3.13-1 for an illustration of the general location of these wrecks, many of which are located in the JAX EIS/OEIS Study Area.

Recreational Fishing. Table 3.17-5 provides South Carolina fish catch (both saltwater and inland waters) recreational landings for years 2002-2006.

TABLE 3.17-5
SOUTH CAROLINA RECREATIONAL LANDINGS

MONTHS	2006	2005	2004	2003	2002
Jan-Feb	0	0	0	0	0
Mar-Apr	99,485	67,195	202,556	172,004	95,084
May-Jun	339,915	238,107	583,647	363,603	330,433
Jul-Aug	171,927	197,362	154,021	281,060	67,011
Sep-Oct	144,988	68,815	92,667	87,433	43,409
Nov-Dec	83,549	48,346	108,524	136,046	27,774
Year Total	829,864	619,623	1,141,414	1,040,146	565,868

1. Numbers represent the total of all species and all methods of harvest in the Federal Exclusive Economic Zone, which for most states is the state boundary (3 nm) out to 200 nm.
2. Due to data collection problems, months that indicate zero (0) did not have data available.
Source: NMFS, 2007c.

Georgia

Recreational Boating and Diving. Recreational activities offshore primarily comprise game and sport fishing, charter boat fishing, sport diving, whale watching, sailing, power cruising, and other recreational boating activities. Georgia ranks 14th in the nation for the number of recreational boats registered in the state (USCG, 2005), with 318,212 registered by 2005 (NMMA, 2007). Recreational boats range throughout the Georgia coastal waters, depending on season and weather conditions.

Travel between the most popular cruising destinations along the Georgia coast includes some recreational vessels traversing Navy OPAREAs. Some larger recreational vessels, in particular sailboats and motor cruisers in the 50-foot and larger class, do travel considerable distances offshore.

One of the most popular dive sites off the Georgia coast is Gray's Reef. The area is one of the largest nearshore live-bottom reefs of the southeastern United States (Dive Training Magazine Online). The associated Gray's Reef National Marine Sanctuary, which is exposed to limited use

by divers due to depth, strong current, and frequent turbidity (NOAA, 2006), is 17.5 nm off Sapelo Island, Georgia, and encompasses 17 nm^2 of live-bottom habitat. Sandstone outcroppings and ledges up to 9 feet high separate the sandy, flat-bottomed troughs in a reef that combines temperate and tropical qualities. The rocky platform, 59 to 69 feet below the surface of the ocean, is wreathed in a carpet of attached organisms, known locally as a "live-bottom habitat." Divers access the reef from numerous facilities between Savannah and Brunswick, Georgia (Dive Training Magazine Online). Shipwrecks provide habitat suitable for development of artificial reefs, and are popular destinations for divers.

Recreational Fishing. Table 3.17-6 provides Georgia fish catch (both saltwater and inland waters) recreational landings for years 2002-2006.

TABLE 3.17-6
GEORGIA RECREATIONAL LANDINGS

MONTHS	2006	2005	2004	2003	2002
Jan-Feb	0	0	0	0	0
Mar-Apr	32,961	45,609	46,071	15,263	6,255
May-Jun	117,708	176,899	143,018	275,451	24,778
Jul-Aug	153,706	134,854	77,669	139,973	9,005
Sep-Oct	117,386	57,137	114,462	28,053	21,317
Nov-Dec	5,554	32,620	23,725	70,117	8,974
Year Total	427,315	447,119	404,967	505,856	70,327

1. Numbers represent the total of all species and all methods of harvest in the Federal Exclusive Economic Zone, which for most states is the state boundary (3 nm) out to 200 nm.
2. Due to data collection problems, months that indicate zero (0) did not have data available.
Source: NMFS, 2007b.

Florida

Recreational Boating and Diving. Recreational activities offshore of these areas primarily comprise game and sport fishing, charter boat fishing, sport diving, sailing, power cruising, whale watching, and other recreational boating activities. Florida ranks first in the nation for the number of recreational boats registered in the state (USCG, 2005), with 973,859 registered in 2005 (NMMA, 2007). Recreational boats range throughout the Florida coastal waters, depending on season and weather conditions.

Travel between the most popular cruising destinations along the Florida coast includes recreational vessels traversing Navy OPAREAs. Some recreational vessels, in particular sailboats and motor cruisers in the 50-foot and larger class, do travel considerable distances offshore.

Diving and swimming account for 32 percent of all boating activities in the state (USCG, 2003). Artificial reefs in the waters offshore of Jacksonville, St. Augustine, and Daytona Beach, provide popular dive destinations. Creation of fish aggregation devices such as artificial reefs has become an effective and popular method to increase suitable habitats for marine life in areas off the Atlantic coast where narrow, low-profile reefs are common.

Recreational Fishing. Recreational fishing is an important industry along the east coast of Florida. Anglers have caught more than 235 species in waters along the east coast of Florida.

Roughly half of the saltwater fishing trips are taken on private, rental, charter, and party boats, with the remainder taken from shore. Table 3.17-7 provides Florida fish catch (both saltwater and inland waters) recreational landings for years 2002-2006.

TABLE 3.17-7
FLORIDA RECREATIONAL LANDINGS

	2006	2005	2004	2003	2002
MONTHS					
Jan-Feb	615,747	435,918	615,677	812,569	1,345,544
Mar-Apr	1,937,992	1,176,348	1,012,687	2,019,591	1,177,612
May-Jun	3,839,517	2,172,529	3,457,757	3,508,966,	2,615,957
Jul-Aug	1,829,014	1,237,698	2,589,834	3,090,243	1,545,932
Sep-Oct	1,086,177	646,314	477,690	802,489	1,060,429
Nov-Dec	1,051,834	738,911	726,286	780,076	1,517,855
Year Total	10,352,420	6,239,671	8,879,933	11,015,928	9,252,327

1. Numbers represent the total of all species and all methods of harvest in the Federal Exclusive Economic Zone, which for most states is the state boundary (3 nm) out to 200 nm.
Source: NMFS, 2007b.

About 1,443,000 fishing trips were taken in 2002 by individual marine recreational anglers fishing in the federal waters along the east coast of Florida. The estimated number of participants in recreational fishing in marine fishing areas, including the state territorial sea and federal waters, is over 4 million persons.

Unlike the other states, Florida shows substantial activity during the winter months and generally stable recreational fishing effort throughout the year. Measured in terms of trips to federal waters, efforts peak during the 4-month period from May through August, when almost half the annual trips are taken.

Many sites known as fishing hotspots also attract divers. Fishing hotspots and other dive sites, including artificial reefs, coral patches, and shipwrecks, are utilized throughout the year by recreational vessels and commercial chartered boats, but use is highest during the summer.

Inland Ranges

Inland areas of the JAX Range Complex included in this FEIS/OEIS are Lake George Range and Rodman Target, located in rural north-central Florida, along the northeastern end of the Ocala National Forest (Figure 2.1-3). Lake George located on the St. John's River, is 6 miles wide and 11 miles long with an average depth of 10 feet. It is the second largest lake in Florida. The west side of the lake is in the Ocala National Forest. Rodman Range is situated in along the northeastern end of the Ocala National Forest, along the north side of the Ocklawaha River.

The surrounding area is rural with predominantly low density residential land use, including with rural home sites and small incorporated communities. The local economy is based on agriculture, forestry, and tourism/leisure, with light manufacturing and distribution enterprises. The Ocala National Forest supports the local tourism and forest industries. Citrus orchards, tree and ornamental plant nurseries and sod farms characterize the agricultural production on private land bordering the Ocala National Forest (USFS, 2007).

The Ocala National Forest offers recreational opportunities for camping, swimming, picnicking, hiking, mountain biking, boating, canoeing, off-road trail use, horseback riding, hunting, and fishing. Camping grounds is offered through developed campgrounds, primitive camp sites, and dispersed tent camping that may be utilized year-round. Additionally there are four group campgrounds available, one of which has a capacity of 250 persons. There are six hiking trails through the forest and a 22-mile bicycling trail. Ocala National Forest contains approximately 600 lakes and ponds, several streams, and has two rivers (St. Johns River and Upper/Lower Ocklawaha River) along its boundary resulting in boating opportunities that range from canoeing, boating, skiing, and personal watercraft. Canoe rentals are available at six different marinas. Off road vehicle trails are not specifically designated, but there are many unnumbered roads and travel ways that do allow off road vehicles. There are four marked horseback trails. The Ocala National Forest is a wildlife management area in which hunting and fishing activities are managed by the Florida Fish and Wildlife Conservation Commission. The Ocala Rifle Range is also available to the public when classes are not scheduled (USFS, 2007).

Since 1878, Silver Springs has been the largest attraction in the area. This tourist park offers live animals, a safari, boat tours, live entertainment, a toddler playland, and a water park. Many small towns in the region offer a wide variety of entertainment, mainly centered on the many natural springs found in the area (Visitflorida.com, 2007).

There is a designated area on the northeast shoreline of Lake George that the Florida Game and Fresh Water Fish Commission has declared off-limits during bass spawning seasons. Another protected area runs from Silver Glen Spring Run to Juniper Point (southwest portion of Lake George). The most favorable areas to catch bass and crappie are those areas that contain favorable water conditions, artificial reefs and groups of eelgrass and peppergrass that develop near shore areas of the lake. The creeks that feed the lake provide favorable habitat for crappie, bass, and bluegills (Visitflorida.com, 2007). In addition to the bass, crappie, and bluegill population in the lake, the salt content of the lake creates habitat suitable for the Atlantic stingray, mullet species, and blue crabs. The blue crab population is large enough to support one of the only fresh water blue crab fisheries in the world.

The Rodman RAICUZ Study was prepared in early 2007 to evaluate the safety hazards and noise impacts associated with air-to-ground ordnance delivery training operations at Rodman Range. The study found that existing land use practices in the vicinity of Rodman Range are largely consistent with range operations. Noise associated with Rodman Range use is generated primarily by low-level operation of rotary-wing aircraft and F/A-18 aircraft within the range boundaries. Most public and residential activities are considered compatible within a DNL 65 dB noise level (a land use recommendation). Recreational use has traditionally been recommended as compatible with higher noise levels; however, a more conservative view is emerging that contends that noise levels above DN) 55 dB, limits the ability to enjoy such uses. The RAICUZ study found that the 55 dB Day-Night Average Sound Level, onset-rate adjusted (L_{dnmr}) noise contour falls almost entirely within the range limits. A small portion of the noise zone extends east of the range limits, falling within an area of uninhabited woodlands (DoN, 2007). Refer to section 3.5.1.2 in Chapter 5 for a more detailed discussion of the RAICUZ study.

Important Bird Areas

Important Bird Areas are found in numerous land, marsh, open inshore waters, and offshore areas of the east coast. Section 3.11 details the Important Bird Areas designated by local Audubon

Societies. These areas attract tourists, students, and conservationists interested in observing these many species in their natural habitat. Individual tours may account for as many as 50 trips annually.

Cruise Industry

The United States ports handle 75 percent of all global cruise embarkations. More than nine million cruise passengers began their cruises from United States ports in 2006, an increase of 4.6 percent from 2005. None of the top ten United States ports are in the Study Area for this FEIS/OEIS; the largest of the ports are in southern Florida, California, or New York. The top ten embarkation points in the United States in 2006 were Miami, Port Canaveral, Port Everglades, Galveston, Los Angeles, New York, Tampa, Long Beach, Seattle, and Honolulu (CLIA, 2006a). In 2005, 50.6 percent of the North American cruise passengers lived in Florida, California, Texas, New York, Massachusetts, and Pennsylvania. North Carolina ranked tenth in the nation for annual passengers which equated to 2.21 percent (213,610) of the national total. South Carolina ranked 20th in the nation for annual passengers which equated to 1.07 percent of the national total. Georgia ranked eighth in the nation for annual passengers which equated to 3.57 percent of the national total. Florida ranked first in the nation for annual passengers which equated to 21.73 percent of the national total (CLIA, 2006b).

3.17.3 Environmental Consequences

The recreational resource analysis addresses recreational activities in the JAX Range Complex. The principal issue is the potential impacts from existing or proposed military activities to affect existing recreational activities. Factors used to assess the significance of impacts on recreational activities include consideration of an alternative's potential to result in increased military restricted activities such that non-participating civilian recreational activities are entirely excluded from use of the area. A serious disruption would occur when civilian recreational activities are entirely excluded from areas in the JAX Range Complex; however, temporary use of alternative recreational areas does not constitute a serious disruption.

3.17.3.1 No Action Alternative

Civilian recreational activities conducted in the OPAREAs include sport fishing and diving, sailing, and other tourist-related activities. These activities make an appreciable contribution to the overall economy of the states within the JAX EIS/OEIS Study Area. Range clearance procedures for safety purposes may temporarily restrict recreational access to the Lake George Range area. The Navy has performed military operations in this area in the past and has not precluded fishing or recreational use in the OPAREAs, even during peak fishing seasons. Sixty percent (22,540,000 angler trips; a combination of all states within the JAX EIS/OEIS Study Area) of recreational fishing occurs within a few miles of shore, and approximately 30 percent (11,270,000 angler trips; a combination of all states within the JAX EIS/OEIS Study Area) occurs in the vicinity of the OPAREAs outside 3 nm. Recreational boaters and divers' activities tend to occur closer to the shore and some larger vessels do travel in the vicinity of the OPAREAs; however, these activities are compatible. When safety clearance of the OPAREAs is required, a NOTMAR is provided in advance that allows boats to select an alternate route or destination without substantially affecting their activities. Navy ships account for three percent of the total ship presence out to 200 nm (CNA, 2001).

Potential stressors to recreation include vessel movements, aircraft overflights, and MEM. These stressors are confined to OPAREAs, and potentially dangerous operations are communicated to all vessels and operators by use of NOTMARs and NOTAMs issued by the USCG and FAA. Under the No Action Alternative, no areas would be exclusive use to military interests, thus excluding civilian, recreational use for more than short-term periods.

The Navy is required to avoid recreational boaters in the range complex when conducting training operations (DoN, 2005). The No Action Alternative does not have a significant impact on recreational activities as they currently exist as a result of the Navy's policy of avoidance. There are no proposed changes to operations at the inland Lake George and Rodman Ranges for the No Action Alternative. The No Action Alternatives does not significantly impact the use of the recreational areas that surround the ranges. Naval activity in U.S. territory would have no significant impact on recreational activities under the No Action Alternative. Naval activity in non-territorial waters would not cause harm to recreational activities under the No Action Alternative.

3.17.3.2 Alternative 1

The proposed increase and modification of training operations, expanded warfare missions, force structure changes, and enhanced range capabilities related to sea and ocean space (as detailed in Chapter 2) would not significantly impact recreational use of the JAX Range Complex in areas analyzed in this FEIS/OEIS. The potential impacts to recreational interests associated with Alternative 1 would be similar to those described for the No Action Alternative. Potential stressors to recreation include vessel movements, aircraft overflights, and MEM. These stressors are confined to OPAREAs, and potentially dangerous operations are communicated to all vessels and operators by use of NOTMARs and NOTAMs issued by the USCG and FAA. Under Alternative 1, no areas would be exclusive use to military interests, thus excluding civilian, recreational use for more than short-term periods.

Implementation of the activities associated with Alternative 1 would have no significant impact. Proposed changes at the inland Lake George and Rodman Ranges are minimal and would not significantly impact the use of the recreational areas that surround the ranges. Proposed Navy operations in U.S. territory would have no significant impact on recreational activities under Alternative 1. Proposed Navy operations in non-territorial waters would not cause harm to recreational activities under Alternative 1.

3.17.3.3 Alternative 2 (Preferred Alternative)

The proposed increase and modifications in training operations, force structure changes, and enhanced mine warfare training capabilities related to sea and ocean space (as detailed in Chapter 2) would not significantly impact recreational use of the JAX Range Complex in areas analyzed in this FEIS/OEIS. Under Alternative 2, the Navy proposes to eliminate all BOMBEX training events that involve dropping explosive (live) ordnance on at-sea targets. The potential impacts to offshore recreational interests associated with Alternative 2 would generally be less than those described for Alternative 1. Proposed changes at the inland Lake George and Rodman Ranges are the same as those proposed for Alternative 1 and would not significantly impact the use of the recreational areas that surround the ranges.

The Navy proposes to conduct mine neutralization operations in the areas currently designated for UNDET training. These activities would take place in the same areas where they now occur.

Implementation of the activities associated with Alternative 2 would have a less than significant impact. Proposed Navy operations in U.S. territory would have no significant impact on recreational activities under Alternative 2. Proposed Navy operations in non-territorial waters would not cause harm to recreational activities under Alternative 2.

3.17.4 Unavoidable Significant Environmental Effects

Based on the preceding analysis, there are no unavoidable significant environmental impacts as a result of implementation of the No Action Alternative, Alternative 1, or Alternative 2.

3.17.5 Summary of Environmental Effects (NEPA and EO 12114)

Conflicts between Navy operations and civilian recreation are confined to operating areas and potentially dangerous operations are communicated to all vessels and operator by use of NOTMARs (issued by the USCG) and NOTAMs (issued by the FAA). Operational activities are required to avoid recreational boaters in the ranges. Recreational activity exclusions would continue in existing areas and would be temporary. Table 3.17-8 is a summary of the environmental effects of the alternatives on the recreational resources in the JAX Range Complex Study Area. Proposed Navy operations in U.S. territory would have no significant impact on recreational activities under the No Action Alternative, Alternative 1, or Alternative 2. Proposed Navy operations in non-territorial waters would not cause harm to recreational activities under the No Action Alternative, Alternative 1, or Alternative 2.

TABLE 3.17-8
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON THE RECREATION IN THE JAX RANGE COMPLEX

Alternatives and Stressors	NEPA (U.S. Territory)	EO 12114 (Non-Territorial Waters, >12 nm)
No Action		
Vessel Movements (Disturbance)	The No Action Alternative would not impact recreational interests in the ocean, air, or inland due to the use of NOTMARs, NOTAMs, and exclusive use areas for Navy activities.	The No Action Alternative would not impact recreational interests in the ocean, air, or inland due to the use of NOTMARs, NOTAMs, and exclusive use areas for Navy activities.
Aircraft Overflights (Disturbance)		
MEM		
Conclusion	Implementation of the No Action Alternative would have no impact on recreation in U.S. territory.	Implementation of the No Action Alternative would not cause harm to recreation in non-territorial waters.
Alternative 1		
Vessel Movements (Disturbance)	Alternative 1 would not impact recreational interests in the ocean, air, or inland due to the use of NOTMARs, NOTAMs, and exclusive use areas for Navy activities.	Alternative 1 would not impact recreational interests in the ocean, air, or inland due to the use of NOTMARs, NOTAMs, and exclusive use areas for Navy activities.
Aircraft Overflights (Disturbance)		
MEM		
Conclusion	Alternative 1 would not impact recreational interests in U.S. territory.	Alternative 1 would not impact recreational interests in the ocean, air, or inland due to the use of NOTMARs, NOTAMs, and exclusive use areas for Navy activities.

TABLE 3.17-8 (Continued))
SUMMARY OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES ON THE RECREATION IN THE JAX RANGE COMPLEX

Alternatives and Stressors	NEPA (U.S. Territory)	EO 12114 (Non-Territorial Waters, >12 nm)
Alternative 2		
Vessel Movements (Disturbance)	Alternative 2 would not impact recreational interests in the ocean, air, or inland due to the use of NOTMARs, NOTAMs, and exclusive use areas for Navy activities.	Alternative 2 would not impact recreational interests in the ocean, air, or inland due to the use of NOTMARs, NOTAMs, and exclusive use areas for Navy activities.
Aircraft Overflights (Disturbance)		
MEM		
Conclusion	Implementation of Alternative 2 would have no impact on recreation in U.S. territory.	Implementation of Alternative 2 would not cause harm to recreation in non-territorial waters.

3.18 ENVIRONMENTAL JUSTICE

3.18.1 Introduction and Methods

Environmental Justice

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, was issued on February 11, 1994. This EO requires each federal agency to identify and address, as appropriate, disproportionately high and adverse human health or environmental impacts of its programs, policies, and activities on minority and low-income populations. The USEPA and CEQ emphasize the importance of incorporating environmental justice review in the analyses conducted by federal agencies under the National Environmental Policy Act of 1969 and of developing mitigation measures that avoid disproportionate environmental impacts on minority and low-income populations. Objectives of this EO as it pertains to this FEIS/OEIS include development of federal agency implementation strategies, identification of minority and low-income populations where proposed federal actions have disproportionately high and adverse human health and environmental impacts, and participation of minority and low-income populations in the public participation process.

Protection of Children

The President issued EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, in 1997. This order requires each federal agency to "…make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children and shall...ensure that its policies, programs, activities, and standards address disproportionate risks to children…." This order was issued because a growing body of scientific knowledge demonstrates that children may suffer disproportionately from environmental health risks and safety risks.

Navy Supplemental Environmental Planning Policy

Both EO 12898 and EO 13045 require each federal agency to identify and address impacts of their programs, policies, and activities. The Navy chose to ensure compliance with both EO 12898 and EO 13045 through implementation of the Chief of Naval Operations (CNO) Supplemental Environmental Planning Policy (September 23, 2004). This policy provides instructions for naval personnel to identify and assess stressors to and disproportionately high and adverse impacts to minorities, low-income populations, and children. A component of this policy institutes processes that result in consistent and efficient consideration of environmental impacts on Navy decision-making.

3.18.1.1 Assessment Methods and Data Used

This section was prepared primarily by compiling and evaluating existing information supplied by the U.S. Census Bureau and state and local governmental agencies and local organizations, as shown in Chapter (References) which outlines the references used to develop the socioeconomic (regional economy, demographics, transportation, and recreation) and public health and safety sections. A review of the resources discussed in this chapter was conducted to identify stressors on individual resources and whether the identified stressors could result in disproportionately high and adverse impacts for the purposes of the environmental justice analysis. An evaluation was then conducted to determine if further analysis was needed to determine if impacts could disproportionately fall on minorities, low-income populations, or children.

3.18.1.2 Warfare Areas and Associated Environmental Stressors

The CEQ's Environmental Justice Guidance under NEPA identifies factors to be considered to the extent practicable when determining whether environmental impacts to minority populations and low-income populations are disproportionately high and adverse. These factors include whether there is or will be an effect on the natural or physical environment that adversely affect a minority population, low-income population, or Indian tribe. Such impacts may include ecological, cultural, human health, economic, or social impacts when those impacts are interrelated to impacts to the natural or physical environment. Other factors to be considered if adverse impacts are projected include: (1) whether they will appreciably exceed those same impacts to the general population or other appropriate comparison group, and (2) whether these populations have been affected by cumulative or multiple exposures from environmental hazards.

The method used to conduct the impacts analysis included a review of conclusions for resources discussed in Chapter 3 to determine if stressors exist for environmental justice. If impacts were identified or if the identified impacts were disproportionately high and adverse for the purposes of environmental justice analysis, an evaluation was conducted to determine if impacts could disproportionately fall on minority populations or low-income populations. A review of the conclusions for the resources in Chapter 3 revealed no major environmental impacts that would require additional analysis.

3.18.2 Affected Environment

The affected environment is primarily open water and the States of North Carolina, South Carolina, Georgia, and Florida. Populations that could be impacted would be fisherman and recreational users of the open water areas who are most likely to live in the coastal areas adjacent to the proposed action. In North Carolina the number of children under the age of five is 7 percent, in South Carolina the number of children under the age of five is 6.6 percent, in Georgia the number of children under the age of five is 7.6 percent, and in Florida the number of children under the age of five is 6.3 percent, which is consistent with the United States, which reports that 6.8 percent of the total population is under the age of five.

The North Carolina poverty level is 13.8 percent, South Carolina is 15 percent, Georgia is 13.7 percent, and Florida is 11.9 percent, which is consistent with the U.S. rate of 12.7 percent. The percentage of the non-white race population (that includes Black, American Indian and Alaska Native, Asian, Native Hawaiian and Other Pacific Islander, Hispanic or Latino Origin, and persons reporting two or more races) is 32.4 percent of the North Carolina total population, 34.9 percent of the South Carolina population, 41 percent of the Georgia total population, and 39 percent of the Florida total population, which is consistent with the U.S. total of 34.2.

North Carolina, South Carolina, Georgia, and Florida were all within four percent of the United States total of the population that had attained high school and bachelor degrees. The 2002 U.S. Census indicates that the greatest number of establishments in the United States was in the retail trade industry. The States of North Carolina, South Carolina, Georgia, and Florida reflected that trend with the retail trade industry leading the states with the greatest number of establishments (35,851, 18,416, 34,050, and 69,543, respectively) (USCB, 2002). The fishing industry, consistently placed fifth in the top ten industries with 13,826 in North Carolina, 6,979 in South Carolina, 13,137 in Georgia, and 28,053 in Florida (USCB, 2007).

3.18.3 Environmental Consequences

Environmental impacts related to Environmental Justice or Protection of Children would occur if they would disproportionately affect minorities, low-income populations, or children. The lack of potential impacts from analysis of Chapter 3 resources means there are no disproportionately high or adverse impacts to minority populations or low-income populations.

3.18.3.1 No Action Alternative

The No Action Alternative is the current training operations. Potential impacts to socioeconomics, public health, and safety would remain unchanged because the No Action Alternative is the continuation of current training operations in established military training areas. With unlikely impacts to open water-related industries, the proposed actions would not result in a finding of any disproportional impacts to minorities, low-income populations, or children. Navy activities in U.S. territory would have no impact on environmental justice under the No Action Alternative. Likewise, Navy activities in non-territorial waters would not cause harm to environmental justice.

3.18.3.2 Alternative 1

Alternative 1 includes increases and modifications to operational training, expanded warfare missions, force structure changes, and enhanced range capabilities. There are no anticipated disproportional impacts to minorities, low-income populations, or children. Navy activities in U.S. territory would have no impact on environmental justice under Alternative 1. Likewise, Navy activities in non-territorial waters would not cause harm to environmental justice.

3.18.3.3 Alternative 2 (Preferred Alternative)

Alternative 2 includes increases and modifications to operational training, force structure changes, and enhanced mine warfare training capabilities. There are no anticipated disproportional impacts to minorities, low-income populations, or children. Navy activities in U.S. territory would have no impact on environmental justice under Alternative 2. Likewise, Navy activities in non-territorial waters would not cause harm to environmental justice.

3.18.4 Unavoidable Environmental Impacts

There were no unavoidable environmental impacts reported as part of the analysis of the resources in Chapter 3. The Air Quality analysis indicated that "minor, short-term" effects could be expected as a result of implementing the No Action Alternative, Alternative 1, or Alternative 2; but all other resources reported no unavoidable environmental impacts anticipated as a result of implementing the No Action Alternative, Alternative 1, or Alternative 2.

3.18.5 Summary of Environmental Impacts (NEPA and EO 12114)

Table 3.18-1 shows a summary of the environmental impacts of the No Action Alternative, Alternative 1, and Alternative 2 on environmental justice. There are no aspects of the proposed action likely to act as stressors to minorities, low-income, and children populations; thus, there are no NEPA or EO 12114 impacts on environmental justice. Implementation of the proposed actions in the No Action Alternative, Alternative 1, or Alternative 2 would not pose disproportionate high or adverse impacts to minority or low-income populations, or environmental health and safety risks to children.

TABLE 3.18-1
SUMMARY OF ENVIRONMENTAL IMPACTS OF THE ALTERNATIVES ON ENVIRONMENTAL JUSTICE IN THE JAX RANGE COMPLEX

Alternative and Stressor	NEPA (U.S. Territory)	EO 12114 (Non-Territorial Waters, >12 nm)
No Action		
No Stressors Identified	The analysis of resources in Chapter 3 did not identify any stressors to the general population that would disproportionately affect minority or low-income populations or the environmental health or level of safety risks to children.	The analysis of resources in Chapter 3 did not identify any stressors to the general population that would disproportionately affect minority or low-income populations or the environmental health or level of safety risks to children.
Conclusion	Implementation of No Action Alternative would have no impact on the environmental justice or protection of children within the Study Area.	Implementation of No Action Alternative would not cause harm to the environmental justice or protection of children within the Study Area.
Alternative 1		
No Stressors Identified	The analysis of resources in Chapter 3 did not identify any stressors to the general population that would disproportionately affect minority or low-income populations or the environmental health or level of safety risks to children.	The analysis of resources in Chapter 3 did not identify any stressors to the general population that would disproportionately affect minority or low-income populations or the environmental health or level of safety risks to children.
Conclusion	Implementation of Alternative 1 would have no impact on the environmental justice or protection of children within the Study Area.	Implementation of Alternative 1 would not cause harm to the environmental justice or protection of children within the Study Area.
Alternative 2		
No Stressors Identified	The analysis of resources in Chapter 3 did not identify any stressors to the general population that would disproportionately affect minority or low-income populations or the environmental health or level of safety risks to children.	The analysis of resources in Chapter 3 did not identify any stressors to the general population that would disproportionately affect minority or low-income populations or the environmental health or level of safety risks to children.
Conclusion	Implementation of Alternative 2 would have no impact on the environmental justice or protection of children within the Study Area.	Implementation of Alternative 2 would not cause harm to the environmental justice or protection of children within the Study Area.

3.19 PUBLIC HEALTH AND SAFETY

3.19.1 Introduction and Methods

Public health and safety issues include potential hazards inherent in flight operations, vessel movements, mine laying, and onshore small arms firing. It is the policy of the Navy to observe every possible precaution in the planning and execution of all activities that occur onshore or offshore to prevent injury to people or damage to property.

3.19.1.1 Assessment Methods and Data Used

All current and proposed training operations were examined for the possibility of civilians entering a hazardous training environment that could cause personal injury. Current Navy safety procedures, according to existing Navy Instructions were assessed for their protection of the general public and whether the procedures would protect the public from hazardous training operations proposed in the Alternatives presented.

3.19.1.2 Warfare Areas and Associated Environmental Stressors

Impacts to public health and safety are assessed in terms of the potential of Navy training operations to injure or compromise civilians in any way. Impacts may arise from physical injury directly from hazardous operations or as an indirect result of hazardous material expended from a training event. Stressors that would likely impact public health and safety include surface and subsurface ship movements, aircraft movements, use of explosives, missiles and various ordnance, expended material, radio frequencies, and aircraft noise. These stressors were identified by conducting a detailed analysis of the warfare areas, operations, and specific activities included in the Alternatives. Table 3.19-1 identifies these stressors by warfare area. Issues regarding hazardous material and hazardous waste are addressed in Section 3.2; water resources in Section 3.3; air quality in Section 3.4; and noise in Section 3.5. Additional safety and health issues are addressed in this section.

3.19.2 Affected Environment

Military, commercial, institutional, and recreational activities take place in the JAX Range Complex. The FAA established Warning Areas for military aircraft operations; however, most of the airspace and seaspace is available for co-use most of the time. Only hazardous activities require exclusive use of an area, and these periods are scheduled and broadcast by the Navy through NOTMARs and NOTAMs.

The public typically accesses the offshore ocean areas for recreational purposes such as sport fishing, sailing, boating, sight seeing, eco-tourism, diving, and swimming. Public access to offshore marine areas is a safety concern for the Navy because its activities occur primarily in international waters. Commercial and recreational vessels generally are allowed to operate in the OPAREAs. During training events or exercises in these areas, weapons delivery events are delayed or cancelled if range areas are not clear. Prior to issuing a "Green Range," Navy personnel must ensure that the hazard footprint of the ordnance being fired is clear of non-participating surface vessels, divers, and aircraft.

TABLE 3.19-1
SUMMARY OF POTENTIAL STRESSORS TO PUBLIC HEALTH AND SAFETY

Warfare Area and Operation	Training Areas	Vessel Movements (Disturbance)	Vessel Movements (Collisions)	Aircraft Overflights (Disturbance)	Mine Warfare Deployment/Recovery	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Material
Mine Warfare (MIW)								
Mine Laying	Lake George Range			✓	✓	✓		✓
MCM	Carrier Operating Areas			✓	✓	✓		
Mine Neutralization	Charleston OPAREA (North and South UNDET Boxes)	✓	✓		✓		✓	✓
Surface Warfare (SUW)								
MISSILEX (A-S)	W-157A (Area 4X) W-159A (Area 5X)			✓		✓	✓	✓
GUNEX (A-S)	W-132, W-133, W-134, W-157, W-158			✓		✓	✓	✓
GUNEX (S-S) Boat	Charleston OPAREA (Areas 11J)	✓	✓			✓		✓
GUNEX (S-S) Ship	JAX OPAREA (AA, BB, and CC)	✓	✓			✓	✓	✓
BOMBEX (A-S) (at sea)	HE, W-158 (31J) NEPM, W157A/B and W-158 A/B			✓		✓	✓	✓
Laser Targeting	W-132, W-133, W-134, W-157, W-158			✓				
GUNEX (S-S) (FAC/FIAC)	Amber Strait: Charleston OPAREA (Boxes Q-9&10, R-9&10)	✓	✓					
VBSS/MIO-Ship	JAX and Charleston OPAREAs	✓	✓					
VBSS/MIO-Helicopter	W-157A (Area 4X) and W-159A (Area 5X)			✓				

TABLE 3.19-1 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO PUBLIC HEALTH AND SAFETY

Warfare Area and Operation	Training Areas	Vessel Movements (Disturbance)	Vessel Movements (Collisions)	Aircraft Overflights (Disturbance)	Mine Warfare Deployment/Recovery	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Material
Air Warfare (AW)								
ACM	W-157A (Areas 3X & 4X)			✓				✓
Air Intercept Control	JAX and Charleston OPAREAs	✓	✓	✓				
ACM Chaff Exercise	W-157A (Areas 3X & 4X)	✓	✓	✓				✓
ACM Flare Exercise	W-157A (Areas 3X & 4X)							
MISSILEX (A-A)	W-132, W-133, W-134, W-157, W-158			✓		✓	✓	✓
MISSILEX (S-A)	JAX and Charleston OPAREAs							✓
Detect-to-Engage	W-132, W-133, W-134, W-157, W-158	✓	✓	✓				
GUNEX (S-A)	JAX OPAREA (AA, BB, and CC)	✓	✓	✓		✓		✓
GUNEX (A-A)	W-157A/W-133 (Area 2X)			✓				✓
Amphibious Warfare (AMW)								
FIREX (S-S) with IMPASS	JAX OPAREA (BB and CC)	✓	✓			✓	✓	✓
Strike Warfare (STW)								
BOMBEX (A-G)	Rodman Range			✓		✓		✓
CSAR and Convoy Operations	Rodman Range			✓				✓
Electronic Combat (EC)								

TABLE 3.19-1 (Continued)
SUMMARY OF POTENTIAL STRESSORS TO PUBLIC HEALTH AND SAFETY

Warfare Area and Operation	Training Areas	Vessel Movements (Disturbance)	Vessel Movements (Collisions)	Aircraft Overflights (Disturbance)	Mine Warfare Deployment/Recovery	Non-Explosive Practice Munitions	Underwater Detonations and High Explosive Ordnance	Military Expended Material
EC Operations - Aircraft	W-132, W-133, W-134, W-157, W-158			✓				
EC Operations - Surface Ships	JAX and Charleston OPAREAs	✓	✓					
Chaff Exercise	JAX and Charleston OPAREAs	✓	✓	✓				✓
Flare Exercise- Helicopter	Lake George Range			✓				✓
Other Training								
SESEF Utilization	5-15 nm east of Mayport	✓	✓					
Precision Anchoring	NS Mayport	✓						
Small Arms with anti-swimmer grenades (MK3A2)	Charleston OPAREA (Area 10L, 12I)	✓	✓				✓	✓

Airspace Controlling Procedures

As a designated ATC facility, FACSFAC JAX, is required to provide air traffic separation consistent with FAA guidelines to ensure the safe, efficient and expeditious flow of air traffic. Radar surveillance and radio communications provide air traffic control separation between high-performance military aircraft and the large volume of commercial aircraft transiting the numerous jet routes off the southeast coast of the United States.

The FACSFAC JAX ATC, call sign SEALORD, is located on NAS Jacksonville and is staffed continuously. In addition to air traffic control services, the facility is responsible for other missions including fleet support, and search and rescue.

Pilots planning to penetrate warning area airspace must contact SEALORD for airspace clearance and SUA assignments. While within a warning area, pilots must remain on SEALORD-assigned frequency.

When possible, SEALORD provides altitude blocks in accordance with pilot requests. However, assignments of altitude blocks do not preclude private and commercial aircraft from entering an SUA.

SEALORD advises flights entering warning areas of other flight operations that may affect airspace use, and provides data on known aircraft carrier operations in the area. SEALORD also provides VFR advisory service to aircraft proceeding to/from or operating inside an SUA or warning area, when able. Specific traffic information is provided as radar coverage permits. Civil aircraft may operate VFR in any warning area below FL180.

Surface and Subsurface Controlling Procedures

Surface and subsurface operations, including transits in the Charleston and JAX OPAREAs, require prior authorization and clearance by FACSFAC JAX. Clearance for a surface area does not include the airspace above or the subsurface below.

Requests for clearance for operations by submarines shall be addressed to the appropriate submarine exercise area coordinator. The Submarine Exercise Area Coordinator individual must obtain clearances from FACSFAC JAX and promulgate the clearance to the individual units and/or commands.

Subsurface/surface mutual use is from the surface to a depth of 98 feet. Submerged operations cover the area from a depth of 98 feet to the sea floor.

Units are required to obtain clearance for all hazardous operations within the OPAREAs. Any operations involving the use of live or non-explosive ordnance must be authorized by FACSFACJAX. To insure maximum safety, all non-explosive and live ordnance expenditures require the issuance of a NOTMAR by FACSFAC JAX. Weapons firings, including small arms and chaff use by surface units, require coordination with airspace controlling procedures.

3.19.2.1 Range Safety Procedures

All range safety precautions and regulations contained in CINCLANTFLTINST 3120.26, Atlantic Fleet Operating Areas and Warning Areas, apply in the Charleston and JAX OPAREAs. Specific safety procedures and requirements for both land and sea ranges are set forth in FACSFAC JAX 3000.1D (DoN, 2001a).

The following general rules apply to area clearances within FACSFAC JAX controlled OPAREAs. Clearance for a surface area does not include the airspace above or the subsurface below. Airspace assignment does not include the surface below. Specific subsurface clearance is required for any subsurface operation.

- Dropping any ordnance, live or non-explosive, or live fire is considered a hazardous event. All hazardous operations and exercises conducted in FACSFACJAX OPAREAs require clearance from FACSFACJAX. The firing or dropping of ordnance, including small arms, must be scheduled with FACSFACJAX. Firing exercises are not authorized without prior FACSFACJAX approval. The unit conducting small arms fire is responsible for the safely clearance of their area.
- Non-hazardous/concurrent air, surface, and subsurface operations, such as independent steaming exercise transits, navigation drills, deck landing qualifications, and helicopter operations, do not require a specific clearance and/or message request. Flare drops are considered a non-hazardous event, but all airborne/surface units must contact FACSFAC JAX prior to dropping flares to prevent errant search-and-rescue reporting. It is the responsibility of individual unit's and/or group's officer in tactical command and/or officer conducting exercise to remain clear of hot and exclusive areas.

3.19.2.2 Range Inspection Procedures

Within the OPAREAs and Warning Areas, all units conducting firing or other hazardous activity must comply with Section 8, Chapter 1 of CINCLANTFLTINST 3120.26 and all Fleet Exercise Publications. FACSFAC JAX promulgates NOTAMs as applicable. Officers conducting the exercise are not permitted to fire or jettison aerial targets unless the area is confirmed to be clear of nonparticipating civilian and military units.

Range inspection at Rodman Target is conducted by Rodman Target Control. Aircraft using the range are required to inform Target Control of run-in heading prior to dropping. No live ordnance, strafing, or lasing is permitted at Rodman Target. All aircraft utilizing Rodman Target are required to make a dry run to observe the range before dropping ordnance.

Use of the Lake George Range requires that aircraft make a preliminary run-in pass to confirm that the impact areas are clear of boats.

Lasing at Rodman Range requires an initial run-in to inspect the target area for large puddles or standing surface water.

3.19.2.3 Coordination Procedures

FACSFACJAX provides range surveillance and functional area support services, including scheduling, monitoring, and controlling air, surface, and subsurface traffic operating in the JAX Range Complex. In addition, the FACSFACJAX mission includes the following coordination activities and procedures:

- Provide air intercept control services;
- Coordinate and provide range control for surface and airborne missile firing exercises;
- Provide coordination and equipment support for opposition forces and data collection teams involved with major fleet exercises;
- Coordinate, schedule, and oversee associated commercial and military aircraft services support (Atlantic Fleet requirements);
- Act as Regional Airspace Coordinator for Department of the Navy activities and the FAA;
- Provide full ATC services by direct interface with FAA and military/civil approach controls; and
- Coordinate operations with others, including but not limited to, USCG Search and Rescue, anti-immigration interdiction defense operations, Federal drug interdiction teams, and Northeast Air Defense Sector.

3.19.3 Environmental Consequences

Public safety impacts would occur if the general public is substantially endangered as a result of Navy activities on the ranges. For each training activity or group of similar activities, an estimate of risk to the general public was formulated, based on the Navy's current set of safety procedures for island and range activities. Activities in the JAX Range Complex would be conducted in accordance with guidance provided in FACSFAC JAX Instruction 3000. The instruction provides operational and safety procedures for all normal range events. Its emphasis is on providing the necessary information to range users so they can operate safely and avoid affecting non-military activities such as shipping, recreational boaters, divers, and commercial or recreational fishermen. Several factors were considered in evaluating the effects of the Navy's activities on public safety. These factors include proximity to the public, ownership, access control, scheduling, public

notification of events, frequency of events, duration of events, range safety procedures, operational control of training events, and safety history.

3.19.3.1 No Action Alternative

Public Safety

Under the No Action Alternative, Fleet training activities would continue to be conducted in the OPAREAs. The ordnance used in offshore operations includes both live and non-explosive munitions. While activities are in progress, a Range Safety Official (RSO) is always on duty. The RSO can halt an activity if a potentially unsafe condition arises. RSOs ensure that projectiles, targets, and missiles operate safely, and that air operations and other hazardous fleet training activities are safely executed in controlled areas.

The Navy's standard range safety procedures are designed to avoid risks to the public and to Navy activities. When aircraft or surface vessels fire ordnance, range procedures and safety practices ensure there are no vessels or aircraft in the intended path or impact area of the ordnance. Before any training event was allowed to proceed, the target area would be determined to be clear using ship sensors, visual surveillance of the range from aircraft and range safety boats, and radar and acoustic data.

The hazard footprint for the ordnance to be used is based on the range of the weapon, and includes a large safety buffer to account for the item going off-target or functioning prematurely. For activities with a large hazard footprint (*e.g.,* MISSILEXs), special sea and air surveillance measures are taken to search for, detect, and clear the area of intended activities. Aircraft are required to make a preliminary pass over the intended target area to ensure it is clear of boats, divers, or other non-participants. Aircraft carrying ordnance are not allowed to over-fly surface vessels.

Target areas would be cleared prior to conducting training, so the only public health and safety issue would be if an activity exceeded the safety area boundaries. Risks to public health and safety are reduced, in part, by providing termination systems on some of the missiles. In those cases where a weapon system did not have a flight termination capability, the target area would be determined to be clear of unauthorized vessels and aircraft, based on the flight distance the vehicle can travel, plus a 5-mile area beyond the system performance parameters.

There are several helicopter operations that take place within the OPAREAs where surface sleds and submerged equipment such as AN/AQS-14A and AN/AQS-20 are towed in the water through simulated threat minefields with the goal of clearing a safe channel through the minefield for the passage of friendly ships. Upon deployment, MH-53 and MH-60S helicopters fly at low altitudes into the training area with one of the AMCM Mine Hunting Systems in-tow. If the aircraft encounters a commercial or recreational vessel, the aircrew either stops forward progress or maneuvers the aircraft safely around the vessel before continuing the mission.

In addition, all training activities must comply with DoD Directive 4540.1, "Use of Airspace by U.S. Military Seas" (DoD, 1981) and OPNAVINST 3770.4A, "Use of Airspace by U.S. Military Aircraft and Firing Over the High Seas" (DoN, 1981), which specify procedures for conducting aircraft operations and for firing missiles and projectiles. The missile and projectile firing areas are to be selected "…so that trajectories are clear of established oceanic air routes or areas of known surface or air activity." (DoD, 1981).

Recreational diving activities within the OPAREAs take place primarily at known diving sites. The locations of popular dive sites are well-documented, dive boats are typically well-marked, and diver down flags would be visible from the ships conducting the proposed training, so possible interactions between training activities within the offshore areas and scuba diving would be minimized.

The remoteness of the ranges also provides a large degree of isolation from coastal population centers. The Navy temporarily limits public access to areas where there is a risk of injury or property damage. The Navy notifies the public of hazardous activities through the use of NOTAMs and NOTMARs.

Prior public notification of Navy training activities, use of known training areas, avoidance of non-military vessels and personnel, and the remoteness of the offshore areas reduce the potential for interaction between the public and Navy vessels. To date, these generally conservative safety strategies have been successful.

Public Health

Management of hazardous material and hazardous waste in conjunction with Navy training exercises in the OPAREAs is discussed in Section 3.2. No substantial releases of these materials to the environment are anticipated.

Material expended on the sea ranges during Navy training exercises would include liquid and soluble constituents of concern that would quickly disperse in the water column. This material would also include solid constituents of concern that would quickly settle to the ocean floor and soon become buried in sediment, coated by corrosion, or encrusted by benthic organisms. Due to the very small quantities of this material relative to the extent of the sea ranges, the volume of the ocean, and the remoteness of the sea ranges relative to human populations, their concentrations in areas of potential human contact generally would be undetectable.

With regard to Electromagnetic Radiation (EMR) hazards, standard operating procedures are in place to protect Navy personnel and the public. These procedures include setting the heights and angles of EMR transmissions to avoid direct exposure, posting warning signs, establishing safe operating levels, and activating warning lights when radar systems are operational. Sources of EMR include radar, navigational aids, and Electronic Warfare (EW). These systems are the same as, or similar to, civilian navigational aids and radars at local airports and television weather stations throughout the United States. EW systems emit EMR similar to that from cell phones, hand-held radios, commercial radio, and television stations. Measures also are in place to avoid excessive exposure from EMR emitted by military aircraft.

Summary

As indicated above, the impacts on public health and safety of each category of JAX training activities are expected to be insignificant under the No Action Alternative. Training operations and major range events would continue at current levels and the elements of the No Action Alternative are anticipated to be less than significant.

3.19.3.2 Alternative 1

Offshore activities proposed under Alternative 1 would have all the components of the No Action Alternative, as well as an increase in training tempo, the introduction of the MH-60R locally and MH-60S as a transient with MIW capabilities, the capability to support MCM, MMA Training

Operations, and MS SSG Training. The safety procedures implemented under this alternative are the same as those described above under the No Action Alternative. The remoteness of the offshore areas, the use of temporary access restrictions, and public notification procedures would substantially reduce potential safety risks during these activities.

Public Safety

Several training activities would experience increases from current levels including increased CAS Support for Fleet Opposition Force (OPFOR) and EW Threat Training, and MS SSG Training. Increases in the number of individual training exercises would increase the potential for conflicts with non-participants. Given the Navy's comprehensive, conservative safety procedures and its excellent safety record for these activities, however, the actual potential for public safety impacts from training activities would remain very low.

Public Health

Management of hazardous material and hazardous waste in conjunction with Navy training exercises in the OPAREAs is addressed in Section 3.11. No substantial releases of this material to the environment are anticipated.

The quantities of material expended on the sea ranges during Navy training exercises would increase moderately under Alternative 1, as compared to the quantities expended under the No Action Alternative. Expended training material would include liquid or soluble constituents of concern that would quickly disperse in the water column. They also would include solid constituents of concern that would quickly settle to the ocean floor and soon become buried in sediment, coated by corrosion, or encrusted by benthic organisms. Due to the very small quantities of this material relative to the extent of the sea ranges, the volume of the ocean, and the remoteness of the sea ranges relative to human populations, their concentrations in areas of potential human contact generally would be undetectable.

Summary

As indicated above, the impacts on public health and safety of each category of JAX training activities are expected to be insignificant under the Alternative 1. Evaluated in aggregate, the elements of the Alternative 1 are anticipated to be less than significant.

3.19.3.3 Alternative 2 (Preferred Alternative)

Training events proposed under Alternative 2 would have all the components of Alternative 1, but with additional increases in operations and the designation of a temporary Mine Warfare Training Area. Under Alternative 2, the Navy proposes to eliminate all BOMBEX training events that involve dropping explosive (live) ordnance on at-sea targets. The safety procedures implemented under this alternative are the same as those described above under the No Action Alternative and Alternative 1. The remoteness of the offshore areas, the use of temporary access restrictions, and public notification procedures would substantially reduce potential safety risks during these activities.

Public Safety

Several training activities would experience increases from current levels. Only the number of training activities would increase; no new types of training would be introduced. The Navy's proposal to eliminate BOMBEX activities involving explosive ordnance would eliminate this as a

potential safety concern. Increases in the number of individual training exercises would increase the potential for conflicts with non-participants. Given the Navy's safety procedures and its excellent safety record for these activities, however, the actual potential for public safety impacts from training activities would remain very low.

Public Health

Management of hazardous material and hazardous waste in conjunction with Navy training exercises in the OPAREAs is addressed in Section 3.11. No substantial releases of this material to the environment are anticipated.

The quantities of material expended on the sea ranges during Navy training exercises would increase substantially under Alternative 2, as compared to the quantities expended under the No Action Alternative. Expended training material would include liquid and soluble constituents of concern that would quickly disperse in the water column. They also would include solid constituents of concern that would quickly settle to the ocean floor and soon become buried in sediment, coated by corrosion, or encrusted by benthic organisms. Due to the very small quantities of this material relative to the extent of the sea ranges, the volume of the ocean, and the remoteness of the sea ranges relative to human populations, their concentrations in areas of potential human contact generally would be undetectable.

Summary

As indicated above, the impacts on public health and safety of each category of JAX training activities are expected to be insignificant under the Alternative 2. Evaluated in aggregate, the elements of Alternative 2 are anticipated to be less than significant.

3.19.4 Unavoidable Environmental Effects

No unavoidable environmental effects were identified.

3.19.5 Summary of Environmental Effects (NEPA and EO 12114)

Table 3.19-2 summarizes the effects for the No Action, Alternative 1, and Alternative 2. Implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in significant impacts to public health and safety in territorial waters. Implementation of the No Action Alternative, Alternative 1 or Alternative 2 would not result in significant harm to public health and safety in the global commons.

TABLE 3.19-2
SUMMARY OF ENVIRONMENTAL EFFECTS ON PUBLIC HEALTH AND SAFETY

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	NEPA (U.S. Territory)	Executive Order 12114 (Non-Territorial Waters, >12 nm)
No Action		
Vessel Movements	SOPs in place to avoid civilian craft and NOTMARs issued to warn recreationists of hazards	SOPs in place to avoid civilian craft and NOTMARs issued to warn recreationists of hazards in international waters
Aircraft Overflights	FACSFAC JAX control aircraft in SUAs; NOTAMs issued to warn commercial and general aviators; SOPs exist for proper handoff of Air Traffic Control. Noise from aircraft would be below levels that cause even temporary impacts to hearing; ordnance detonations occur in areas where civilians would not likely be impacted by the noise	FACSFAC JAX control aircraft in SUAs; NOTAMs issued to warn commercial and general aviators; SOPs exist for proper handoff of Air Traffic Control. Noise from aircraft would be below levels that cause even temporary harm to hearing; ordnance detonations occur in areas where civilians would not likely be harmed by the noise
UNDET and HE Ordnance	SOPs in place to ensure range is clear before ordnance deliveries and detonations	SOPs in place to ensure range is clear before ordnance deliveries and detonations
MEM	Localized accumulation of expended material on sea bottom; limited potential for impacts due to accumulation of expended material	Localized accumulation of expended material on sea bottom; limited potential for harm due to accumulation of expended material
Mine Warfare Deployment/Recovery	No hazardous material or hazardous waste would be expended in the water, intentionally or unintentionally	No hazardous material or hazardous waste would be expended in the water, intentionally or unintentionally
NEPM	NO NEPM would be expended in the water, intentionally or unintentionally	No NEPA would be expended in the water, intentionally or unintentionally
Conclusion	Less than significant impacts to the general public.	Less than significant harm to the general public.
Alternative 1		
Vessel Movements	SOPs in place to avoid civilian craft and NOTMARs issued to warn recreationists of hazards	SOPs in place to avoid civilian craft and NOTMARs issued to warn recreationists of hazards in international waters

TABLE 3.19-2 (Continued)
SUMMARY OF ENVIRONMENTAL EFFECTS ON PUBLIC HEALTH AND SAFETY

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	NEPA (U.S. Territory)	Executive Order 12114 (Non-Territorial Waters, >12 nm)
Aircraft Overflights	FACSFAC JAX control aircraft in SUAs; NOTAMs issued to warn commercial and general aviators; SOPs exist for proper handoff of Air Traffic Control. Noise from aircraft would be below levels that cause even temporary impacts to hearing; ordnance detonations occur in areas where civilians would not likely be impacted by the noise.	FACSFAC JAX control aircraft in SUAs; NOTAMs issued to warn commercial and general aviators; SOPs exist for proper handoff of Air Traffic Control. Noise from aircraft would be below levels that cause even temporary harm to hearing; ordnance detonations occur in areas where civilians would not likely be harmed by the noise.
UNDETs and HE Ordnance	SOPs in place to ensure range is clear before ordnance deliveries and detonations	SOPs in place to ensure range is clear before ordnance deliveries and detonations
MEM	Localized accumulation of expended material on sea bottom; limited potential for impacts due to accumulation of expended material	Localized accumulation of expended material on sea bottom; limited potential for harm due to accumulation of expended material
Mine Warfare Deployment/Recovery	No hazardous material or hazardous waste would be expended in the water, intentionally or unintentionally	No hazardous material or hazardous waste would be expended in the water, intentionally or unintentionally
NEPM	No NEPM would be expended in the water, intentionally or unintentionally	NO NEPM would be expended in the water, intentionally or unintentionally.
Conclusion	Less than significant impacts to the general public.	Less than significant harm to the general public.
Alternative 2		
Vessel Movements	SOPs in place to avoid civilian craft and NOTMARs issued to warn recreationists of hazards	SOPs in place to avoid civilian craft and NOTMARs issued to warn recreationists of hazards in international waters
Aircraft Overflights	FACSFAC JAX control aircraft in SUAs; NOTAMs issued to warn commercial and general aviators; SOPs exist for proper handoff of Air Traffic Control. Noise from aircraft would be below levels that cause even temporary impacts to hearing; ordnance detonations occur in areas where civilians would not likely be	FACSFAC JAX control aircraft in SUAs; NOTAMs issued to warn commercial and general aviators; SOPs exist for proper handoff of Air Traffic Control. Noise from aircraft would be below levels that cause even temporary harm to hearing; ordnance detonations occur in areas where civilians would not likely be harmed by the noise.

TABLE 3.19-2 (Continued)
SUMMARY OF ENVIRONMENTAL EFFECTS ON PUBLIC HEALTH AND SAFETY

	Summary of Effects and Impact Conclusion	
Alternative and Stressor	NEPA (U.S. Territory)	Executive Order 12114 (Non-Territorial Waters, >12 nm)
	impacted by the noise.	
UNDETs and HE Ordnance	SOPs in place to ensure range is clear before ordnance deliveries and detonations	SOPs in place to ensure range is clear before ordnance deliveries and detonations
MEM	Localized accumulation of expended material on sea bottom; limited potential for impacts due to accumulation of expended material	Localized accumulation of expended material on sea bottom; limited potential for harm due to accumulation of expended material
Mine Warfare Deployment/Recovery	No hazardous material or hazardous waste would be expended in the water, intentionally or unintentionally	No hazardous material or hazardous waste would be expended in the water, intentionally or unintentionally
NEPM	NO NEPM would be expended in the water, intentionally or unintentionally	No NEPM would be expended in the water, intentionally or unintentionally
Conclusion	Less than significant impacts to the general public.	Less than significant harm to the general public.

3.20 SUMMARY OF ATLANTIC FLEET ACTIVE SONAR TRAINING AND AGGREGATE IMPACTS IN THE JAX RANGE COMPLEX

The JAX Range Complex FEIS/OEIS incorporates by reference the Atlantic Fleet Active Sonar Training (AFAST) FEIS/OEIS (DoN, 2008). This section provides information on the AFAST activities proposed in the JAX Range Complex; AFAST activities proposed outside the JAX Range Complex are discussed in Chapter 6, Cumulative Impacts. Because sonar use and sonar effects cross and go beyond Range Complex boundaries, the Navy comprehensively analyzed all Atlantic Fleet sonar training in a separate EIS/OEIS. Active sonar training, however, is an integral component of fleet readiness training within each range complex; therefore, the Final AFAST FEIS/OEIS analysis and conclusions are summarized herein so the direct and indirect impacts of all components of fleet training in the JAX Range Complex can be comprehensively evaluated under NEPA and EO 12114. The reader should refer to the Final AFAST EIS/OEIS (available at http://afasteis.gcsaic.com) for the full description and analysis of active sonar activities along the East Coast and within the Gulf of Mexico. The Final AFAST EIS/OEIS was released to the public on December 12, 2008 (73 FR 75715). The Navy's consultation with NMFS, under the MMPA, concluded when the Final Rule was filed for public inspection with the Office of the Federal Register (74 FR 4844) on January 22, 2009 and the annual Letter of Authorization was subsequently issued. The Navy's consultation with NMFS, in accordance with Section 7 of the ESA, concluded when the Biological Opinion was signed on January 16, 2009 and the annual Incidental Take Statement was subsequently issued.

The Final AFAST EIS/OEIS analyzes the potential environmental effects associated with the the improved extended echo ranging (IEER) system during Atlantic Fleet training exercises. The IEER system consists of an explosive source sonobuoy (AN/SSQ-110A) and an air deployable active receiver (ADAR) sonobuoy (AN/SSQ-101). The Navy is developing the Advanced Extended Echo Ranging (AEER) system as a replacement to the IEER system. The AEER system would use a new active sonobuoy (AN/SSQ-125) that utilizes a tonal (or a ping) versus an impulsive (or explosive) sound source as a replacement for the AN/SSQ-110A. The AEER system will still use the ADAR sonobuoy as the systems receiver. In addition, the Final AFAST EIS/OEIS incorporates research, development, test, and evaluation (RDT&E) active sonar activities similar, and coincident with, Atlantic Fleet training. For the purposes of the Final AFAST EIS/OEIS, "active sonar activities" refers to training, maintenance, and RDT&E activities involving mid- and high-frequency active sonar and explosive source sonobuoy (AN/SSQ-110A). During active sonar activities, surface ships, submarines, helicopters, and marine patrol aircraft use active sonar during ASW, MIW, object detection/navigation, and maintenance events. The activities involving active sonar described in the AFAST FEIS/OEIS are not new and do not involve significant changes in systems, tempo, or intensity from past activities.

The Navy analyzed four geographic alternatives in the Final AFAST EIS/OEIS. Under Alternative 1, active sonar areas would be designated using an environmental analysis to determine locations that would minimize environmental effects to biological resources while still meeting operational requirements. Under Alternative 2, active sonar training areas would be designated using the same environmental analysis conducted under Alternative 1; however, these areas would be adjusted seasonally to minimize effects to marine resources. Under Alternative 3, sonar training would not occur within certain environmentally sensitive areas, which would be designated areas of increased awareness. The No Action Alternative can be regarded as continuing with the present course of action. Under the No Action Alternative, the Navy would continue conducting active sonar activities within and adjacent to existing OPAREAs rather than designate active sonar areas or areas of increased awareness.

The Deputy Assistant Secretary of the Navy (Environment), considered the following factors: the Congressional mandates in 10 U.S.C. § 5062; the Navy, DoD, and other federal agencies' operational, testing, and training requirements; environmental impacts; and comments received during the EIS/OEIS process in determining whether and how to designate areas where active sonar activities would occur within and adjacent to existing OPAREAs located along the East Coast of the U.S. and in the Gulf of Mexico. After carefully weighing all of these factors and analyzing the data presented in the EIS/OEIS, the DASN (E) determined that the Preferred Alternative, the No-Action Alternative, best meets the requirements for the proposed AFAST active sonar activities. The DASN (E) signed the Navy's Record of Decision (74 FR 5650) on January 23, 2009.

3.20.1 Summary of Sonar Activities in the JAX Range Complex

3.20.1.1 Description of Sonar Systems

There are two basic types of sonar: passive and active.

- ***Passive sonars*** are only used to listen to incoming sounds. Passive sonars do not emit sound energy into the water and cannot acoustically affect the environment.
- ***Active sonars*** emit acoustic energy to obtain information concerning a distant object from the reflected sound energy. Active sonars are the most effective detection systems against modern ultra-quiet submarines and sea mines.

Table 3.20-1 identifies the active acoustic systems acoustically modeled in the AFAST FEIS/OEIS. The systems that were not acoustically modeled include systems typically operated at frequencies greater than 200 kHz, such as the AN/AQS-14 or AN/AQS-20. Since active sonar sources operating at 200 kHz or higher attenuate rapidly and are at or outside the upper frequency limit of marine mammals with ultrasonic hearing, further consideration and modeling of these higher frequency acoustic sources were not warranted. Refer to Section 2.3 and Appendix C in the AFAST FEIS/OEIS for more information on sonar systems used during Atlantic fleet training.

TABLE 3.20-1
ACOUSTIC SYSTEMS ANALYZED

Systems That Were Modeled			
System	*Frequency*	*Associated Platform*	*System Description*
AN/SQS-53	3.5 kHz	DDG and CG hull-mounted sonar	ASW search, detection, & localization; utilized 70% in search mode and 30% track mode
AN/AQS-13	10.0 kHz	Helicopter dipping sonar	ASW sonar lowered from hovering helicopter (approximately 10 pings/dip, 30 seconds between pings)
AN/AQS-22	10.0 kHz	Helicopter dipping sonar	ASW sonar lowered from hovering helicopter (approximately 10 pings/dip, 30 seconds between pings)
Explosive source sonobuoy (AN/SSQ-110A)	Impulsive broadband	MPA deployed	ASW system consists of explosive acoustic source buoy (contains two 4.1 lb charges) and expendable passive receiver sonobuoy
AN/SQQ-125	MF	MPA deployed	ASW system consist of active sonobuoy and expendable passive receiver sonobuoy
AN/SQQ-32	HF	MCM over the side system	Detect, classify, and localize bottom and moored mines

TABLE 3.20-1 (Continued)
ACOUSTIC SYSTEMS ANALYZED

Systems That Were Modeled			
System	*Frequency*	*Associated Platform*	*System Description*
AN/BQS-15	HF	Submarine navigational sonar	Only used when entering and leaving port
AN/SQS-56	MF	FFG hull-mounted sonar	ASW search, detection, & localization; Utilized 70% in search mode and 30% track mode
MK-48 Torpedo	HF	Submarine fired exercise torpedo	Recoverable and non-explosive exercise torpedo; sonar is active approximately 15 min per torpedo run
MK-46 and MK-54 Torpedo	HF	Surface ship and aircraft fired exercise torpedo	Recoverable and non-explosive exercise torpedo; sonar is active approximately 15 min per torpedo run
AN/SLQ-25 (NIXIE)	MF	DDG, CG, and FFG towed array	Towed countermeasure to avert localization and torpedo attacks (approximately 20 mins per use)
AN/SQS-53 and AN/SQS-56 (Kingfisher)	MF	DDG, CG, and FFG hull-mounted sonar (object detection)	Only used when entering and leaving port
AN/BQQ-10 and AN/BQQ-5	MF	Submarine hull-mounted sonar	ASW search and attack (approximately one ping per two hours when in use)
Tonal sonobuoy (DICASS) (AN/SSQ-62)	8 kHz	Helicopter and MPA deployed	Remotely commanded expendable sonar-equipped buoy (approximately 12 pings per use, 30 secs between pings)
ADC MK-1, MK-2, MK-3, and MK-4	MF	Submarine deployed countermeasure	Expendable acoustic countermeasure (approximately 20 mins per use)
Submarine deployed countermeasure (NAE)	MF	Submarine deployed countermeasure	Expendable acoustic countermeasure (20 mins per use)

3.20.1.2 Description of Active Sonar Activities

Because the Navy conducts many different types of Independent Unit Level Training (ULT), Coordinated ULT, Strike Group training, maintenance, and RDT&E active sonar activities, the Navy grouped similar events to form representative scenarios for analysis in the Final AFAST EIS/OEIS. Specific active sonar events are described in more detail in Appendix C of the Final AFAST EIS/OEIS. Note that specific exercise names and other details occasionally change as required to meet the current operational needs. Table 3.20-2 summarizes the active sonar scenarios that typically occur in the JAX Range Complex and seaward. Refer to Section 2.3 and Appendix C in the Final AFAST EIS/OEIS for more detail on Atlantic fleet sonar training events.

In the JAX Range Complex, all ASW training would occur beyond 12 nm from shore.

TABLE 3.20-2
SUMMARY OF ACTIVE SONAR ACTIVITIES IN THE JAX RANGE COMPLEX AND SEAWARD

Event Name	Training Event Scenarios	Events per Year*	Length of Overall Event	Typical Event Area Dimensions	Equipment or Action	Equipment Use or Action per Event	Effects Considered
ULT- Surface Ship ASW	One or two surface ships (CG, DDG, and FFG) conducting ASW localization and tracking training.	292	2 to 6 hours	5 nm x 10 nm to 30 nm x 40 nm	Surface ship MFA ASW sonar (AN/SQS-53 or AN/SQS-56)	One to two ships (CG, DDG, or FFG) pinging 1 to 3 hours each	MFA sonar exposure
					Acoustic countermeasures (AN/SLQ-25 NIXIE, MK-1, MK-2, MK-3, MK-4, or Noise Acoustic Emitter)	Two hours per NIXIE 20 minutes per MK-1, MK-2, MK-3, or MK-4 Noise Acoustic Emitter	MFA sonar exposure and expended material
					MK-46 or MK-54 Torpedo	Exercise torpedoes could be used for RDT&E	HFA sonar exposure, direct strike, and expended material
					MK-39 EMATT or MK-30 target	One EMATT or MK-30 (recoverable) per exercise may be used as a target	Direct strike and expended material
					Vessel movement	1 to 2 ships maneuvering	Vessel strike
ULT- Surface Ship Object Detection	One ship (CG, DDG, and FFG) conducting object detection during transit in/out of port for training and safety during reduced visibility.	40	1 to 2 hours	5 nm x 10 nm	Surface ship MFA ASW sonar (AN/SQS-53 or AN/SQS-56 Kingfisher) operated in object detection mode	One ship (CG, DDG, or FFG) pinging for 1 to 2 hours	MFA sonar exposure
					Vessel movement	One ship maneuvering	Vessel strike

TABLE 3.20-2 (Continued)
SUMMARY OF ACTIVE SONAR ACTIVITIES IN THE JAX RANGE COMPLEX AND SEAWARD

Event Name	Training Event Scenarios	Events per Year*	Length of Overall Event	Typical Event Area Dimensions	Equipment or Action	Equipment Use or Action per Event	Effects Considered
ULT- Helicopter ASW	One helicopter conducting ASW training using dipping sonar or sonobuoys	115	2 to 4 hours	20 nm x 30 nm	Helicopter dipping sonar (AN/AQS-13 or AN/AQS-22)	One helicopter dipping up to two hours (10 pings per five-minute dip)	MFA sonar exposure
					Tonal sonobuoy (DICASS) (AN/SSQ-62)	Up to four tonal sonobuoys (DICASS)	MFA sonar exposure, direct strike, and expended material
					Passive sonobuoy (DIFAR) AN/SSQ-53D/E	Number of sonobuoys deployed can vary	Expended material and direct strike
					MK-46 or MK-54 Torpedo	Exercise torpedoes could be used for RDT&E	HFA sonar exposure, direct strike, and expended material
					MK-39 EMATT or MK-30 target	One EMATT or MK-30 (recoverable) per exercise may be used as a target	Direct strike and expended material
ULT- Submarine ASW	One submarine conducting ASW and SUW training using passive and active sonar.	45	2 to 3 days	30 nm x 40 nm	Submarine MFA sonar (AN/BQQ-10)	One submarine pinging once per two hours (average 36 pings per event)	MFA sonar exposure
					MK-48 Torpedo	Number of exercise torpedoes could be used in a single RDT&E event could vary	HFA sonar exposure, direct strike, and expended material
					Vessel movement	One submarine maneuvering	Vessel strike
					MK-39 EMATT or MK-30 target	One EMATT or MK-30 (recoverable) per exercise may be used as a target	Direct strike and expended material
					Tactical page buoy	One tactical page buoy may be deployed	Expended materials

TABLE 3.20-2 (Continued)
SUMMARY OF ACTIVE SONAR ACTIVITIES IN THE JAX RANGE COMPLEX AND SEAWARD

Event Name	Training Event Scenarios	Events per Year*	Length of Overall Event	Typical Event Area Dimensions	Equipment or Action	Equipment Use or Action per Event	Effects Considered
ULT- Submarine Navigational	One submarine operating sonar for navigation and object detection during transit in/out of port during reduced visibility.	57	1 to 2 hours	5 nm x 10 nm	Submarine MFA and HFA object detection sonar (AN/BQQ-10 or AN/BQS-15)	One submarine pinging 1 t0 2 hours	MFA and HFA sonar exposure
					Vessel movement	One submarine maneuvering	Vessel strike
ULT- MPA ASW (tonal sonobuoy)	One MPA conducting ASW submarine localization and tracking training using tonal sonobuoys.	356	2 to 8 hours	30 nm x 30 nm to 60 nm x 60 nm	Tonal sonobuoy (DICASS) (AN/SSQ-62)	Up to 10 tonal sonobuoys (DICASS)	MFA sonar exposure, direct strike, and expended material
					Passive sonobuoy (DIFAR) AN/SSQ-53D/E	Number of sonobuoys deployed can vary	Expended material and direct strike
					MK-46 or MK-54 Torpedo	Exercise torpedoes could be used for RDT&E	HFA sonar exposure, direct strike, and expended material
					MK-39 EMATT (repeater) and or MK-30 Target	One EMATT or MK-30 (recoverable) per exercise may be used as a target	direct strike and expended material
ULT- MPA ASW (explosive source sonobuoy)	One MPA conducting ASW submarine localization and tracking training using explosive source sonobuoy (AN/SSQ-110A).	34	2 to 8 hours	60 nm x 60 nm	Explosive source Sonobuoy (AN/SSQ-110A)	Up to 14 AN/SQ-110A sonobuoys	Explosive byproducts, pressure wave exposure, impulsive sound exposure, direct strike, and expended material
					Receiver (ADAR) Sonobuoy (AN/SSQ-101)	Up to five AN/SSQ-101 sonobuoys	Direct Strike and expended material
Coordinated ULT- Southeastern Anti-Submarine	An exercise with TWO DDGS, one FFG with embarked helicopter, two submarines, and one MPA	5	5 to 7 days	30 nm x 30 nm	Surface ship MFA ASW sonar (AN/SQS-53 or AN/SQS-56)	Two to three ships pinging daily for several hours	MFA sonar exposure
					Helicopter ASW dipping sonar (AN/AQS-13 or AN/AQS-22)	One helicopter dipping several times daily (10 pings per five-minute dip)	MFA sonar exposure

TABLE 3.20-2 (Continued)
SUMMARY OF ACTIVE SONAR ACTIVITIES IN THE JAX RANGE COMPLEX AND SEAWARD

Event Name	Training Event Scenarios	Events per Year*	Length of Overall Event	Typical Event Area Dimensions	Equipment or Action	Equipment Use or Action per Event	Effects Considered
					Submarine MFA sonar (AN/BQQ-5 or AN/BQQ-10)	One submarine pinging up to 4 times daily	MFA sonar exposure
					Acoustic countermeasures (AN/SLQ-25 NIXIE, MK-2, MK-3, or Noise Acoustic Emitter)	Two hours per NIXIE 20 minutes per MK-2, MK-3, and Noise Acoustic Emitter	MFA sonar exposure, direct strike, and expended material
					Tonal sonobuoy (DICASS) (AN/SSQ-62)	One MPA dropping up to eight sonobuoys in one day; 24 sonobuoys for entire SEASWITI	MFA sonar exposure, direct strike, and expended material
					Passive sonobuoy (DIFAR) AN/SSQ-53D/E	Number of sonobuoys deployed can vary	Expended material and direct strike
					Vessel movement	Three to four ships maneuvering	Vessel strike
Coordinated ULT- Integrated ASW Course (IAC)	An exercise with three DDGs, one CG, one FFG, two to three helicopters, one to two submarines, and one MPA	2.4	2 to 5 days	120 nm X 60 nm	Surface ship MFA ASW sonar (AN/SQS-53 or AN/SQS-56)	Five ships pinging for up to 10 hours	MFA sonar exposure
					Helicopter ASW dipping sonar (AN/AQS-13 or AN/AQS-22)	One helicopter dipping up to one hour (10 pings per five-minute dip)	MFA sonar exposure
					Submarine MFA sonar (AN/BQQ-5 or AN/BQQ-10)	One - two submarines pinging up to six times each	MFA sonar exposure
					Acoustic countermeasures (AN/SLQ-25 NIXIE, MK-2, MK-3, or Noise Acoustic Emitter)	Two hours per NIXIE 20 minutes per MK-2, MK-3, and Noise Acoustic Emitter	MFA sonar exposure, direct strike, and expended material

TABLE 3.20-2 (Continued)
SUMMARY OF ACTIVE SONAR ACTIVITIES IN THE JAX RANGE COMPLEX AND SEAWARD

Event Name	Training Event Scenarios	Events per Year*	Length of Overall Event	Typical Event Area Dimensions	Equipment or Action	Equipment Use or Action per Event	Effects Considered
					Tonal sonobuoy (DICASS) (AN/SSQ-62)	Helicopters and/or MPA dropping up to 36 sonobuoys	MFA sonar exposure, direct strike, and expended material
					Passive sonobuoy (DIFAR) AN/SSQ-53D/E	Number of sonobuoys deployed can vary	Expended material and direct strike
Coordinated ULT- Group Sail	An exercise with two DDGs with embarked helicopters, and one submarine.	13	Two to three days	30 nm x 30 nm	Surface ship MFA ASW sonar (AN/SQS-53 or AN/SQS-56)	Two-three ships pinging for several hours	MFA sonar exposure
					Helicopter ASW dipping sonar (AN/AQS-13 or AN/AQS-22)	One helicopter dipping up to six hours (10 pings per five-minute dip)	MFA sonar exposure
					Submarine MFA sonar (AN/BQQ-5 or AN/BQQ-10)	One submarine pinging up to two times	MFA sonar exposure
					Acoustic countermeasures (AN/SLQ-25 NIXIE, MK-2, MK-3, or Noise Acoustic Emitter)	Two hours per NIXIE 20 minutes per MK-2, MK-3, and Noise Acoustic Emitter	MFA sonar exposure, direct strike, and expended material
					Tonal sonobuoy (DICASS) (AN/SSQ-62)	One helicopter dropping up to four sonobuoys	MFA sonar exposure, direct strike, and expended material
					Passive sonobuoy (DIFAR) AN/SSQ-53D/E	Number of sonobuoys deployed can vary	Expended material and direct strike
					Vessel movement	Three ships maneuvering	Vessel strike
Coordinated ULT-	Two submarines operating against each other as part of the SCC for prospective submarine	1.6	3 to 5 days	30 nm x 50 nm	Submarine MFA sonar (AN/BQQ-5 or AN/BQQ-10)	One submarine pinging up to four times daily	MFA sonar exposure

TABLE 3.20-2 (Continued)
SUMMARY OF ACTIVE SONAR ACTIVITIES IN THE JAX RANGE COMPLEX AND SEAWARD

Event Name	Training Event Scenarios	Events per Year*	Length of Overall Event	Typical Event Area Dimensions	Equipment or Action	Equipment Use or Action per Event	Effects Considered
					Acoustic countermeasures (AN/SLQ-25 NIXIE, MK-2, MK-3, or Noise Acoustic Emitter)	20 minutes per MK-2, MK-3, and Noise Acoustic Emitter	MFA sonar exposure, direct strike, and expended material
					Vessel movement	Two submarines maneuvering	Vessel strike
Strike Group Training- ESG COMPTUEX and CSG COMPTUEX and similar RDT&E	Intermediate level battle group exercise designed to create a cohesive CSG/ ESG prior to deployment or JTFEX. Three DDGs, one FFG, helicopters, one MPA, and two submarines.	2.4 training events and similar RDT&E	21 days	60 nm x 120 nm	Surface ship MFA ASW sonar (AN/SQS-53 and AN/SQS-56)	Four ships (CG, DDG, or FFG) pinging approximately 60 hours each over 10 days	MFA sonar exposure
					Helicopter ASW dipping sonar (AN/AQS-13 or AN/AQS-22)	One to four helicopters (10 pings per five-minute dip) during CSG COMPTUEX	MFA sonar exposure
					Submarine MFA sonar (AN/BQQ-5 or AN/BQQ-10)	Two submarines pinging up to 16 times each	MFA sonar exposure
					Acoustic countermeasures (AN/SLQ-25 NIXIE, MK-2, MK-3, or Noise Acoustic Emitter)	Two hours per NIXIE 20 minutes per MK-2, MK-3, and Noise Acoustic Emitter	MFA sonar exposure, direct strike, and expended material
					Tonal sonobuoy (DICASS) (AN/SSQ-62)	MPA and/or helicopter dropping three to 10 sonobuoys for a total of up to 218 sonobuoys over duration of event	MFA sonar exposure, direct strike, and expended material
					Passive sonobuoy (DIFAR) AN/SSQ-53D/E	Number of sonobuoys deployed can vary	Expended material and direct strike
					Explosive source sonobuoy (AN/SSQ-110A)	Two MPA dropping up to 14 AN/SQ-110A sonobuoys	Explosive byproducts, pressure wave exposure, impulsive sound exposure, direct strike, and expended material

TABLE 3.20-2 (Continued)
SUMMARY OF ACTIVE SONAR ACTIVITIES IN THE JAX RANGE COMPLEX AND SEAWARD

Event Name	Training Event Scenarios	Events per Year*	Length of Overall Event	Typical Event Area Dimensions	Equipment or Action	Equipment Use or Action per Event	Effects Considered
					Receiver (ADAR) sonobuoy (AN/SSQ-101)	Up to five AN/SSQ-101 sonobuoys	Direct Strike and expended material
					Vessel movement	Six ships (CG, DDG, FFG, or submarine) maneuvering	Vessel strike
Strike Group training- JTFEX	Final fleet exercise prior to deployment of the CSG and ESG. Serves as a ready-to-deploy certification for all units. Four DDGs, two FFGs, one helicopter, one MPA, and three submarines.	1.2	10 days	60 nm x 80 nm up to 180 nm x 180 nm	Surface ship MFA ASW sonar (AN/SQS-53 or AN/SQS-56)	Six ships (CG, DDG, FFG) pinging up to 25 hours each	MFA sonar exposure
					Helicopter ASW dipping sonar (AN/AQS-13 or AN/AQS-22)	One helicopters dipping for up to one hour (10 pings per five-minute dip)	MFA sonar exposure
					Submarine MFA sonar (AN/BQQ-5 or AN/BQQ-10)	Three submarines pinging twice each	MFA sonar exposure
					Acoustic countermeasures (AN/SLQ-25 NIXIE, MK-2, MK-3, or Noise Acoustic Emitter)	Two hours per NIXIE 20 minutes per MK-2, MK-3, and Noise Acoustic Emitter	MFA sonar exposure, direct strike, and expended material
					Tonal sonobuoy (DICASS) (AN/SSQ-62)	One MPA and/or one helicopter dropping three to 10 sonobuoys for a total of up to 174 sonobuoys over duration of event	MFA sonar , direct shrike, and expended material
					Passive sonobuoy (DIFAR) AN/SSQ-53D/E	Number of sonobuoys deployed can vary	Expended material and direct strike
					explosive source sonobuoy (AN/SSQ-110A)	Two MPA dropping up to 14 AN/SSQ-110A sonobuoys	Explosive byproducts, pressure wave exposure, impulsive sound exposure, direct strike, and expended material
					receiver (ADAR) sonobuoy (AN/SSQ-101)	Up to 5 AN/SSQ-101 sonobuoys	Direct Strike and expended material

TABLE 3.20-2 (Continued)
SUMMARY OF ACTIVE SONAR ACTIVITIES IN THE JAX RANGE COMPLEX AND SEAWARD

Event Name	Training Event Scenarios	Events per Year*	Length of Overall Event	Typical Event Area Dimensions	Equipment or Action	Equipment Use or Action per Event	Effects Considered
					Vessel movement	Nine ships (CG, DDG, FFG, or submarine) maneuvering	Vessel strike
Surface Ship Sonar Maintenance	Pier side and at-sea maintenance to sonar system.	263	0.2 to 4 hours		Surface ship MFA ASW sonar (AN/SQS-53 OR AN/SQS-56)	One ship (CG, DDG, or FFG) pinging	MFA sonar exposure
Submarine Sonar Maintenance	Pier side and at-sea maintenance to sonar system.	45	1 hour		Submarine MFA sonar (AN/BQQ-5 or AN/BQQ-10)	One submarine pinging for up to one hour (60 pings per hour)	MFA sonar exposure

** Events per year is an estimate of the average number Atlantic Fleet sonar activities or sonar portion of other activities that occur annually within the JAX/Charleston OPAREA and seaward of the JAX/Charleston OPAREA. Some Coordinated ULT exercises and Strike Group Training are shown as less than one event; this indicates that only a portion of that event is expected to occur in the JAX/Charleston OPAREA.*

ADC – Acoustic Device Countermeasure; CG – Guided Missile Cruiser; COMPTUEX – Composite Training Unit Exercise; DDG – Guided Missile Destroyer; DICASS – Directional Command-Activated Sonobuoy System; EMATT – Expendable Mobile Acoustic Training Target; FFG – Fast Frigate; HFA – High-Frequency Active; IEER – Improved Extended Echo Ranging; kHz – Kilohertz; JTFEX – Joint Task Force Exercise; MFA – Mid-Frequency Active; MPA – Maritime Patrol Aircraft; nm – Nautical Mile; TORPEX – Torpedo Exercise

3.20.2 Summary of Environmental Consequences

In the following sections, a summary of the environmental consequences due to sonar activities in the JAX Range Complex is provided by resource area. This is followed by a discussion of the aggregate environmental consequences by resource area due to the combined effects of:

1. Sonar activities occurring in the JAX Range Complex under the selected alternative presented in the Final AFAST EIS/OEIS and
2. The other training events, RDT&E activities, and range enhancements proposed for each alternative in this EIS/OEIS.

Only the resource areas potentially impacted by sonar activities are presented below. Other resources potentially impacted by range complex activities, but not affected by sonar activities, are discussed previously in this chapter.

For each resource area potentially affected by sonar activities, the relevant section of the Final AFAST EIS/OEIS is referenced. The reader should refer to the Final AFAST EIS/OEIS for the full discussion and analysis of environmental consequences due to sonar activities.

3.20.2.1 Bathymetry and Sediments

Summary of Environmental Consequences Due to AFAST

Potential effects to bathymetry and sediments are discussed in Section 4.3 of the AFAST FEIS/OEIS. Any potential effects are due to material expended during sonar activities and not recovered. Material expended during sonar activities is summarized in Table 3.20-3.

Because a limited quantity of material would be expended over a large operational area, there would be no significant accumulation of expended material. Material on the sea floor would eventually be covered by sediments or be overgrown by marine life. Under the AFAST selected alternative, therefore, there would be no significant impact to bathymetry or sediments in territorial waters due to expended material or sediment displacement. In addition, there would be no significant harm to bathymetry or sediments in non-territorial waters due to expended material or sediment displacement.

Aggregate Environmental Consequences

The potential impacts to bathymetry and sediments due to range complex activities (other than sonar activities) are presented in Section 3.1 of this FEIS/OEIS. Under all alternatives presented in this FEIS/OEIS, when the potential impacts due to sonar activities are included with the potential impacts due to range complex activities, there will be no significant impact to bathymetry or sediments in territorial waters due to expended material or sediment displacement. In addition, there will be no significant harm to bathymetry or sediments in non-territorial waters due to expended material or sediment displacement.

3.20.2.2 Hazardous Material and Hazardous Waste

Summary of Environmental Consequences Due to AFAST

Potential effects due to both hazardous and non-hazardous constituents of material expended during sonar activities are discussed in Section 4.3 of the Final AFAST EIS/OEIS. The components of material expended during sonar activities are provided in Table 3.20-3. Most of these components are non-

TABLE 3.20-3
MATERIAL EXPENDED DURING SONAR ACTIVITIES

Device	Description	Expended Material	Number Expended per Year*
Sonobuoys	A sonobuoy is an expendable device containing either an active or passive sonar or a bathythermic (temperature measuring) device and a radio transmitter or transmitter/receiver. Sonobuoys are cylindrical devices about 12.5 cm (4.9 in) in diameter and 91 cm (36 in) long, weighing from 6 to 18 kg (14 to 39 lbs). Following deployment, sonobuoys descend to specified depths and transmit data measurements to a surface unit via an electrical suspension cable or radio frequency signal. At water impact, a seawater battery activates and deployment initiates. The parachute assembly (aircraft only) is jettisoned and sinks away from the unit, while a float containing an antenna is inflated. The subsurface assembly descends to a selected depth, and the sonobuoy case falls away and sea anchors deploy to stabilize the hydrophone (underwater microphone). The operating life of the seawater battery is eight hours, after which the sonobuoy scuttles itself and sinks to the ocean bottom.	• Parachute assembly (12-18 inch diameter nylon chute) and nylon cord • Fabric floatation unit • Lead chloride, cuprous thiocyanate, or silver chloride batteries, Lithium batteries, or Lithium iron disulfide thermal batteries (XBT does not contain a battery) • Plastic casing • Metal clips • Nylon strap • Electrical wiring (90-4—ft of copper wiring, depending on type of sonobuoy) • Drogue (fabric and frame; on some sonobuoys) • Hydrophone/transducer assembly (configuration and amount of material varies depending on type of sonobuoy – sonobuoys may contain up to 38 lbs of material)	• Listening sonobuoys: 14,252 • Tonal sonobuoys: 3032 • Explosive source sonobuoys: 237 • Receiver sonobuoys: 84
Acoustic Device Countermeasure (ADC)	Typically cylinder-shaped about 40 to 110 inches long, 3 to 6 inches in diameter, and weighing between 7 and 125 lbs.	• Lithium sulfur dioxide battery • Metal casing • Wires	• 146 ADCs
EMATT	Approximate shape of 5 by 36 inches with a weight of 21 lbs.	• Parachute assembly (12-18 inch diameter nylon chute) and nylon cord • Lithium sulfur dioxide battery • Metal casing • Metal clips • Nylon strap • Electrical wiring	• 384 EMATTs

**The quantity shown is an estimate of the portion of overall AFAST expended material anticipated to be used in the JAX Range Complex or seaward of the JAX Range Complex.*

hazardous and non- reactive and, therefore, would have no significant effect. The potential effects due to battery constituents were also examined and found to be minimal.

Because a limited quantity of material would be expended, and the constituents of the expended material would have no or minimal effects, under the AFAST selected alternative there would be no significant impact in territorial waters due to hazardous material. In addition, there would be no significant harm in non-territorial waters due to hazardous material.

Aggregate Environmental Consequences

The potential impacts of hazardous material and hazardous waste due to range complex activities (other than sonar activities) are presented in Section 3.2 of this FEIS/OEIS. When the potential impacts due to sonar activities are included with the potential impacts due to range complex activities, under all alternativespresented in this FEIS/OEIS there would be less than significant impacts in territorial waters due to hazardous material. In addition, there would be less than significant harm in non-territorial waters due to hazardous material.

3.20.2.3 Water Resources

Summary of Environmental Consequences Due to AFAST

Potential effects due to water quality due to constituents of expended material and byproducts formed during sonar activities are discussed in Section 4.3.3 of the Final AFAST EIS/OEIS. The following sources were examined for potential impacts to water quality:

- Sonobuoy, ADC, and EMATT battery constituents
- Explosion byproducts from explosive-source sonobuoys

The constituents of concern for each of these sources are identified and analyzed in detail in the Final AFAST EIS/OEIS; overall, negligible impacts were found. Under the AFAST selected alternative, therefore, there will be no significant impacts to water quality in territorial waters. In addition, there will be no significant harm to water quality in non-territorial waters.

Aggregate Environmental Consequences

The potential impacts to water quality due to range complex activities (other than sonar activities) are presented in Section 3.3 of this FEIS/OEIS. When the potential impacts due to sonar activities are included with the potential impacts due to range complex activities, under all alternatives presented in this FEIS/OEIS there will be no significant impact to water quality in territorial waters. In addition, there will be no significant harm to water quality in non-territorial waters.

3.20.2.4 Marine Communities

Summary of Environmental Consequences Due to AFAST

The potential effects to marine invertebrates, including shell fish and corals, are discussed in Section 4.9 of the Final AFAST EIS/OEIS. There is very little information available regarding the hearing capability of marine invertebrates. However, no effects to marine invertebrates are anticipated from active sonar since acoustic transmissions are brief in nature. Any small level of mortality caused by the explosive source sonobuoy will not be significant to the population as a whole. In addition, the explosions will occur within the water column. Based on the small net explosive weight of the explosive, it is not likely the pressure wave associated with the detonation would reach the bottom, where the majority of invertebrates live.

The potential effects to marine plants and algae are discussed in Section 4.10 of the Final AFAST EIS/OEIS. No effects to marine plants and algae are anticipated from active sonar because plants and algae are acoustically transparent. Moreover, ships and submarines will not be operating in the shallow waters where sea grasses are present. In addition, *Sargassum* mats are easily identified and will be avoided wherever possible.

Under the AFAST selected alternative, therefore, there will be no significant impacts to marine communities in territorial waters. In addition, there will be no significant harm to marine communities in non-territorial waters.

Aggregate Environmental Consequences

The potential impacts to marine communities due to range complex activities (other than sonar activities) are presented in Section 3.6 of this FEIS/OEIS. When the potential impacts due to sonar activities are included with the potential impacts due to range complex activities, under all alternatives presented in this FEIS/OEIS there will be no significant impact to marine communities in territorial waters. In addition, there will be no significant harm to marine communities in non-territorial waters.

3.20.2.5 Marine Mammals

Summary of Environmental Consequences Due to AFAST

The Final AFAST EIS/OEIS evaluates potential direct and indirect effects to marine mammals as a result of exposure to in-water sound and non-acoustic interactions during sonar activities in Section 4.4.

Acoustic Effects

Assessing whether a sound may disturb or injure a marine mammal involves understanding the characteristics of the acoustic sources, the marine mammals that may be present in the vicinity of the sound, and the effects that sound may have on the physiology and behavior of those marine mammals. The Final AFAST EIS/OEIS analyzed potential effects to marine mammals using the regulatory framework of the MMPA.

- Level A harassment: potential injury (biological tissue is damaged or lost as a result of the action)
- Level B harassment: disruption of natural behavior patterns to the a point where they are abandoned or significantly altered

Although exposure to sound may cause a variety of physiological effects in mammals, the tissues of the ear are most susceptible. Threshold shift (TS), or loss of hearing sensitivity over a subsection of an animal's hearing range, therefore, is used as an indicator of physiological effects. TSs can be either permanent (PTS) or temporary (TTS), depending on the duration and intensity of the sound exposure. For the purpose of estimating physiological effects to marine mammals due to sound exposure, the Navy and NMFS concur on use of the energy flux density level (EFD) method, which takes into account the total sound energy received. Under this method, harassment is correlated to EFD as follows:

- Marine mammals predicted to receive a sound exposure with EFD of 215 dB re 1 μPa^2-s or greater are assumed to experience PTS and are counted as Level A harassment exposures.
- Marine mammals predicted to receive a sound exposure with EFD greater than or equal to 195 dB re 1 μPa^2-s but less than 215 dB re 1 μPa^2-s are assumed to experience TTS and are counted as Level B harassment exposures.

In addition to TTS exposures, Level B harassment includes behavioral responses, such as fleeing and interruption of social or foraging activity. A behavioral response is dependent on many factors, including the species, an individual's characteristics, and the context of the exposure. Because a range of

behavioral responses may occur to a particular sound exposure, the Navy, in cooperation with NMFS, has implemented a risk function approach to estimate the number of behavioral responses that NMFS would classify as behavioral harassment. The risk function is a mathematical function that estimates the probability of behavioral response based on the maximum sound pressure level (SPL) to which the animal is exposed. Figure 3.20-1 is the curve resulting from the risk function inputs for odontocetes (except harbor porpoises) and pinnipeds. Figure 3.20-2 is the curve resulting from the risk function inputs for mysticetes. Due to information that suggests harbor porpoises exhibit a very low threshold for response, a single exposure threshold of 120 dB SPL is used to estimate behavioral harassment for this species.

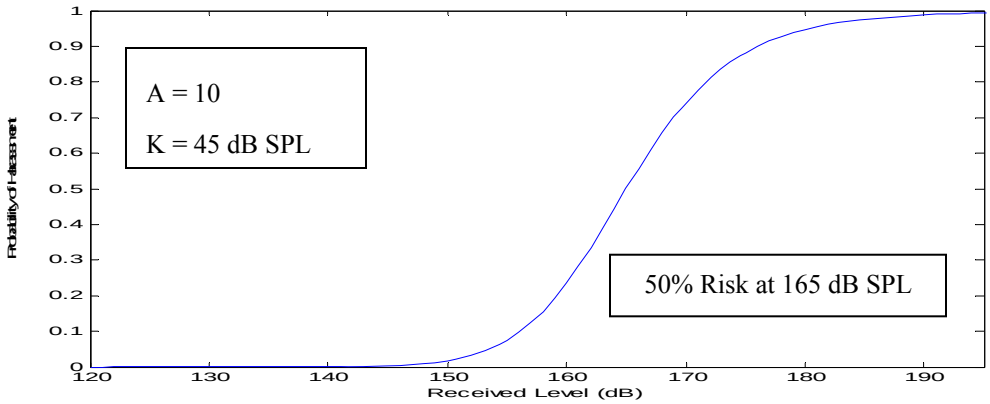


Figure 3.20-1. Risk Function Curve for Odontocetes (Except Harbor Porpoises) (Toothed Whales) and Pinnipeds

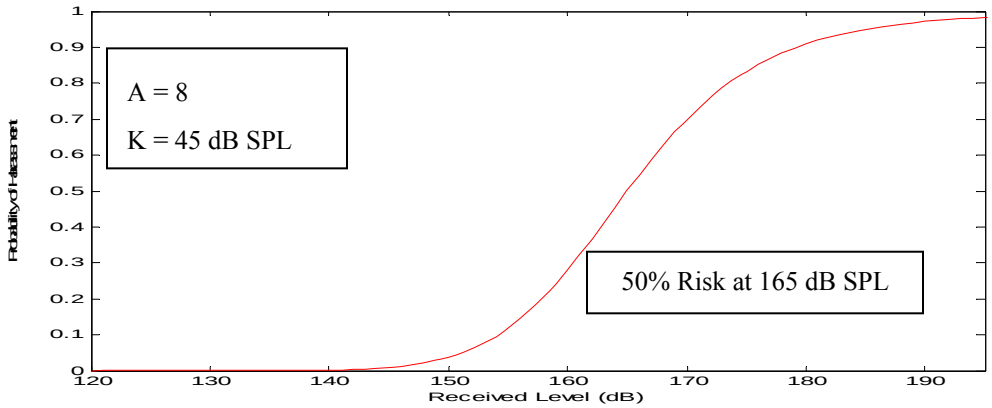


Figure 3.20-2. Risk Function Curve for Mysticetes (Baleen Whales)

Although immediate behavioral effects may occur at a receive level above the physiological thresholds, for purposes of this analysis, behavioral responses to sonar are counted as those occurring beyond the range to physiological effects. Figure 3.20-3 depicts shows the ranges of effects that correspond to MMPA harassment levels.

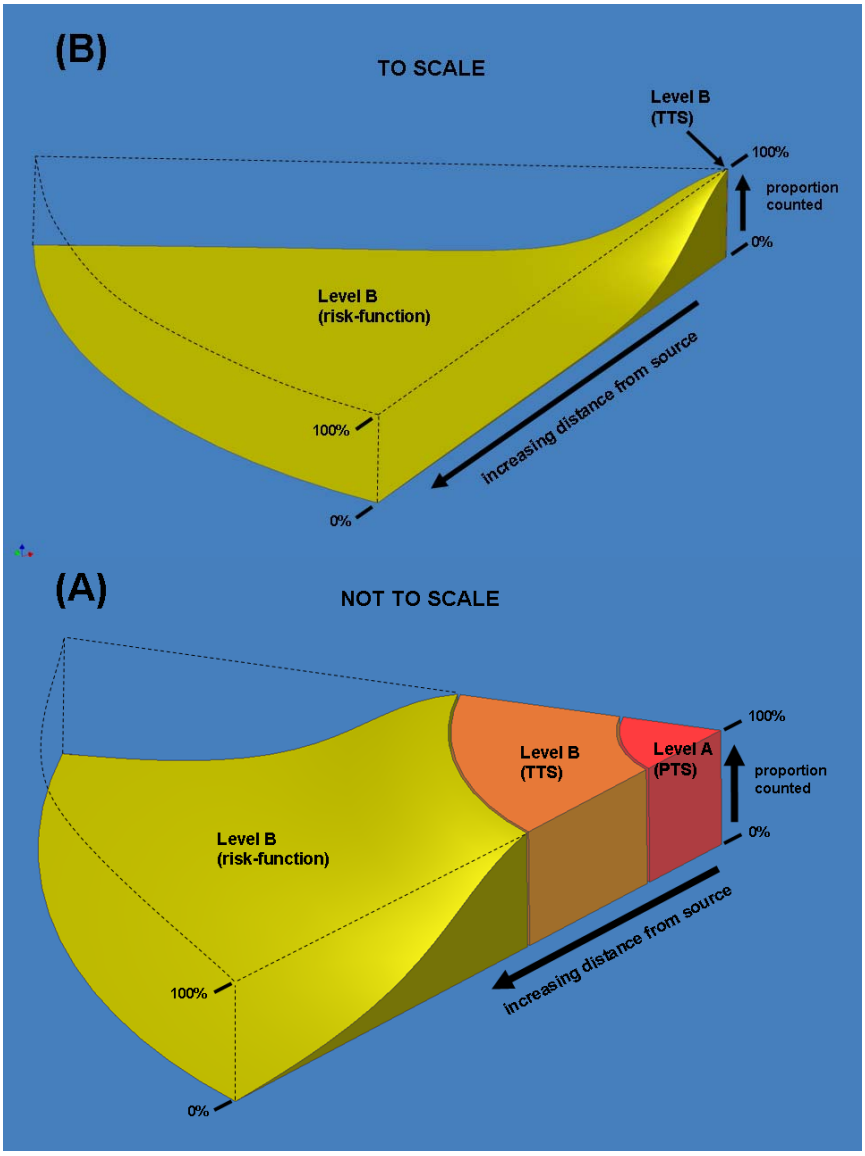


Figure 3.20-3 Summary of the Acoustic Effect Framework used in this OEIS/EIS

(A) General relationships between PTS, TTS, and risk function harassment zones. Image is not scaled, which allows each zone to be visible. (B) Scaled representation of harassment zone areas. Scaled distances were based on a single, 1-second ping with source level of 235 dB re 1 µPa.

The Final AFAST EIS/OEIS also analyzed the effects to marine mammals due to exposure to small explosives during deployment of the AN/SSQ-110A IEER sonobuoy. The Final AFAST EIS/OEIS used the same small explosives criteria (for single explosions) presented in Section 3.7.3.1 of this FEIS/OEIS.

To estimate the number of exposures of marine mammals to sound that would result in regulatory levels of harassment, sonar activities were acoustically modeled for the JAX Study Area. By analyzing both the

acoustic propagation of each source and the estimates of marine mammal presence, annual marine mammal exposures were calculated (Table 3.20-4). When interpreting the modeling results, it is important to recognize the limitations of the model. The model does not reflect implementation of protective measures (such as reducing power levels or ceasing sonar use in the presence of marine mammals) and it assumes the acoustic footprint extends to the seafloor regardless of the operating environment (in reality the zone of influence for physiological effects is shaped like a bubble in deeper waters). Sonar power reduction would reduce the likelihood of hearing impairment due to close aboard exposure, but some animals could be missed or could surface within the safety zone. Others could receive multiple pings that cause TTS due to added energy of multiple exposures over a short time period.

In addition, the exposure estimates rely on the best available information from marine mammal surveys. Marine species density models rely on limited survey data, and for some species data are insufficient to estimate densities (blue whale, white-beaked dolphin, hooded seal, and harp seal throughout the AFAST Study Area; harbor porpoise, gray seal, harbor seal, sei whale in the JAX Range Complex.

Due to the above reasons, quantitative exposure estimates should be used in conjunction with a qualitative analysis to assess potential impacts.

Potential acoustic effects to individual marine mammal species, including those for which density data are not available to quantify potential exposures, are discussed in sections 4.4.10.3 (ESA-listed species) and 4.4.10.4 (non-ESA-listed species) of the Final EIS/OEIS. Most exposures would cause short-term recoverable behavioral effects, and protective measures, such as sonar power reduction and shutdown as an animal approaches a vessel, would reduce the likelihood of physiological effects.

TABLE 3.20-4
ESTIMATED ANNUAL TAKES OF MARINE MAMMALS
FOR JACKSONVILLE RANGE COMPLEX
UNDER THE AFAST PREFERRED ALTERNATIVE

Species	Mortality	PTS	TTS	Risk-Function (Behavioral)
Atlantic spotted dolphin	0	11	2176	202708
Bottlenose dolphin	0	35	4722	461586
Clymene dolphin	0	2	277	26064
Common dolphin	0	0	0	0
***Kogia* spp.**	0	0	26	2476
Pantropical spotted dolphin	0	5	580	54555
Pilot whales* **	0	7	796	77082
Risso's dolphin	0	5	585	57169
Rough-toothed dolphin	0	0	13	1177
Sperm whale**	0	0*	17	1517
Striped dolphin	0	0	0	0
Beaked whale	0	0	19	1731
Fin whale**	0	0	0	0
Humpback whale**	0	0*	19	2371
Minke whale	0	0	1	129
North Atlantic right whale**	0	0	3	363

* Indicates an exposure greater than or equal to 0.05, therefore, is considered a "may affect" for ESA-listed species.
** Denotes species listed in accordance with the Endangered Species Act
*** Pilot whales include both short- and long-finned pilot whales along the East Coast

The quantified physiological and behavioral effects above account solely for exposures to levels of sound associated with the effects thresholds discussed previously. Other potential acoustic effects are also discussed in the Final AFAST EIS/OEIS. Currently, evidence of acoustically mediated bubble growth and decompression sickness is limited and inconclusive; therefore, these phenomena are discussed but not considered as potential effects. Investigations of air cavity resonance predict it would occur at frequencies lower than those analyzed in the Final AFAST EIS/OEIS. The potential for masking, in which sounds interfere with an animal's ability to hear other sounds, exists; however, due to the intermittent use and narrow-frequency band of sonars, masking effects are considered negligible. The reader should refer to Section 4.4.10.2.4 of the Final AFAST EIS/OEIS for a discussion of what is known about the possibility of these phenomena.

The reader should refer to the Final AFAST EIS/OEIS for full discussion and explanation of the following topics:

- *Conceptual Biological Framework* (Section 4.4.3)- an explanation of the pathways to potential physiological and behavioral effects, including stress responses, due to sound exposure
- *The Regulatory Frameworks* (Section 4.4.4)- an explanation of MMPA Level A and Level B harassment and the corresponding biological indicators and exposure zones
- *Criteria and Thresholds for Physiological Effects (Active Sonar)* (Section 4.4.5)- an explanation of the development of PTS and TTS EFD criteria for physiological effects
- *Criteria and Thresholds for MMPA Harrassment* (Section 4.4.5)- an explanation of the development of PTS and TTS EFD criteria for physiological effects and an explanation of the risk function approach used to estimate behavioral responses to sonar exposure
- *Criteria and Thresholds for Small Explosives* (Section 4.4.6)- an explanation of small explosives criteria
- *Acoustic Effects Results for Marine Mammals* (Section 4.4.9)- an overview of the acoustic analysis approach and modeling (for more detail on the modeling and assumptions, refer to Final AFAST EIS/OEIS Appendix H)
- *Summary of Potential Acoustic Effects by Marine Mammal Species* (Section 4.4.10)- analysis of acoustic impacts by individual species

Non-acoustic Effects

The Final AFAST EIS/OEIS also examined the potential non-acoustic effects to marine mammals during sonar activities, including interactions with vessels (Section 4.4.12.1) and interactions with other components of sonar activities, such as entanglement in expended material (Section 4.4.12.2) and direct animal strike by a deployed item, such as torpedoes, sonobuoys, or training targets (Section 4.4.12.3). As discussed in Section 3.7.3.2 of the JAX Range Complex FEIS/OEIS, the Navy employs protective measures to reduce the likelihood of vessel strikes. The characteristics of material expended during sonar activities make them unlikely to be a source of entanglement or ingestion for marine mammals. Due to the large area over which sonar training material could be deployed from the air, the likelihood of striking an animal that may be near the surface is negligible. In addition, there are no known instances in which an animal has been struck by an exercise torpedo, as torpedoes are designed to home on mechanical signatures or active sonar returns from vessel hulls.

Potential for Strandings

The history of Navy activities in the AFAST Study Area and analysis in the Final AFAST EIS/OEIS indicate that military readiness activities are not expected to result in any sonar – induced mortalities to marine mammals. Natural and manmade sources of mortality other than sonar and UNDETs that may contribute to stranding events are discussed in the Final AFAST EIS/OEIS (Section 3.6.3). The actual cause of a particular stranding may not be immediately apparent when there is little evidence of physical trauma, especially in the case of disease or age-related mortalities. These events require careful scientific investigation by a collaborative team of subject matter experts to determine actual cause of death.

Evidence from five beaked whale strandings that occurred over approximately a decade suggests that exposure of beaked whales to mid-frequency sonar in the presence of certain conditions (*e.g.*, multiple units using tactical sonar, steep bathymetry, constricted channels, strong surface ducts, *etc.*) may result in strandings, potentially leading to mortality. Although these physical factors believed to contribute to the likelihood of beaked whale strandings are not present, in their aggregate, in the AFAST Study Area, scientific uncertainty exists regarding what other factors, or combination of factors, may contribute to beaked whale strandings.

Summary of Effects to Marine Mammals

In conclusion, under the AFAST selected alternative, no significant impacts are predicted to marine mammals in territorial waters due to sonar activities. In addition, there would be no significant harm in non-territorial waters to marine mammals due to sonar activities. The Navy has completed consultation with NMFS in accordance with Section 7 of the ESA for ESA-listed marine mammals (with the exception of manatees) located in the AFAST Study Area. The Navy has completed consultation with NMFS in accordance with the MMPA for marine mammals located in the AFAST Study Area.

Aggregate Environmental Consequences

The potential impacts to marine mammals due to range complex activities (other than sonar activities) are presented in Section 3.7 of this EIS/OEIS. Although it is possible a single animal may be significantly affected when considering all events (sonar and non-sonar) in the training complex, no significant effects are predicted by the analysis and no significant impacts to populations of marine mammals are anticipated when the potential impacts due to sonar activities are included with the potential impacts due to range complex activities. Therefore, under all alternatives presented in this EIS/OEIS there would be no significant impact to marine mammals in territorial waters. In addition, there would be no significant harm to marine mammal populations in non-territorial waters.

3.20.2.6 Sea Turtles

Summary of Environmental Consequences Due to AFAST

The Final AFAST EIS/OEIS evaluates potential direct and indirect effects to sea turtles as a result of exposure to in-water sound and non-acoustic interactions during sonar activities in Section 4.5.

Acoustic Effects

Assessing whether a sound may disturb or injure a sea turtle involves understanding the characteristics of the acoustic sources, the presence of sea turtles in the vicinity of the sound, and the effects that sound may have on the physiology and behavior of those animals. Little is known about the role of sound and hearing in sea turtles; however, their greatest sensitivity appears to be at frequencies below the frequencies used by sonar systems during Atlantic fleet sonar activities. Use of these systems, therefore, is not expected to acoustically affect sea turtles. Sea turtles are, however, expected to be physiologically or behaviorally affected by use of explosive source sonobuoys. Effects to sea turtles were analyzed in the

Final AFAST EIS/OEIS using the same methods and criteria presented for small explosive impacts (single explosions) to sea turtles in the JAX Range Complex FEIS/OEIS (Section 3.8).

Table 3.20-5 shows that no acoustic exposures resulting in a physiological effect are anticipated in the JAX Study Area. In the case of single explosions, behavioral effects are expected to be limited to short-term startle effects.

TABLE 3.20-5
ESTIMATED SEA TURTLE ACOUSTIC EXPOSURES FROM EXPLOSIVE SOURCE SONOBUOYS

Species	Mortality	PTS	TTS
Loggerhead sea turtle	0	0	1
Kemp's ridley sea turtle[1]	0	0	0
Leatherback sea turtle	0	0	0
Hardshell sea turtles[2]	0	0	0

1. This category does not include Kemp's ridley sea turtles in the Gulf of Mexico. They are included in the hardshell sea turtle class.

2. This category includes green, hawksbill, and unidentified hardshell species for all regions. It also includes Kemp's ridley sea turtles in the Gulf of Mexico, and may include extralimital occurrences of olive ridley turtles along the Atlantic coast.

Non-acoustic Effects

The Final AFAST EIS/OEIS also examined the potential non-acoustic effects to sea turtles during sonar activities, including interactions with vessels (Section 4.5.3.1) and interactions with other components of sonar activities, such as entanglement in expended material (Section 4.5.3.2) and direct animal strike by a deployed item, such as torpedoes, sonobuoys, or training targets (Section 4.5.3.3). As discussed in Section 3.8.3.1 of the JAX Range Complex DEIS/OEIS, although the potential for vessel strike exists, the Navy employs protective measures to reduce the likelihood of vessel strikes. The characteristics of material expended during sonar activities make them unlikely to be a source of entanglement or ingestion for sea turtles. Due to the large area over which sonar training material could be deployed from the air, the likelihood of striking an animal that may be near the surface is negligible. In addition, there are no known instances in which an animal has been struck by an exercise torpedo, as torpedoes are designed to home on mechanical signatures or active sonar returns from vessel hulls.

Summary of Effects to Sea Turtles

In conclusion, under the AFAST selected alternative, although there could be potential impacts to individuals, there would be no significant impact to sea turtles in territorial waters due to sonar activities. In addition, there would be no significant harm in non-territorial waters to sea turtles due to sonar activities. The Navy has completed consultation with NMFS in accordance with Section 7 of the ESA for ESA-listed sea turtles due to sonar activities in the AFAST Study Area.

Aggregate Environmental Consequences

The potential impacts to sea turtles due to range complex activities (other than sonar activities) are presented in Section 3.8 of this EIS/OEIS. When the potential impacts due to sonar activities are included

with the potential impacts due to range complex activities, under all alternatives presented in this EIS/OEIS there would be no significant impact to sea turtles in territorial waters. In addition, there will be no significant harm to sea turtles in non-territorial waters.

3.20.2.7 Fish and Essential Fish Habitat

Summary of Environmental Consequences Due to AFAST

Effects to Essential Fish Habitat

Potential effects to EFH are analyzed in Section 4.6 of the Final AFAST EIS/OEIS. The potential stressors examined were effects of expended material or byproducts and the effects due to small explosive forces. As previously discussed in Bathymetry and Sediments (Section 3.19.2.1), Hazardous Material and Hazardous Waste (Section 3.19.2.2), and Water Resources (Section 3.19.2.3), under the AFAST selected alternative, there would be no significant impact to the physical environment due to expended material and byproducts of sonar activities. Detonation of explosive sonobuoys would occur in relatively deeper waters where the sea bottom habitat structure would not be affected.

Effects to Fish: Sonar Exposure

Potential effects to fish due to exposure to active sonar are discussed in Section 4.7.1 of the Final AFAST EIS/OEIS.

Studies have indicated that acoustic communication and orientation of fish may be restricted by sound regimes in their environment. However, most marine fish species are not expected to able to detect sounds in the mid-frequency range of the operational sonars used during Atlantic fleet sonar activities and, therefore, the sound sources do not have the potential to mask key environmental sounds. The few fish species shown to be able to detect mid-frequencies do not have their best sensitivities in the range of the operational sonars. Additionally, vocal marine fish largely communicate below the range of mid-frequency sonars.

There is no information available that suggests that exposure to non-impulsive acoustic sources results in significant fish mortality on a population level. Mortality has been shown to occur in the larval stage of one species; however, the level of mortality was considered insignificant in light of natural daily mortality rates. Experiments show that exposure to loud sound can result in significant threshold shifts in certain fish classified as hearing specialists (but not those classified as hearing generalists). Threshold shifts are temporary, and considering the best available data, no data exist that demonstrate any long-term negative effects on marine fish from underwater sound associated with sonar activities. Further, while fish may respond behaviorally to mid-frequency sources, this behavioral modification is only expected to be brief and not biologically significant.

Effects to Fish: Exposure to Small Explosives (Explosive Source Sonobuoy)

Potential effects to fish due to exposure to detonation of the explosive source sonobuoy are discussed in Section 4.7.2 of the Final AFAST EIS/OEIS.

Fish located in the water column in proximity to the source of detonation could be injured, killed, or disturbed by the impulsive sound of a sonobuoy detonation or possibly temporarily leave the area. The potential for injury depends on proximity, fish anatomy (presence of a swim bladder), fish size, fish shape, and orientation of the fish to the explosive source. The huge variations in the fish population, including numbers, species, sizes, and orientation and range from the detonation point, make it very difficult to accurately predict mortalities at any specific site of detonation.

Summary of Effects to EFH and Fish

Sonar activities will not reduce the quality or quantity of EFH, introduce significant contamination to the water column or bottom habitats, or result in physical disruption of EFH. The likelihood of significant effects to individual fish from active sonar is low. Most fish species experience large number of natural mortalities especially during early life-stages and, therefore, any small level of mortality caused by sonar activities involving the explosive source sonobuoy would most likely be insignificant to the population as a whole. Therefore, under the AFAST selected alternative, there would be no significant impact to EFH or fish populations as a result of active sonar activities in territorial waters. In addition, there would be no significant harm to EFH or fish populations from active sonar activities in non-territorial waters.

Aggregate Environmental Consequences

The potential impacts to EFH and fish due to range complex activities (other than sonar activities) are presented in Section 3.9 of this EIS/OEIS. When the potential impacts due to sonar activities are included with the potential impacts due to range complex activities, under all alternatives presented in this EIS/OEIS there would be no impact to EFH and fish in territorial waters. In addition, there would be no significant harm to EFH and fish in non-territorial waters.

3.20.2.8 Seabirds and Migratory Birds

Summary of Environmental Consequences Due to AFAST

Potential effects to seabirds due to exposure to sonar or explosive source sonobuoy detonations are discussed in Section 4.8 of the Final AFAST EIS/OEIS. Little is known about the general hearing or underwater hearing capabilities of sea birds. It was concluded effects were unlikely even if some diving birds were able to hear a signal for the following reasons:

- There is no evidence seabirds use underwater sound.
- Seabirds spend a small fraction of time submerged.
- Seabirds could rapidly fly away from the area and disperse to other areas if disturbed.

Since sonobuoys are only detonated more than 12 nm from shore, only birds traveling far from shore have the potential to be exposed to a detonation; however, the likelihood of a seabird diving near a sonobuoy at the time of detonation is negligible. Therefore, under the AFAST selected alternative,there would be no significant impact to sea birds as a result of active sonar activities in territorial waters. In addition, there would be no significant harm to sea birds from active sonar activities in non-territorial waters.

Aggregate Environmental Consequences

The potential impacts to sea birds due to range complex activities (other than sonar activities) are presented in Section 3.10 of this EIS/OEIS. When the potential impacts due to sonar activities are included with the potential impacts due to range complex activities, under all alternatives presented in this EIS/OEIS there would be no significant impact to sea birds in territorial waters. In addition, there would be no significant harm to sea birds in non-territorial waters.

3.20.2.9 Cultural Resources

Summary of Environmental Consequences Due to AFAST

The potential impacts to cultural resources due to sonar activities are discussed in Section 4.19 of the Final AFAST EIS/OEIS. Sound in the water is not expected to affect cultural resources, and the explosions associated with the explosive source sonobuoy will occur within the water column and will not reach the ocean floor. Although shipwrecks are located in multiple locations throughout the AFAST Study Area, the likelihood of expended material causing a disturbance is low. Therefore, under the

AFAST selected alternative, there would be no significant impact to cultural resources as a result of active sonar activities in territorial waters. In addition, there would be no significant harm to cultural resources from active sonar activities in non-territorial waters.

Aggregate Environmental Consequences

The potential impacts to cultural resources due to range complex activities (other than sonar activities) are presented in Section 3.13 of this EIS/OEIS. When the potential impacts due to sonar activities are included with the potential impacts due to range complex activities, under all alternatives presented in this EIS/OEIS there would be less than significant impact to cultural resources in territorial waters. In addition, there would be less than significant harm to cultural resources in non-territorial waters.

3.20.2.10 Transportation

Summary of Environmental Consequences Due to AFAST

The potential impacts to airspace management are discussed in Section 4.12 of the Fnal AFAST EIS/OEIS. Because no new or modified activities are proposed within the airspace of the AFAST Study Area, there would be no effects to airspace management due to sonar activities.

The potential impacts to commercial shipping are discussed in Section 4.16 of the Final AFAST EIS/OEIS. No significant effects to commercial shipping have been reported in the past due to sonar activities.

Therefore, under the AFAST selected alternative, there would be no significant impact to transportation as a result of active sonar activities in territorial waters. In addition, there would be no significant harm to transportation from active sonar activities in non-territorial waters.

Aggregate Environmental Consequences

The potential impacts to transportation due to range complex activities (other than sonar activities) are presented in Section 3.14 of this EIS/OEIS. When the potential impacts due to sonar activities are included with the potential impacts due to range complex activities, under all alternatives presented in this EIS/OEIS there would be no significant impact to transportation in territorial waters. In addition, there would be no significant harm to transportation in non-territorial waters.

3.20.2.11 Regional Economy

Summary of Environmental Consequences Due to AFAST

The potential impacts to commercial fishing are discussed in Section 4.15 of the Final AFAST EIS/OEIS. The Navy does not routinely close areas for active sonar activities. In addition, the largest portion commercial fishing occurs in state waters, where active sonar activities would not occur, with the exception of limited maintenance, navigation, and helicopter dipping sonar use. Furthermore, no significant impacts to fish are anticipated due to sonar activities. Therefore, under the AFAST selected alternative, no significant impact to commercial fishing is anticipated due to sonar activities.

Aggregate Environmental Consequences

The potential impacts to regional economy due to range complex activities (other than sonar activities) are presented in Section 3.16 of this EIS/OEIS. When the potential impacts due to sonar activities are included with the potential impacts due to range complex activities, under all alternatives presented in this EIS/OEIS there would be no significant impact to the regional economy in territorial waters. In addition, there would be no significant harm to the regional economy in non-territorial waters.

3.20.2.12 Recreation

Summary of Environmental Consequences Due to AFAST

The potential effects to recreational boating are discussed in Section 4.14 of the Final AFAST EIS/OEIS. The potential effects to recreational fishing are discussed in Section 4.15 of the Final AFAST EIS/OEIS. The Navy does not routinely close areas for active sonar activities; therefore, under the AFAST selected alternative there would be no significant impacts to recreational boating or fishing due to sonar activities. Furthermore, as previously discussed, no potential impacts to fish are anticipated due to active sonar activities.

The potential effects to scuba diving are discussed in Section 4.17 of the Final AFAST EIS/OEIS. No significant impacts to diving are anticipated due to sonar activities.

The potential effects to marine mammal watching are discussed in Section 4.18 of the AFAST FEIS/OEIS. Under the AFAST selected alternative, no significant impact to marine mammal watching due to sonar activities.

Aggregate Environmental Consequences

The potential impacts to recreation due to range complex activities (other than sonar activities) are presented in Section 3.17 of this EIS/OEIS. When the potential impacts due to sonar activities are included with the potential impacts due to range complex activities, under all alternatives presented in this EIS/OEIS there would be no significant impact to recreation in territorial waters. In addition, there would be no significant harm to recreation in non-territorial waters.

3.20.3 Mitigation Measures for Atlantic Fleet Active Sonar Activities

The AFAST FEIS/OEIS and Record of Decision (ROD) provides a detailed discussion of mitigation measures employed during sonar activities, specifically during active sonar activities (AFAST FEIS/OEIS Section 5.1), use of explosive source sonobuoys (AFAST EIS/OEIS Section 5.2), and vessel transit (AFAST EIS/OEIS Section 5.3). In addition, the AFAST FEIS/OEIS and ROD presents a discussion of other measures that have been considered and rejected after consideration of known science; likely effectiveness; personnel safety; practicality of implementation; and impact on the effectiveness of the military readiness activity.

All mitigation measures incorporated into the JAX FEIS/OEIS, including those from AFAST, are discussed in Chapter 5. AFAST mitigations are presented below.

3.20.3.1 AFAST Mitigation Measures Related to Acoustic Effects

As discussed in the NMFS MMPA regulations for AFAST active sonar activities, ESA Biological Opinion, and the AFAST ROD, the Navy would implement various mitigation measures to maximize the ability of operators to recognize instances when marine mammals are in the vicinity. These measures include the following:

1. Training personnel in lookout/watchstander duties;
2. Stationing at least three people on watch with binoculars at all times;
3. Stationing at least two additional people on watch during ASW exercises when MFA sonar is being used;
4. Requiring all personnel engaged in passive acoustic sonar operation to monitor for marine mammal vocalizations;
5. Using all available sensor and optical systems, such as night vision goggles during MFA and HFA active sonar activities;

6. Using only passive capability of sonobuoys when marine mammals are detected within 183 meters (200 yards);
7. Limiting ship or submarine active transmission levels to at least 6 dB below normal operating levels when marine mammals are detected by any means within 914 meters (1,000 yards) of the sonar dome (the bow);
8. Limiting ship or submarine active transmission levels to at least 10 dB below normal operating levels when marine mammals are detected by any means within 457 meters (500 yards) of the sonar dome, or ceasing ship or submarine active transmissions when a marine mammal is detected by any means within 183 meters (200 yards) of the sonar dome;
9. If the need for such power-down arises, following power-down requirements as though the system is operating at 235 dB, the normal operating level (i.e., power-down would be to 229 dB);
10. Operating sonar at the lowest practicable level, not to exceed 235 dB, except as required to meet tactical training objectives;
11. Requiring helicopters to observe or survey the vicinity of an ASW activity for ten minutes before first deployment of active (dipping) sonar in the water; prohibiting dipping sonar within 183 meters (200 yd) of a marine mammal and ceasing pinging if a marine mammal closes to within 183 meters (200 yd) after pinging has begun; and
12. Coordinating with the local NMFS Stranding Coordinator; and submitting a report containing a discussion of the nature of any observed effects based on both modeled results of real-time events and sightings of marine mammals.

Special Conditions Applicable for Bow-Riding Dolphins: If, after conducting an initial maneuver to avoid close quarters with dolphins, the ship concludes that dolphins are deliberately closing in on the ship to ride the vessel's bow wave, no further mitigation actions would be necessary because dolphins are out of the main transmission axis of the active sonar while in the shallow-wave area of the vessel bow.

The Navy and NMFS worked together to identify additional practicable and effective mitigation measures to address the following three issues of concern: (1) general minimization of marine mammal impacts; (2) minimization of impacts within the southeastern North Atlantic right whales critical habitat; and (3) the potential relationship between the operation of mid and/or high-frequency active sonar and marine mammal strandings. Any mitigation measure(s) prescribed by NMFS should be able to accomplish, have a reasonable likelihood of accomplishing (based on current science), or contribute to the accomplishment of one or more of the following general goals:

- avoidance or minimization of injury or death of marine mammals wherever possible;
- a reduction in the numbers of marine mammals (total number or number at biologically important time or location) exposed to received levels of mid- or high-frequency active sonar,
- underwater detonations, or other activities expected to result in the take of marine mammals (this goal may contribute to the first goal above, or by reducing harassment takes only);
- a reduction in the number of times (total number or number at biologically important time or location) individuals would be exposed to received levels of mid- or high-frequency active sonar, underwater detonations, or other activities expected to result in the take of marine mammals (this goal may contribute to the first goal listed above or by reducing harassment takes only);
- a reduction in the intensity of exposures (either total number or number at biologically important time or location) to received levels of MFA or HFA sonar, underwater detonations, or other activities expected to result in the take of marine mammals (this goal may contribute to the first goal listed above or to reducing the severity of harassment takes only);
- a reduction in adverse effects to marine mammal habitat, paying special attention to the food base, activities that block or limit passage to or from biologically important areas, permanent destruction of habitat, or temporary destruction/disturbance of habitat during a biologically important time; and

- for monitoring directly related to mitigation, an increase in the probability of detecting marine mammals, thus allowing for more effective implementation of the mitigation (shut-down zone, etc.).

NMFS and the Navy had extensive discussions regarding mitigation as part of consultation on the proposed and final rules, in which several mitigation options and their respective practicability were explored. Ultimately, NMFS and the Navy developed the following measures which the Navy and NMFS believes supports (or contributes) to the goals mentioned above.

(A) Planning Awareness Areas (PAAs): The Navy has designated several Planning Awareness Areas (PAAs) based on areas of high productivity that have been correlated with high concentrations of marine mammals (such as persistent oceanographic features like upwellings associated with the Gulf Stream front where it is deflected off the east coast near the Outer Banks), and areas of steep bathymetric contours that are frequented by deep diving marine mammals such as beaked whales and sperm whales. In developing the PAAs, USFF was able to consider these factors because of geographic flexibility in conducting ASW training. USFF is not tied to a specific range support structure for the majority of the training for AFAST.

Additionally, the topography and bathymetry along the East Coast and in the Gulf of Mexico is unique in that there is a wide continental shelf leading to the shelf break affording a wider range of training opportunities. The Navy shall avoid planning major exercises in the specified PAAs where feasible. Should national security require the conduct of more than four major exercises (COMPTUEX, JTFEX, SEASWITI, or similar scale event) in these areas (meaning all or a portion of the exercise) per year the Navy shall provide NMFS with prior notification and include the information in any associated after-action or monitoring reports. To the extent operationally feasible, the Navy plans to conduct no more than one of the four above-mentioned major exercises (COMPTUEX, JTFEX, SEASWITI, or similar scale event) per year in the Gulf of Mexico. Based on operational requirements, the exercise area for this one exercise may include the De Soto Canyon. If national security needs require more than one major exercise to be conducted in the PAAs, which includes portions of the DeSoto Canyon, the Navy would provide NMFS with prior notification and include the information in any associated after-action or monitoring reports. The PAAs will be included in the Navy's Protective Measures Assessment Protocol (PMAP) (implemented by the Navy for use in the protection of the marine environment) for unit level situational awareness (i.e., exercises other than COMPTUEX, JTFEX, or SEASWITI). The goal of PMAP is to raise awareness in the fleet and ensure common sense and informed oversight is injected into planning processes for testing and training evolutions.

(B) Helicopter Dipping Sonar in North Atlantic right whale Critical Habitat: Helicopter Dipping Sonar is one of the two activity types that have been identified as planned to occur in the southern North Atlantic right whale critical habitat. Historically, only maintenance of helicopter dipping sonars occurs within a portion of the North Atlantic right whale critical habitat. Tactical training with helicopter dipping sonar does not typically occur in the North Atlantic right whale critical habitat area at any time of the year. The critical habitat area is used on occasion for post maintenance operational checks and equipment testing due to its proximity to shore. Unless otherwise dictated by national security needs, the Navy will minimize helicopter dipping sonar maintenance within the southeast North Atlantic right whale critical habitat from November 15 to April 15.

(C) Object Detection Exercises in North Atlantic Right Whale Critical Habitat: Object detection training requirements are another type of activity that has been identified as planned to occur in the southern North Atlantic right whale critical habitat. The Navy recognizes the significance of the North Atlantic right whale calving area and has explored ways of affecting the least practicable impact (which includes a consideration of practicality of implementation and impacts to training fidelity) to right whales. Navy units will incorporate data from the Early Warning System (EWS) into exercise pre-planning efforts. USFF contributes more than $150,000 annually for aerial surveys that support the EWS, a communication network

that assists afloat commands to avoid interactions with right whales. Fleet Area Control and Surveillance Facility, Jacksonville (FACSFAC JAX) houses the Whale Fusion Center, which disseminates the latest right whale sighting information to Navy ships, submarines, and aircraft. Through the Fusion Center, FACSFAC JAX coordinates ship and aircraft movement into the right whale critical habitat and the surrounding operating areas based on season, water temperature, weather conditions, and frequency of whale sightings and provides right whale reports to ships, submarines and aircraft, including coast guard vessels and civilian shipping. The Navy proposes:

(i) To reduce the time spent conducting object detection exercises in the North Atlantic right whale critical habitat during the time of November 15 to April 15; and

(ii) Prior to conducting surface ship object detection exercises in the southeast North Atlantic right whale critical habitat during the time of November 15 to April 15, ships will contact The Fleet Air Control Surveillance Facility (FACSFAC) JAX to obtain the latest right whale sighting information. FACSFAC JAX will advise ships of all reported whale sightings in the vicinity of the critical habitat and Associated Area of Concern. To the extent operationally feasible, ships will avoid conducting training in the vicinity of recently sighted right whales. Ships will maneuver to maintain at least 457 meters (500 yards) separation from any observed whale, consistent with the safety of the ship.

3.20.3.2 AFAST Mitigation Measures Related to Explosive Source Sonobuoys (AN/SSQ-110A)

As discussed in the NMFS MMPA regulations for AFAST active sonar activities, ESA Biological Opinion, and the AFAST Record of Decision dated 23 Jan 2009, the Navy would implement the following mitigation measures for explosive source sonobuoys (AN/SSQ-110A) as well as for the follow on Advanced Extended Echo Ranging (AEER) system:

1. Crews will conduct visual reconnaissance of the drop area prior to laying their intended sonobuoy pattern;
2. Crews will conduct a minimum of 30 minutes of visual and aural monitoring of the search area prior to commanding the first post (source/receiver sonobuoy pair) detonation;
3. If a post (source/receiver sonobuoy pair) will be deployed within 914 meters (1,000 yards) of observed marine mammal activity, crews will deploy the receiver only and monitor while conducting a visual search;
4. When operationally feasible, crews will conduct continuous visual and aural monitoring of marine mammal activity, including monitoring of their aircraft sensors from first sensor placement to checking off-station and of radio frequency range of these sensors; aural detection of marine mammal cues the aircrew to increase the diligence of their visual surveillance;
5. If marine mammals are visually detected within 914 meter (1,000 yards) of the explosive source sonobuoy (AN/SSQ-110A) intended for use, then that payload shall not be detonated;
6. Aircrews will ensure a 914-meter (1,000-yard) safety zone, visually clear of marine mammals, is maintained;
7. Aircrews shall only leave posts with unexploded charges in the event of a sonobuoy malfunction, an aircraft system malfunction, or when an aircraft must immediately depart the area due to issues such as fuel constraints, inclement weather, and in-flight emergencies;
8. Aircrews will ensure all payloads are accounted for; and
9. Marine mammal monitoring shall continue until out of their aircraft sensor range.

CHAPTER 4 OTHER CONSIDERATIONS

4.1 CONSISTENCY WITH OTHER FEDERAL, STATE, AND LOCAL PLANS, POLICIES, AND REGULATIONS

Based on evaluation with respect to consistency and statutory obligations, the DoN'S alternatives, including the proposed action for the JAX Range Complex FEIS/OEIS, does not conflict with the objectives or requirements of federal, state, regional, or local plans, policies, or legal requirements. Table 4.1-1 provides a summary of environmental compliance requirements that may apply.

TABLE 4.1-1
SUMMARY OF ENVIRONMENTAL COMPLIANCE FOR THE PROPOSED ACTION

Plans, Policies, and Controls	Responsible Agency	Status of Compliance
National Environmental Policy Act of 1969 (42 U.S.C. §§4321, *et seq.*) Council on Environmental Quality Regulations for Implementing the Procedural Provisions of NEPA (40 CFR §§1500-1508) DoN Procedures for Implementing NEPA (32 CFR Part 775)	DoN	This EIS/OEIS has been prepared in accordance with NEPA, CEQ regulations, and Navy NEPA procedures. Public participation and review have been conducted in compliance with NEPA. The proposed action would not result in significant impacts.
Executive Order 12114, Environmental Effects Abroad of Major Federal Actions	DoN	EO 12114 requires environmental consideration for actions that may affect the environment outside of U.S. territorial waters. The proposed action would not result in significant harm to the environment.
Clean Water Act (CWA) (33 U.S.C. §§1344, *et seq*.)	USEPA	No permit under the CWA, whether under Section 401, 402, or 404 (b) (1), is required.
Coastal Zone Management Act (CZMA) (16 CFR §§1451, *et seq.*)	Florida Department of Environmental Protection, Georgia Department of Natural Resources: Environmental Protection Division, South Carolina Department of Health and Environmental Control, and North Carolina Division of Coastal Management	The Navy determined that the proposed action is consistent to the maximum extent practicable with the North, Carolina, South Carolina, Georgia, and Florida Coastal Management Plans, and submitted a Coastal Consistency Determination (CCD) in accordance with the CZMA.
Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. §§1801-1802)	National Marine Fisheries Service	The proposed action would not adversely affect Essential Fish Habitat (EFH) and would not decrease the available area or quality of EFH.

TABLE 4.1-1 (Continued)
SUMMARY OF ENVIRONMENTAL COMPLIANCE FOR THE PROPOSED ACTION

Plans, Policies, and Controls	Responsible Agency	Status of Compliance
Endangered Species Act (16 U.S.C. §§1531, *et seq*.)	DoN U.S. Fish and Wildlife Service NMFS	The EIS/OEIS analyzes potential effects to species listed under the ESA. The Navy completed consultation under Section 7 of the ESA with NMFS and USFWS on the potential that the proposed action may affect listed species.
Bald and Golden Eagle Protection Act (16 U.S.C. § 668 a-d)	DoN U.S. Fish and Wildlife Service	The proposed action would not affect Bald Eagles
Marine Mammal Protection Act (16 U.S.C. §§1431, *et seq.*)	NMFS	This EIS/OEIS analyzes potential effects to marine mammals, some of which are species-listed under the ESA. As noted, potential effects on listed species are the subject of consultations with NMFS. The Navy prepared a request for a Letter of Authorization from the NMFS regarding effects on marine mammals.
Act to Prevent Pollution from Ships (APPS) (33 U.S.C. §§1901, *et seq.*)	DoN	The Navy complies with the discharge regulations set forth under requirements of the APPS.
The National Marine Sanctuaries Act (16 U.S.C. §§1431, *et. seq*.)	National Oceanic and Atmospheric Administration	The proposed action would have no effect on sanctuary resources in the offshore environments of South Carolina, Georgia, or Florida. Review of agency actions under Section 304 is not required.
National Historic Preservation Act (16 U.S.C. §§470, *et seq*.)	DoN	The Navy complies with the consultation and other requirements of the NHPA. The proposed action would not have a significant impact on protected resources.
EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations	DoN	The proposed action would not result in disproportionately high and adverse human health or environmental effects on minority or low income populations.
EO 13045, Protection of Children from Environmental Health Risks and Safety Risks	DoN	The proposed action would not result in disproportionate risks to children from environmental health risks or safety risks.
EO 13112, Invasive Species	DoN	EO 13112 requires Agencies to identify actions that may affect the status of invasive species and take measures to avoid introduction and spread of those species. This EIS/OEIS satisfies the requirement of EO 13112 with regard to the proposed action.

TABLE 4.1-1 (Continued)
SUMMARY OF ENVIRONMENTAL COMPLIANCE FOR THE PROPOSED ACTION

Plans, Policies, and Controls	Responsible Agency	Status of Compliance
EO 11990, Protection of Wetlands	DoN	The proposed action would not have a significant impact on wetlands.
EO 12962, Recreational Fisheries	DoN	EO 12962 requires Agencies to fulfill certain duties with regard to promoting the health and access of the public to recreational fishing areas. The proposed action complies with these duties.
EO 13158, Marine Protected Areas	DoN	EO 13158 requires Agencies to identify any actions that affect natural or cultural resources protected by an MPA. Agencies shall avoid harm to the natural and cultural resources protected by an MPA. This EIS/OEIS satisfies the requirement of EO 13158 with regard to the proposed action.
Migratory Bird Treaty Act (16 U.S.C. §§703-712)	USFWS	The proposed action would not have a significant impact on migratory birds, and would comply with applicable requirements of the MBTA.
The Sikes Act of 1960 (16 U.S.C. §§670a-670o, as amended by the Sikes Act Improvement Act of 1997, Public Law No. 105-85) requires military installations with significant natural resources, to prepare and implement Integrated Natural Resource Management Plans (INRMP).	DoN	The proposed action would be implemented in accordance with the management and conservation criteria developed in the INRMP for JAX.

4.2 REQUIRED PERMITS AND APPROVALS

All required permits and approvals have been obtained. The decisions and supporting data can be found in the appendices.

4.2.1 Coastal Zone Management Act Compliance

The CZMA of 1972 (16 U.S.C. §1451) encourages coastal states to be proactive in managing coastal zone uses and resources. CZMA established a voluntary coastal planning program; participating states submit a Coastal Management Plan to NOAA for approval. Under CZMA, federal actions are required to be consistent, to the maximum extent practicable, with the enforceable policies of approved Coastal Management Plans.

CZMA defines the coastal zone (16 U.S.C. §1453) as extending, "to the outer limit of State title and ownership under the Submerged Lands Act" (*i.e.*, 3 nm from the shoreline). The coastal zone extends inland only to the extent necessary to control the shoreline. Excluded from the coastal zone is use of lands that are subject solely to the discretion of, or which are held in trust by, the federal government (16 U.S.C. §1453).

Review of federal agency activities is conducted through the submittal of either a Consistency Determination or a Negative Determination. A federal agency shall submit a Consistency Determination when it determines that its activity may have either a direct or an indirect effect on a state's coastal zone or resources. In accordance with 15 CFR § 930.39, the Consistency Determination shall include a brief statement indicating whether the proposed activity will be undertaken in a manner consistent to the maximum extent practicable with the enforceable policies of the management program and should be based on evaluation of the relevant enforceable policies of the management program. A federal agency may submit a Negative Determination to a coastal state when the federal agency has determined that its activities would not have an effect on the state's coastal zone or its resources or when conducting the same or similar activities for which Consistency Determinations have been prepared in the past.

Pursuant to 15 CFR § 930.41, the state has 60 days from the receipt of the Consistency Determination in which to concur with or object to the Consistency Determination, or to request an extension under 15 CFR § 930.41(b). Federal agencies shall approve one request for an extension period of 15 days or less.

In accordance with the CZMA, the Navy reviewed the enforceable policies of each state's Coastal Zone Management Plan (CZMP) relevant to the Study Area. Based on the limitations discussed in this EIS, the enforceable policies of each state's CZMP, and pursuant to 15 CFR § 930.39, the Navy prepared Federal Consistency Determinations or Negative Determinations for the affected states. Specific information regarding regulatory framework for CZMA can be found in Appendix K. Determinations for each state adjacent to the EIS/OEIS Study Area are presented in Appendix G.

4.3 Relationship Between Short-Term Use of Man's Environment and Maintenance and Enhancement of Long-Term Productivity

NEPA requires analysis of the relationship between a project's short-term impacts on the environment and the effects those impacts may have on the maintenance and enhancement of the long-term productivity of the affected environment. Impacts that narrow the range of beneficial uses of the environment are of particular concern. This means that choosing one option may reduce future flexibility in pursuing other options, or that committing a resource to a certain use may often eliminate the possibility for other uses of that resource.

With respect to marine mammals, the Navy, in partnership with the NMFS, is committed to furthering understanding of these creatures and developing ways to lessen or eliminate the impacts Navy training activities may have on these animals.

The proposed action would result in both short- and long-term environmental effects. However, the proposed action would not be expected to result in any impacts that would reduce environmental productivity, permanently narrow the range of beneficial uses of the environment, or pose long-term risks to health, safety, or general welfare of the public. The Navy is committed to sustainable range management, including co-use of the JAX Range Complex with general public and commercial interests. This commitment to co-use will enhance long-term productivity of the range areas surrounding the JAX Range Complex.

4.4 Irreversible or Irretrievable Commitment of Resources

NEPA requires that environmental analysis include identification of "any irreversible and irretrievable commitments of resources which would be involved in the Proposed Action should it be implemented." Irreversible and irretrievable resource commitments are related to the use of non-renewable resources and the effects that the uses of these resources have on future generations. Irreversible effects primarily result from the use or destruction of a specific resource (*e.g.,* energy or minerals) that cannot be replaced within

a reasonable time frame. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action (*e.g.,* the disturbance of a cultural site).

For the alternatives, including the preferred alternative, most resource commitments are neither irreversible nor irretrievable. Most impacts are short-term and temporary, or long lasting but negligible. No culturally significant resources are known to occur in the area proposed for training activities. No habitat associated with threatened or endangered species would be lost as result of implementation of the proposed action. Since there would be no building or facility construction, the consumption of material typically associated with such construction (*e.g.,* concrete, metal, sand, fuel) would not occur. Energy typically associated with construction activities would not be expended and irreversibly lost. Implementation of the proposed action would require fuels used by aircraft, ships, and ground-based vehicles. Since fixed- and rotary-wing flight and ship activities could increase relative to the baseline, total fuel use would increase. Fuel use by ground-based vehicles involved in training activities would also increase. Therefore, total fuel consumption would increase and this nonrenewable resource would be considered irretrievably lost.

4.5 Energy Requirements and Conservation Potential of Alternatives and Mitigation Measures

Increased training and testing operations on the JAX Range Complex would result in an increase in energy demand over the No Action Alternative. This would result in an increase in fossil fuel consumption, mainly from aircraft, vessels, ground equipment, and power supply. Although the required electricity demands of increased intensity of land-use would be met by the existing electrical generation infrastructure at the JAX Range Complex, the alternatives would result in a net cumulative negative impact on the energy supply.

Energy requirements would be subject to any established energy conservation practices at each facility. No additional power generation capacity other than the potential use of generators would be required for any of the operations. The use of energy sources has been minimized wherever possible without compromising safety, training, or testing operations.

At the present time, the Navy, under the direction of the Energy Policy Act of 1992 and EO 13149, is actively testing and introducing several different types of alternate fuels (bio-diesel B100/B20, clean natural gas, fuel ethanol E85, fuel cells, *etc*.) to further reduce the impacts of its activities on the environment and non-renewable resources.

4.6 Natural or Depletable Resource Requirements and Conservation Potential of Various Alternatives and Mitigation Measures

Resources that would be permanently and continually consumed by project implementation include water, electricity, natural gas, and fossil fuels; however, the amount and rate of consumption of these resources would not result in significant environmental impacts or the unnecessary, inefficient, or wasteful use of resources. Nuclear powered vessels would be a benefit as they decrease the use of fossil fuels. In addition, activities related to increased training and testing operations on the JAX Range Complex would result in the irretrievable commitment of nonrenewable energy resources, primarily in the form of fossil fuels (including fuel oil), natural gas, and gasoline equipment. With respect to operational activities, compliance with all applicable building codes, as well as project mitigation measures, would ensure that all natural resources are conserved or recycled to the maximum extent feasible. It is also possible that new technologies or systems would emerge, or would become more cost effective or user-friendly, which would further reduce reliance on nonrenewable natural resources. However, even with implementation of conservation measures, consumption of natural resources would generally increase with implementation of the alternatives.

Aircraft operations within the OPAREAs are the single largest airborne noise source. Noise levels in excess of 90 decibels can occur. Miitigation measures (structural attenuation features) are in place. Sustainable range management practices are in place that protect and conserve natural and cultural resources as well as preserve access to training areas for current and future training requirements, while addressing potential encroachments that threaten to impact range capabilities.

4.7 URBAN QUALITY, HISTORIC AND CULTURAL RESOURCES, AND THE DESIGN OF THE BUILT ENVIRONMENT

There are no urban areas under consideration in this FEIS/OEIS and; therefore, no urban quality issues exist. Likewise, there is no new construction being proposed. Historic and cultural resources are addressed in Section 3.12.

CHAPTER 5 MITIGATION MEASURES

5.1 INTRODUCTION

Effective training in the JAX Range Complex dictates that ship, submarine, and aircraft participants utilize their sensors and exercise weapons to their optimum capabilities as required by the mission. As discussed in Chapter 3, the Navy recognizes that the proposed actions have the potential to impact some marine resources in the vicinity of training. This chapter describes the Navy's overall mitigation approach as well as specific mitigation measures that would be implemented to protect marine mammals, sea turtles, and other resources during training activities. Some of these measures are generally applicable and others are designed to apply to certain geographic areas and/or for specific types of Navy training.

Due to the nature of the proposed action analyzed in this document, mitigation measures for many elements of the action have been established through previous environmental analyses, consultation, and/or permitting processes.

As noted above, this chapter describes the overall approach to mitigation for the proposed action as well as specific mitigation measures to be implemented. Section 5.2 describes the Navy's overall mitigation approach. The Navy's Monitoring and Reporting Requirements are presented in Section 5.3 and research efforts are presented in Section 5.4. Mitigation measures taken by Navy personnel on a regular and routine basis are discussed in Section 5.5 and are known as "Standard Operating Procedures." Section 5.6 presents special mitigation measures associated with vessel transit during North Atlantic right whale migration. Section 5.7 presents measures for specific training events. Section 5.8 presents coordination and reporting requirements. Section 5.9 provides alternative mitigation that was considered but eliminated. Section 5.10 discusses the effectiveness of visual observation including the detection probability and efficacy of mitigation measures. Measures for activities that are part of the proposed action, but are analyzed in separate environmental documents that are incorporated by reference are not necessarily included in this chapter. Mitigation measures specific to sonar use are addressed fully in the AFAST EIS/OEIS (DoN, 2008a) and are presented in sections 5.7.17 and 5.7.18.

5.2 APPROACH

Mitigation of impacts is defined in the Council on Environmental Quality (CEQ) regulations (40 CFR § 1508.20) to include avoidance, minimization, rectification, reduction/elimination over time, and compensation. Given the nature of the proposed action and alternatives and potential impacts analyzed here, the Navy believes that a comprehensive approach to mitigation for the JAX Range Complex requires focus on: (1) mitigation by avoidance, in which adverse impacts are avoided altogether by altering the location, design, or other aspect of an activity, and (2) minimization of impacts when avoidance is not feasible. An important complement to the *avoidance and minimization* of impacts is *monitoring* to track compliance with take authorizations, impacts on protected resources, and effectiveness of mitigation measures. Taken together, these three elements – avoidance, minimization, and monitoring - comprise the Navy's integrated approach to addressing potential environmental impacts.

Avoidance. Avoidance of geographic areas of particular sensitivity has been integrated into the proposed action and alternatives where feasible. Mitigation measures discussed later in this chapter involve avoidance of sensitive areas. Planning for training activities takes into consideration whether and how training locations could be planned to avoid sensitive areas (e.g. those known to have a high density of protected species or the presence of a protected species of particular concern). Consideration is also given to avoiding smaller scale habitats (*e.g*. *Sargassum* rafts, a known sea turtle habitat) as they are encountered during an activity. Those avoidance measures that require an ongoing evaluation of conditions or awareness during an activity are listed later in this chapter.

Minimization. In some cases, avoiding environmentally sensitive locations altogether is not possible. In these instances, mitigation measures have been designed to minimize the potential for impact on the resources of concern. These minimization measures are also listed in this chapter.

Monitoring. A well-designed monitoring program can provide important feedback for validating assumptions made in analyses and allow for adaptive management. Since monitoring will be a requirement for compliance with the final rule issued for this proposed action under the Marine Mammal Protection Act (MMPA), details of the monitoring program will be developed in coordination with NMFS through those regulatory processes. A description of the monitoring program framework is provided in Section 5.3.

It is important to note that discussions with resource agencies as part of consultation and permitting processes may result in changes to the mitigation as described in this document. Such changes will be reflected in the final EIS as well as in documents that result from other regulatory processes (*e.g.*, ESA Biological Opinion).

It should be noted that several of these mitigation measures align with mitigation measures for unit-level training that the Navy has had in place since 2004. In addition, the Navy coordinated with the NMFS to further develop measures for protection of marine mammals as part of the National Defense Exemption. The National Defense Exemption from Requirements of the MMPA for Certain DoD Military Readiness Activities That Employ Mid-Frequency Act Sonar or Improved Extended Echo Ranging Sonobuoys is dated January 23, 2007. This exemption is pursuant to Title 16, Section 1371 (f) of the United States Code. This exemption is was applicable to mid-frequency active (MFA) sonar systems or Improved Extended Echo Ranging (IEER) sonobuoys, operating within the frequency range of 1 kHz to 10 kHz, and Improved Extended Echo Ranging (IEER) sonobuoys. The exemption iswas in effect for a period of two years from the date of enactment (January 23, 2007) and iswas authorized until "the Department of Navy is granted authorization under the MMPA for one or both of these categories of actions as associated with a specified proposed activity, whichever is earliest" (DoN, 2007a).

ToThe final suite of measures developed in Navy's application for a Marine Mammal Protection Act (MMPA) Letter of Authorization (LOA) are analyzed in this Final EIS/OEIS. In addition to the National Environmental Policy Act (NEPA) process, the public had an opportunity to provide input to NMFS through the MMPA process, both during the comment period following NMFS' Notice of Receipt of the application for a MMPA LOA, and during the comment period following NMFS' publication of the proposed rule. In order to make the findings necessary to issue the Marine Mammal Protection Act (MMPA) authorization, it may be necessary for NMFS to require additional mitigation or monitoring measures beyond those addressed in the Biological Evaluation (BE). These could include measures yet to be developed. this Final EIS/OEIS. If additional mitigation or monitoring measures are required, they will be included in the Record of Decision.

5.3 MONITORING AND REPORTING MEASURES

5.3.1 Integrated Comprehensive Monitoring Plan

The Navy is committed to demonstrating environmental stewardship while executing its National Defense mission and is responsible for compliance with a suite of federal environmental and natural resources laws and regulations that apply to the marine environment. As part of those responsibilities, an assessment of the long-term and/or population-level effects of Navy training activities, as well as the efficacy of mitigation measures, is necessary. To address this need, the Navy is developing an Integrated Comprehensive Monitoring Plan (ICMP) for marine species to assess the effects of training activities on marine species and investigate population-level trends in marine species distribution, abundance, and habitat use in various range complexes and geographic locations where Navy training occurs (Figure 5.3-

1). Although the ICMP is intended to apply to all Navy training, use of MFA Sonar in training and RDT&E will comprise a major component of the overall program.

The ICMP will establish the overarching structure and coordination that will facilitate the collection and synthesis of monitoring data from Navy training and research and development projects. The Program will compile data from range-specific monitoring efforts as well as research and development (R&D) studies that are fully or partially Navy-funded. Monitoring methods across the ranges will include methods such as vessel and aerial surveys, tagging, and passive acoustic monitoring.

The primary objectives of the ICMP are to:

- Monitor Navy training exercises, particularly those involving active sonar and underwater detonations, for compliance with the terms and conditions of ESA Section 7 consultations and/or MMPA authorizations;
- Minimize exposure of protected species to sound levels from active sonar or sound pressure levels from underwater detonations currently considered to result in harassment;
- Collect data to support estimating the number of individuals exposed to sound levels above current regulatory thresholds;
- Assess the efficacy of the Navy's current marine species mitigation;
- Assess the practicality and effectiveness of potential future mitigation tools and techniques;
- Document trends in species distribution and abundance in Navy training areas through focused longitudinal monitoring efforts; and
- Add to the knowledge base on potential behavioral and physiological effects to marine species from active sonar and underwater detonations.

The ICMP will provide a comprehensive structure and serve as the basis for establishing monitoring plans for individual range complexes and specific training activities as well as geographically based longitudinal monitoring programs at select locations. Specific training exercise plans will focus on short-term monitoring and mitigation for individual training activities. Each training event will be evaluated to determine if it represents an appropriate monitoring opportunity within the ICMP framework. Due to the scale (spatial, temporal, and operational) of various training activities, not every event will present optimum opportunity for concentrated monitoring and, as a result, various levels of effort and resources will be associated with individual exercises. The overall approach of the ICMP is to target the majority of available monitoring resources on a limited number of opportunities with best potential for high quality data collection rather than attempting to apply a thin blanket of monitoring over the entirety of Navy training.

Data collection methods will be standardized across the program to the extent possible to provide the best opportunity for pooling data from multiple regions. Some methods may be universally applicable; however, some may be utilized only in specific locations where conditions are most appropriate. For example, in Hawaii, there is significant baseline data on odontocetes from tagging, which can be used to provide context for tagging data collected during training events. The Navy's overall monitoring approach will seek to leverage and build on existing research efforts whenever possible.

By using a combination of monitoring techniques or tools appropriate for the species of concern, the type of training activities conducted, sea state conditions, and the appropriate spatial extent, the detection, localization, and observation of marine species can be optimized, and return on the monitoring investment can be maximized in terms of data collection and mitigation effectiveness evaluation. The ICMP will evaluate the range of potential monitoring techniques that can be tailored to any Navy range or exercise

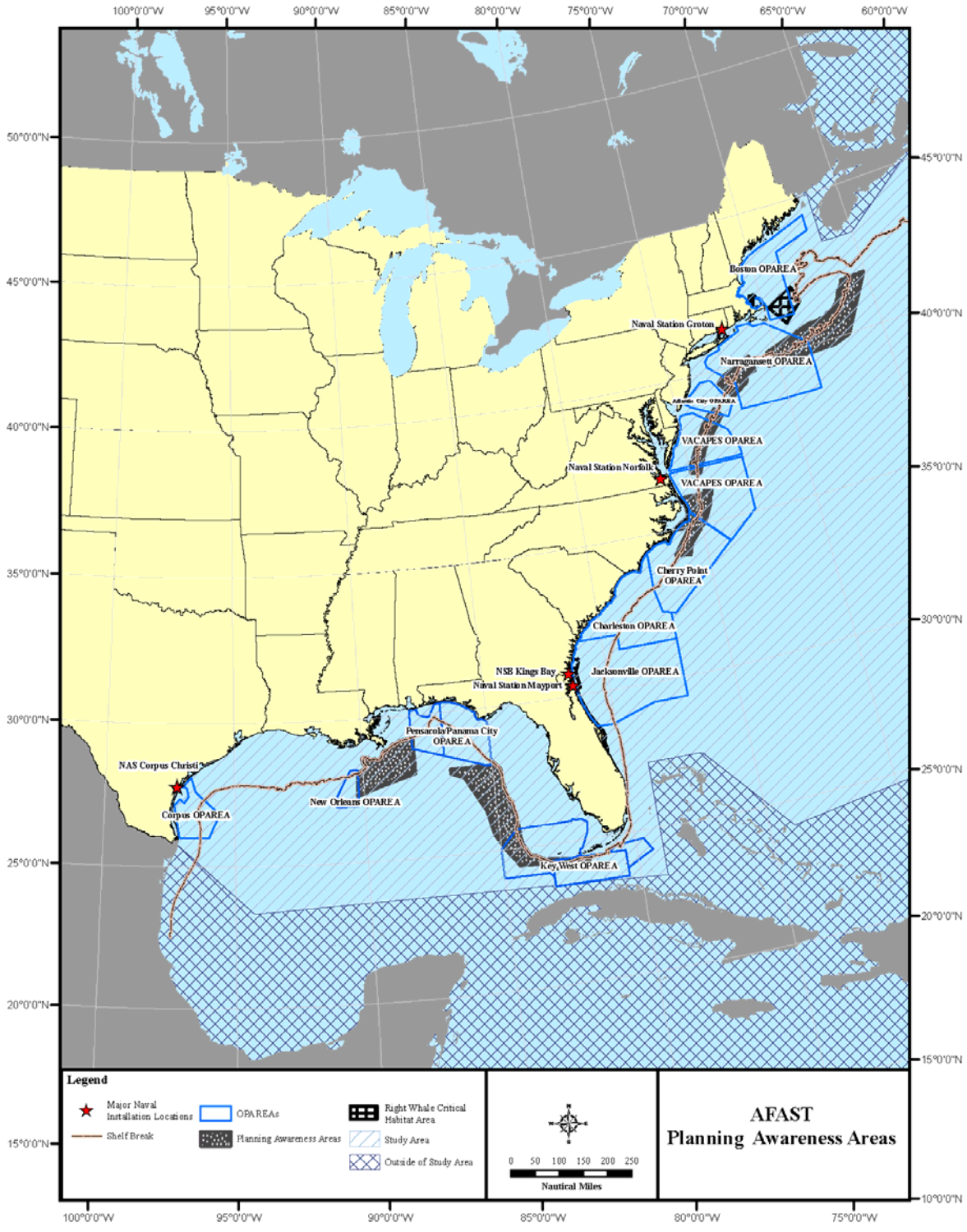


Figure 5.3-1 Navy-Wide Map of Areas Where Data Collection is Expected to Occur

and the appropriate species of concern. The primary tools available for monitoring generally include the following:

- Visual Observations – Surface vessel and aerial survey platforms can provide data on both long term population trends (abundance and distribution) as well as occurrence immediately before, during, and after training events. In addition, visual observation has the potential to collect information related to behavioral response of marine species to Navy training activities. Both Navy personnel (lookouts) and independent visual observers (Navy biologists) will be used from a variety of platforms (both Navy and third-party) for monitoring as appropriate and when logistically feasible.
- Passive Acoustic Monitoring – Autonomous Acoustic Recorders (moored buoys), High Frequency Acoustic Recording Packages (HARPS), sonobuoys, passive acoustic towed arrays, shipboard passive sonar, and Navy Instrumented Acoustic Ranges can provide data on presence/absence as well as localization, identification, and tracking in some cases. Passive acoustic observations are particularly important for species that are difficult to detect visually or when conditions limit the effectiveness of visual monitoring. Instrumented Navy ranges present a unique opportunity to take advantage of infrastructure that would otherwise not be available for monitoring such a large area. The Marine Mammal Monitoring on Navy Ranges (M3R) program takes advantage of this opportunity and may support long-term data collection at specific fixed sites.
- Tagging is an important tool for examining the movement patterns and diving behavior of cetaceans. Sensors can be used that measure location, swim velocity, orientation, vocalizations, as well as record received sound levels. Tagging with sophisticated digital acoustic recording tags (D-tags) may also allow direct monitoring of behaviors not readily apparent to surface observers. D-tags were recently deployed as part of a behavioral response study (BRS-07) initiated at the Atlantic Undersea Test and Evaluation Center (AUTEC) range in the Bahamas to begin identifying behavioral mechanisms related to anthropogenic sound exposure.
- Photo identification and tagging of animals – Photo identification contributes to understanding of movement patterns and stock structure that is important to determine how potential effects may relate to individual stocks or populations.
- Oceanographic and environmental data collection – Physical and environmental data related to habitat parameters are necessary for analyzing distribution patterns, developing predictive habitat and density models, and better understanding habitat use.

Because data concerning physiological and behavioral effects, as well as long-term modifications of habitat use, are extremely limited at this time, the ICMP will also incorporate several geographically fixed longitudinal monitoring sites to assess potential effects to marine mammals, both at the individual and population level. One example of this geographically fixed monitoring approach is the program recently initiated for the proposed Undersea Warfare Training Range (USWTR) in the Atlantic. The Navy contracted with a consortium of researchers from Duke University, the University of North Carolina at Wilmington, the University of St. Andrews, and the NMFS Northeast Fisheries Science Center to conduct a pilot study analysis and subsequently develop a survey and monitoring plan that prescribes the recommended approach for data collection, including surveys (aerial/shipboard, frequency, spatial extent, *etc*.), passive acoustic monitoring, photo identification and data analysis (standard line-transect, spatial modeling, *etc*.) necessary to establish a fine-scale seasonal baseline of protected species distribution and abundance.

This baseline study will provide the foundation for establishing a monitoring program designed to provide meaningful data on potential long term effects to marine species that may be chronically exposed to training activities on the USWTR. The baseline data collection portion of the program began in June 2007 at the Onslow Bay alternative site and includes coordinated aerial, shipboard, and passive acoustic surveys as well as deployment of HARPs to supplement the traditional visual surveys. A similar program

is currently being initiated at the Jacksonville preferred site. Similar efforts may be developed for other Navy ranges to support the overall ICMP objectives.

In addition to the specific monitoring initiative outlined above, the ICMP framework proposes to continue or initiate studies of behavioral response, abundance, distribution, habitat utilization, etc. for species of concern using a variety of methods, which may include visual surveys, passive and acoustic monitoring, radar, and data logging tags (to record data on acoustics, diving and foraging behavior, and movements). This work will help to build the collective knowledgebase on the geographic and temporal extent of key habitats and provide baseline information to account for natural perturbations such as El Niño or La Niña events as well as establish baseline information to determine the spatial and temporal extent of reactions to Navy operations, or indirect effects from changes in prey availability and distribution. Both the Office of Naval Research and Chief of Naval Operations are heavily involved in supporting a variety of ongoing research efforts (summarized below), including the recent BRS-07 conducted at AUTEC during the summer of 2007.

The Navy will coordinate with the local NMFS Stranding Coordinator for any unusual marine mammal behavior and any stranding, beached live/dead, or floating marine mammals that may occur at any time during or within 24 hours after completion of explosive training activities.

5.3.2 JAX Monitoring Summary

The monitoring methods proposed for use during training events in the JAX Range Complex include a combination of individual elements designed to allow a comprehensive assessment include:

(1) Vessel and aerial surveys

(i) Visual surveillance of 2 events per year. The primary goal will be to survey two different types of explosive events with one of them being a multiple detonation event.

(ii) For surveyed training events, aerial or vessel surveys will be used 1– 2 days prior to, during if reasonably safe, and 1–5 days post detonation. The variation in the number of days after allows for the detection of animals that gradually return to an area, if they indeed do change their distribution in response to underwater detonation events.

(iii) Surveys will include any specified exclusion zone around a particular detonation point plus 2000 yards beyond the exclusion zone. For vessel-based surveys a passive acoustic system (hydrophone or towed array) could be used to determine if marine mammals are in the area before and/or after a detonation event. Depending on animals sighted, it may be possible to conduct focal surveys of animals outside of the exclusion zone (detonations could be delayed if marine mammals are observed within the exclusion zone) to record behavioral responses to the detonations.

(iv) When conducting a particular survey, the survey team will collect:

(A) species identification and group size;

(B) location and relative distance from the detonation site;

(C) the behavior of marine mammals including standard environmental and oceanographic parameters;

(D) date, time and visual conditions associated with each observation;

(E) direction of travel relative to the detonation site; and

(F) duration of the observation.

(v) An aerial survey team will conduct pre- and post-aerial surveys, taking local oceanographic currents into account, of the exercise area.

(2) Passive acoustic monitoring

(i) When practicable, a towed hydrophone array should be used whenever shipboard surveys are being conducted. The towed array would be deployed during daylight hours for each of the days the ship is at sea.

(ii) A towed hydrophone array is towed from the boat and can detect and localize marine mammals that vocalize and would be used to supplement the ship-based systematic line-transect surveys (particularly for species such as beaked whales that are rarely seen).

(iii) The array would need to detect low frequency vocalizations (< 1,000 Hz) for baleen whales and relatively high frequency vocalizations (up to 30 kHz) for odontocetes such as sperm whales. The use of two simultaneously deployed arrays can also allow more accurate localization and determination of diving patterns.

(3) Marine mammal observers on Navy platforms

(i) Marine mammal observers (MMOs) will be placed on a Navy platform during one of the exercises being monitored per year.

(ii) Qualifications must include expertise in species identification of regional marine mammal species and experience collecting behavioral data. Experience as a NMFS marine mammal observer is preferred, but not required. Navy biologists and contracted biologists will be used; contracted MMOs must have appropriate security clearance to board Navy platforms.

(iii) MMOs will not be placed aboard Navy platforms for every Navy training event or major exercise, but during specifically identified opportunities deemed appropriate for data collection efforts. The events selected for MMO participation will take into account safety, logistics, and operational concerns.

(iv) MMOs will observe from the same height above water as the lookouts.

(v) The MMOs will not be part of the Navy's formal reporting chain of command during their data collection efforts; Navy lookouts will continue to serve as the primary reporting means within the Navy chain of command for marine mammal sightings. The only exception is that if an animal is observed within the shutdown zone that has not been observed by the lookout, the MMO will inform the lookout of the sighting for the lookout to take the appropriate action through the chain of command.

(vi) The MMOs will collect species identification, behavior, direction of travel relative to the Navy platform, and distance first observed. All MMO sighting will be conducted according to a standard operating procedure.

The Navy would submit a report annually on September 1 describing the implementation and results (through June 1 of the same year) of the monitoring required above. Standard marine species sighting forms would be provided by the Navy and data collection methods will be standardized across ranges to allow for comparison in different geographic locations.

JAX Range Complex Comprehensive Report – The Navy will submit to NMFS a draft report that summarizes all of the marine mammal observations and data gathered during explosive exercises through June 1, 2012. This report will be submitted to NMFS at the end of the fourth year of the rule (November 2012).

The Navy will respond to NMFS comments on the draft comprehensive report if submitted within 3 months of receipt. The report will be considered final after the Navy has addressed NMFS' comments, or three months after the submittal of the draft if NMFS does not comment by then.

To implement the aforementioned monitoring measures, the Navy is developing an Integrated Comprehensive Monitoring Program (ICMP) for marine species in order to assess the effects of training activities on marine species and investigate population-level trends in marine species distribution, abundance, and habitat use in various range complexes and geographic locations where Navy training occurs. Although the ICMP is intended to apply to all Navy training, use of mid-frequency active (MFA) sonar in training, testing, and research, development, test, and evaluation (RDT&E) will comprise a major component of the overall program.

The ICMP will establish the overarching structure and coordination that will facilitate the collection and synthesis of monitoring data from Navy training and research and development projects. The Program will compile data from range-specific monitoring efforts as well as research and development (R&D) studies that are fully or partially Navy funded. Monitoring methods across the ranges will include methods such as vessel and aerial surveys, tagging, and passive acoustic monitoring. The Navy will coordinate with the local NMFS Stranding Coordinator for any unusual marine mammal behavior and any stranding, beached live/dead, or floating marine mammals that may occur at any time during or within 24 hours after completion of explosives training activities.

Monitoring Workshop

The Navy, with guidance and support from NMFS, will convene a Monitoring Workshop, including marine mammal and acoustic experts as well as other interested parties, in 2011. The Monitoring Workshop participants will review the monitoring results from the previous two years of monitoring pursuant to the JAX Range Complex rule as well as monitoring results from other Navy rules and LOAs. The Monitoring Workshop participants would provide their individual recommendations to the Navy and NMFS on the monitoring plan(s) after also considering the current science (including Navy research and development) and working within the framework of available resources and feasibility of implementation. NMFS and the Navy would then analyze the input from the Monitoring Workshop participants and determine the best way forward from a national perspective. Subsequent to the Monitoring Workshop, modifications would be applied to monitoring plans as appropriate.

5.3.3 Reporting

In order to issue an Incidental Take Authorization (ITA) for an activity, Section 101(a)(5)(A) of the MMPA states that NMFS must set forth ''requirements pertaining to the monitoring and reporting of such taking''. Effective reporting is critical to ensure compliance with the terms and conditions of an LOA, and to provide NMFS and the Navy with data of the highest quality based on the required monitoring. As NMFS noted in its proposed rule, additional detail has been added to the reporting requirements since they were outlined in the proposed rule. The updated reporting requirements are all included below. A subset of the information provided in the monitoring reports may be classified and not releasable to the public. NMFS will work with the Navy to develop tables that allow for efficient submission of the information required below.

General Notification of Injured or Dead Marine Mammals

Navy personnel will ensure that NMFS (regional stranding coordinator) is notified immediately (or as soon as operational security allows) if an injured or dead marine mammal is found during or shortly after, and in the vicinity of, any Navy training exercise utilizing Mid-frequency Active Sonar (MFAS), High Frequency Active Sonar (HFAS), or underwater explosive detonations. The Navy will provide NMFS with species or description of the animal(s), the condition of the animal(s) (including carcass condition if

the animal is dead), location, time of first discovery, observed behaviors (if alive), and photo or video (if available).

Annual JAX Monitoring Plan Report

The Navy will submit a report annually on September 1 describing the implementation and results (through June 1 of the same year) of the JAX Monitoring Plan, described above. Data collection methods will be standardized across range complexes to allow for comparison in different geographic locations. Although additional information will also be gathered, the marine mammal observers (MMOs) collecting marine mammal data pursuant to the JAX Monitoring Plan shall, at a minimum, provide the same marine mammal observation data required in the MFAS/HFAS major Training Exercises section of the Annual JAX Exercise Report referenced below. The JAX Monitoring Plan Report may be provided to NMFS within a larger report that includes the required Monitoring Plan Reports from multiple Range Complexes.

Annual JAX Exercise Report

The Navy will submit an Annual JAX Exercise Report on September 1 of every year. This report shall contain the subsections and information indicated below.

Major Training Exercises

This section shall contain the following information for Major Training Exercises (MTE) conducted in the JAX Range Complex:

(a) Exercise Information (for each MTE):

(i) Exercise designator.

(ii) Date that exercise began and ended.

(iii) Location.

(iv) Number and types of active sources used in the exercise.

(v) Number and types of passive acoustic sources used in exercise.

(vi) Number and types of vessels, aircraft, etc., participating in exercise.

(vii) Total hours of observation by lookouts (watchstanders).

(viii) Total hours of all active sonar source operation.

(ix) Total hours of each active sonar source (along with explanation of how hours are calculated for sources typically quantified in alternate way (buoys, torpedoes, etc.)).

(x) Wave height (high, low, and average during exercise).

(b) Individual marine mammal sighting information (for each sighting in each MTE).

(i) Location of sighting.

(ii) Species (if not possible—indication of whale/dolphin/pinniped).

(iii) Number of individuals.

(iv) Calves observed (y/n).

(v) Initial Detection Sensor.

(vi) Indication of specific type of platform observation made from (including, for example, what type of surface vessel, *i.e.*, FFG, DDG, or CG)

(vii) Length of time observers maintained visual contact with marine mammal(s).

(viii) Wave height (in feet).

(ix) Visibility.

(x) Sonar source in use (y/n).

(xi) Indication of whether animal is <200yd, 200–500yd, 500–1000yd, 1000–2000yd, or >2000yd from sonar source in (x) above.

(xiii) Mitigation Implementation—whether operation of sonar sensor was delayed, or sonar was powered or shut down, and how long the delay was.

(xiv) If source in use (x) is hull-mounted, true bearing of animal from ship, true direction of ship's travel, and estimation of animal's motion relative to ship (opening, closing, parallel)

(xv) Observed behavior—Lookouts (Watchstanders) shall report, in plain language and without trying to categorize in any way, the observed behavior of the animals (such as animal closing to bow ride, paralleling course/ speed, floating on surface and not swimming, etc.)

(c) An evaluation (based on data gathered during all of the MTEs) of the effectiveness of mitigation measures designed to avoid exposing marine mammals to mid-frequency sonar. This evaluation shall identify the specific observations that support any conclusions the Navy reaches about the effectiveness of the mitigation.

5.3.4 Adaptive Management

The regulations under which the Navy's LOA are issued will contain an adaptive management component (NMFS, 2009). This gives NMFS the ability to consider the results of the previous years' monitoring, research, and/or the results of stranding investigations when prescribing mitigation or monitoring requirements in subsequent years. In the event that NMFS concludes that there is a high likelihood that MFAS or explosive detonations were a cause of a Uncommon Stranding Event ([USE] as defined in 50 CFR § 216.291), NMFS will review the analysis of the environmental and operational circumstances surrounding the USE. In subsequent LOAs, based on this review and through the adaptive management component of the regulations, NMFS may require the mitigation measures be modified or supplemented if the new data suggest that modifications would either have a reasonable likelihood of reducing the chance of future USEs resulting from a similar confluence of events or would increase the effectiveness of the stranding investigations. Further based on this review and the adaptive management component of the regulations, NMFS may modify or add to the existing monitoring requirements if the data suggest that the addition of a particular measure would likely fill a specifically important data or management gap.

5.4 RESEARCH EFFORTS

The Navy provides a significant amount of funding and support to marine research through a variety of organizations. From FY04 to FY08, the Navy provided over $94 million to universities, research institutions, federal laboratories, private companies, and independent researchers around the world for marine life research. During this same time period, the DoD contributed nearly $6 million for a total of $100 million in marine life research projects. These projects include basic science efforts, such as baseline surveys, and do not include monitoring surveys or environmental planning document preparation (DoN, 2008b). In FY08, the Navy will spend over $26 million and the DoD almost $1 million towards this effort (DoN, 2008b). Currently, the Navy has budgeted nearly $22 million and the DoD has budgeted

a half a million dollars for continued marine mammal research in FY09 (DoN, 2008b). Major topics of Navy-supported research include the following:

- Better understanding of marine species distribution and important habitat areas,
- Developing methods to detect and monitor marine species before and during training,
- Understanding the effects of sound on marine mammals, sea turtles, fish, and birds, and
- Developing tools to model and estimate potential effects of sound.

This research is directly applicable to Atlantic Fleet training activities, particularly with respect to the investigations of the potential effects of underwater noise sources on marine mammals and other protected species. Proposed training activities employ sonar and underwater explosives, which introduce sound into the marine environment.

The Marine Life Sciences Division of the Office of Naval Research currently coordinates six programs that examine the marine environment and are devoted solely to studying the effects of noise and/or the implementation of technology tools that will assist the Navy in studying and tracking marine mammals. The six programs are as follows:

1. Environmental Consequences of Underwater Sound,
2. Non-Auditory Biological Effects of Sound on Marine Mammals,
3. Effects of Sound on the Marine Environment,
4. Sensors and Models for Marine Environmental Monitoring,
5. Effects of Sound on Hearing of Marine Animals, and
6. Passive Acoustic Detection, Classification, and Tracking of Marine Mammals.

The Navy has also developed the technical reports referenced within this document, which include the Marine Resource Assessments and the Navy OPAREA Density Estimates (NODE) reports (DoN, 2007b). Furthermore, research cruises by the NMFS and by academic institutions have received funding from the U.S. Navy. For instance, the ONR contributed financially to the Sperm Whale Seismic Survey (SWSS) in the Gulf of Mexico, coordinated by Texas A&M. The goals of the SWSS are to examine effects of the oil and gas industry on sperm whales and what mitigations would be employed to minimize adverse effects to the species. All of this research helps in understanding the marine environment and the effects that may arise from the use of underwater noise in the Gulf of Mexico and western North Atlantic Ocean.

The Navy has sponsored several workshops to evaluate the current state of knowledge and potential for future acoustic monitoring of marine mammals. The workshops brought together acoustic experts and marine biologists from the Navy and other research organizations to present data and information on current acoustic monitoring research efforts and to evaluate the potential for incorporating similar technology and methods on instrumented ranges. However, acoustic detection, identification, localization, and tracking of individual animals still requires a significant amount of research effort to be considered a reliable method for marine mammal monitoring. The Navy supports research efforts on acoustic monitoring and will continue to investigate the feasibility of passive acoustics as a potential mitigation and monitoring tool.

Recently, a workshop was held to discuss the research required to understand the impact of tactical mid-frequency sonar transmission on fish, fisheries and fisheries habitat. Workshop participants included personnel from the Navy, academic universities, and NOAA Fisheries Service, who were selected based on their expertise in acoustics, fish hearing and fisheries biology. The objective of the workshop was to describe the range of scientific concerns regarding the effects of Navy training activities using tactical

mid-frequency active sonar on fish and fisheries resources and to distill these concerns into a long-term research and development plan. The priorities of the workshop included larval fish effects, hearing capabilities, small pelagic and soniferous fish behavior and potential effects to fisheries.

Overall, the Navy will continue to fund ongoing research, and is planning to coordinate long term monitoring/studies of marine mammals on various established ranges and operating areas. The Navy will continue to research and contribute to university/external research to improve the state of the science regarding marine species biology and acoustic effects. These efforts include mitigation and monitoring programs; data sharing with NMFS, through literature for research and development efforts; and future research as described previously.

5.5 STANDARD OPERATING PROCEDURES (GENERAL MARITIME MEASURES)

The mitigation measures presented below are taken by Navy personnel on a regular and routine basis. These are routine measures and are considered "Standard Operating Procedures."

5.5.1 Personnel Training – Lookouts

The use of shipboard lookouts is a critical component of all Navy standard operating procedures. Navy shipboard lookouts (also referred to as "watchstanders") are highly qualified and experienced observers of the marine environment. Their duties require that they report all objects sighted in the water to the Officer of the Deck (OOD) (e.g., trash, a periscope, marine mammals, sea turtles) and all disturbances (e.g., surface disturbance, discoloration) that may be indicative of a threat to the vessel and its crew. There are personnel serving as lookouts on station at all times (day and night) when a ship or surfaced submarine is moving through the water.

All personnel serving as lookouts on Navy ships and submarines are now required to complete Marine Species Awareness Training (MSAT) as part of the lookout training program. MSAT includes instruction on the lookout's role in environmental protection, laws governing the protection of marine species, Navy stewardship commitments, general observation at sea, and detecting/identifying marine mammals. MSAT has been reviewed by NMFS and acknowledged as suitable training.

1. All bridge personnel, Commanding Officers, Executive Officers, officers standing watch on the bridge, maritime patrol aircraft aircrews, and Mine Warfare (MIW) helicopter crews will complete MSAT.
2. Navy lookouts will undertake extensive training to qualify as a watchstander in accordance with the Lookout Training Handbook (NAVEDTRA 12968-D).
3. Lookout training will include on-the-job instruction under the supervision of a qualified, experienced watchstander. Following successful completion of this supervised training period, lookouts will complete the Personal Qualification Standard Program, certifying that they have demonstrated the necessary skills (such as detection and reporting of partially submerged objects).
4. Lookouts will be trained in the most effective means to ensure quick and effective communication within the command structure to facilitate implementation of protective measures if marine species are spotted.
5. Surface lookouts would scan the water from the ship to the horizon and be responsible for all contacts in their sector. In searching the assigned sector, the lookout would always start at the forward part of the sector and search aft (toward the back). To search and scan, the lookout would hold the binoculars steady so the horizon is in the top third of the field of vision and direct the eyes just below the horizon. The lookout would scan for approximately five seconds in as many small steps as possible across the field seen through the binoculars. They would search the entire sector in approximately five-degree steps, pausing between steps for approximately five seconds to scan the field of view. At the end of the sector search, the glasses would be lowered to allow the

eyes to rest for a few seconds, and then the lookout would search back across the sector with the naked eye.

6. At night, to increase effectiveness, lookouts would not continuously sweep the horizon with their eyes. Instead, lookouts would scan the horizon in a series of movements that would allow their eyes to come to periodic rests as they scan the sector. When visually searching at night, they would look a little to one side and out of the corners of their eyes, paying attention to the things on the outer edges of their field of vision. Lookouts will also have night vision devices available for use.

5.5.2 Operating Procedures & Collision Avoidance

1. Prior to major exercises, a Letter of Instruction, Naval Message or Environmental Annex to the Operational Order will be issued to further disseminate the personnel training requirement and general marine species mitigation measures.
2. Commanding Officers will make use of marine species detection cues and information to limit interaction with marine species to the maximum extent possible consistent with safety of the ship.
3. While underway, surface vessels will have at least two lookouts with binoculars; surfaced submarines will have at least one lookout with binoculars. Lookouts already posted for safety of navigation and man-overboard precautions may be used to fill this requirement. As part of their regular duties, lookouts will watch for and report to the OOD the presence of marine mammals and sea turtles.
4. On surface vessels equipped with a mid-frequency active sonar, pedestal mounted "Big Eyes" (20x110) binoculars will be properly installed and in good working order to assist in the detection of marine mammals and sea turtles in the vicinity of the vessel.
5. Personnel on lookout will employ visual search procedures employing a scanning method in accordance with the Lookout Training Handbook (NAVEDTRA 12968-D).
6. After sunset and prior to sunrise, lookouts will employ Night Lookouts Techniques in accordance with the Lookout Training Handbook (NAVEDTRA 12968-D).
7. While in transit, naval vessels will be alert at all times, use extreme caution, and proceed at a "safe speed" so that the vessel can take proper and effective action to avoid a collision with any marine animal and can be stopped within a distance appropriate to the prevailing circumstances and conditions.
8. When whales have been sighted in the area, Navy vessels will increase vigilance and take reasonable and practicable actions to avoid collisions and activities that might result in close interaction of naval assets and marine mammals. Actions may include changing speed and/or direction and are dictated by environmental and other conditions (*e.g.*, safety, weather).
9. Naval vessels will maneuver to keep at least 1,500 ft (460 m) away from any observed whale and avoid approaching whales head-on. This requirement does not apply if a vessel's safety is threatened, such as when change of course will create an imminent and serious threat to a person, vessel, or aircraft, and to the extent vessels are restricted in their ability to maneuver. Restricted maneuverability includes, but is not limited to, situations when vessels are engaged in dredging, submerged operations, launching and recovering aircraft or landing craft, minesweeping operations, replenishment while underway and towing operations that severely restrict a vessel's ability to deviate course. Vessels will take reasonable steps to alert other vessels in the vicinity of the whale.
10. Where feasible and consistent with mission and safety, vessels will avoid closing to within 200-yd (183 m) of sea turtles and marine mammals other than whales (whales addressed above).
11. Floating weeds, algal mats, Sargassum rafts, clusters of seabirds, and jellyfish are good indicators of sea turtles and marine mammals. Therefore, increased vigilance in watching for sea turtles and marine mammals will be taken where these are present.

12. Navy aircraft participating in exercises at sea will conduct and maintain, when operationally feasible and safe, surveillance for marine species of concern as long as it does not violate safety constraints or interfere with the accomplishment of primary operational duties. Marine mammal detections will be immediately reported to assigned Aircraft Control Unit for further dissemination to ships in the vicinity of the marine species as appropriate where it is reasonable to conclude that the course of the ship will likely result in a closing of the distance to the detected marine mammal.
13. All vessels will maintain logs and records documenting training operations should they be required for event reconstruction purposes. Logs and records will be kept for a period of 30 days following completion of a major training exercise.

5.6 MITIGATION MEASURES APPLICABLE TO VESSEL TRANSIT DURING NORTH ATLANTIC RIGHT WHALE MIGRATION

In 1999, a Mandatory Ship Reporting System was implemented by the U.S. Coast Guard, which requires vessels larger than 300 gross registered tons (DoN ships are exempt) to report their location, course, speed, and destination upon entering the nursery and feeding areas of the right whale. At the same time, ships receive information on locations of right whale sightings, in order to avoid collisions with the animals. In the southeastern United States, the reporting system is from November 15 through April 15 of each year; the geographical boundaries include coastal waters within roughly 46 kilometers (km) (25 nautical miles [nm]) of shore along a 167 km (90 nm) stretch of the Atlantic coast in Florida and Georgia. In the northeastern United States, the reporting system is year-round and the geographical boundaries include the waters of Cape Cod Bay, Massachusetts Bay, and the Great South Channel east and southeast of Massachusetts; it includes all of Stellwagen Bank National Marine Sanctuary.

5.6.1 Southeast Atlantic, Offshore of the Eastern United States

For purposes of these measures, the southeast encompasses sea space from Charleston, South Carolina, southward to Sebastian Inlet, Florida, and from the coast seaward to 148 km (80 nm) from shore. The mitigation measures described in this section were developed specifically to protect the North Atlantic right whale during its calving season (typically from December 1 through March 31). During this period, North Atlantic right whales give birth and nurse their calves in and around a federally designated critical habitat off the coast of Georgia and Florida. This critical habitat is the area from 31-15N to 30-15N extending from the coast out to 28 km (15 nm), and the area from 28-00N to 30-15N from the coast out to 9 km (5 nm). All mitigation measures that apply to the critical habitat also apply to an associated area of concern which extends 9 km (5 nm) seaward of the designated critical habitat boundaries.

Prior to transiting or training in the critical habitat or associated area of concern, ships will contact Fleet Area Control and Surveillance Facility, Jacksonville (FACSFAC JAX), to obtain latest whale sighting and other information needed to make informed decisions regarding safe speed and path of intended movement. Subs shall contact Commander, Submarine Group Ten for similar information.

Specific mitigation measures related to activities occurring within the critical habitat or associated area of concern include the following:

1. When transiting within the critical habitat or associated area of concern, vessels will exercise extreme caution and proceed at a slow safe speed. The speed will be the slowest safe speed that is consistent with mission, training and operations.
2. Speed reductions (adjustments) are required when a whale is sighted by a vessel or when the vessel is within 9 km (5 nm) of a reported new sighting less than 12 hours old.
3. Additionally, circumstances could arise where, in order to avoid North Atlantic right whale(s), speed reductions could mean vessel must reduce speed to a minimum at which it can safely keep on course or vessels could come to an all stop.

4. Vessels will avoid head-on approach to North Atlantic right whale(s) and will maneuver to maintain at least 457 m (500 yd) of separation from any observed whale if deemed safe to do so. These requirements do not apply if a vessel's safety is threatened, such as when change of course would create an imminent and serious threat to person, vessel, or aircraft, and to the extent vessels are restricted in the ability to maneuver.
5. Ships shall not transit through the critical habitat or associated area of concern in a North-South direction.
6. Ship, surfaced subs, and aircraft will report any whale sightings to Fleet Area Control and Surveillance Facility, Jacksonville, by most convenient and fast means. Sighting report will include the time, latitude/longitude, direction of movement and number and description of whale (i.e., adult/calf).

5.6.2 Measures Applicable to the "Consultation Area" in the Jacksonville Range Complex during North Atlantic Right Whale Calving Season

During North Atlantic right whale calving season, FACSFAC JAX provides an information resource through the right whale sightings clearinghouse. During calving season and within the consultation area (roughly an area to 80 nm seaward from Charleston, South Carolina, south to Sebastian Inlet, Florida) particular measures are in effect in accordance with the NMFS Biological Opinion issued in 1997 (NMFS, 1997). The following measures from the NMFS Biological Opinion issued in 1997 (NMFS, 1997) will be implemented:

1. Naval vessels operating within North Atlantic right whale critical habitat and the Associated Area of Concern (AAOC)[52] will exercise extreme caution and use slow safe speed, that is, the slowest speed that is consistent with essential mission, training, and operations.
2. Exercise extreme caution and use slow, safe speed when a whale is sighted by a vessel or when the vessel is within 5 nm of a reported new sighting less than 12 hours old.
3. Circumstances could arise where, in order to avoid North Atlantic right whale(s), speed reductions could mean vessels must reduce speed to a minimum at which it can safely keep on course (bare steerageway) or vessels could come to an all stop.
4. During the North Atlantic right whale calving season north-south transits through the critical habitat are prohibited, except for those exercises that necessarily operate at a slow, safe speed. Naval vessel transits through the area shall be in an east-west direction, and shall use the most direct route available during the calving season.
5. Naval vessel operations in the North Atlantic right whale critical habitat and AAOC during the calving season will be undertaken during daylight and periods of good visibility, to the extent practicable and consistent with mission, training, and operation. When operating in the critical habitat and AAOC at night or during periods of poor visibility, vessels will operate as if in the vicinity of a recently reported NARW sighting.
6. Command, Control and Communication.
   - FACSFAC JAX shall coordinate ship/aircraft clearance into the operating area based on prevailing conditions, including water temperature, weather conditions, whale sighting data,

[52] The AAOC is the area extending 5 nm seaward of the designated critical habitat boundaries.

mission or event to be conducted and other pertinent information. Commander Submarine Atlantic (COMSUBLANT) will coordinate any submarine operations that may require clearance with FACSFAC JAX. FASFAC JAX will provide data to ships and aircraft, including U.S. Coast Guard if requested, and will recommend modifying, moving or canceling events as needed to prevent whale encounters. Commander Submarine Group Ten (COMSUBGRU TEN) will provide same information/guidance to subs.

- Prior to transiting or training in the critical habitat ships will contact FASFAC JAX to obtain latest whale sighting and other information needed to make informed decisions regarding safe speed and path of intended movement. Subs shall contact COMSUBGRU TEN for similar information. Ships and aircraft desiring to train/operate inside the critical habitat or within the warning/operating area shall coordinate clearance with FASFAC JAX. Subs shall obtain same clearance from CTF-82 (COMSUBLANT).
- FACSFAC JAX will coordinate local procedures for whale data entry, update, retrieval and dissemination using joint maritime command information system. Ships not yet Officer in Tactical Command Information Exchange subsystem capable, including USCG, will communicate via satellite communication, high frequency, telephone or international marine/maritime satellite.

7. The only type of exercises that may be conducted inside the critical habitat and AAOC in calving season are Maritime Security operations, precision anchorage drills and swept channel exercises. In addition, use of the Shipboard Electronic System Evaluation Facility range is authorized with clearance and advice from FACSFAC JAX.

5.6.3 North Atlantic Right Whale Early Warning System

The coastal waters off the Southeast United States (SEUS) support the only known calving ground for the North Atlantic Right Whale (NARW). In the mid 1990's, the United States (U.S.) Navy, U.S. Coast Guard (USCG), U.S. Army Corps of Engineers (USACE), and National Marine Fisheries Service (NMFS) entered into a Memorandum of Agreement pursuant to the Endangered Species Act. The Early Warning System (EWS) is a result of that agreement and is a collaborative effort which involves comprehensive aerial surveys conducted during the North Atlantic Right Whale calving season. Surveys are flown daily, weather permitting, from December 1st through March 31st. East/west transects are flown from shoreline to approximately 30-35 nm offshore. Aerial surveys are conducted to locate NARW and provide whale detection and reporting information to mariners in the NARW calving ground in an effort to avoid collisions with this endangered species. When a NARW is sighted, information from the aerial survey aircraft is passed to a ground contact. The ground contact e-mails the sighting information to a wide network distribution which includes FACSFAC JAX, the USCG, the USACE and non-profit and commercial interests. Additionally, the ground contact will follow up with a call to FACSFAC JAX to provide further information if necessary. FACSFAC JAX records this valuable information and disseminates to all navy vessels and aircraft operating in the consultation area via the Secret Internet Protocol Router Network (SIPRNET) system. General sighting information and reporting procedures are broadcasted over the following methods: the NOAA weather radio; USCG NAVTEX system and a Broadcast Notice to Mariners over VHF marine-band radio channel 16. The EWS is a wide communication effort to ensure all vessels in the area are aware of the most recent right whale sightings as an avoidance measure. Table 5.6-1 provides port references.

5.7 MEASURES FOR SPECIFIC TRAINING EVENTS

These actions are standard operating procedures that are in place currently and will be used in the future for all activities being analyzed.

TABLE 5.6-1
NORTH ATLANTIC RIGHT WHALE MIGRATION PORT REFERENCES

Region	Months	Port Reference Points
South and East of Block Island	Sep–Oct and Mar–Apr	20 nm seaward of line between 41-4.49N 071-51.15W and 41-18.58N 070-50.23W
New York / New Jersey	Sep–Oct and Feb-Apr	40-30.64N 073-57.76W
Delaware Bay (Philadelphia)	Oct–Dec and Feb–Mar	38-52.13N 075-1.93W
Chesapeake Bay (Hampton Roads and Baltimore)	Nov-Dec and Feb–Apr	37-1.11N 075-57.56W
North Carolina	Dec–Apr	34-41.54N 076-40.20W
South Carolina	Oct–Apr	33-11.84N 079-8.99W 32-43.39N 079-48.72W

5.7.1 Surface-to-Surface Gunnery (up to and including 5-inch explosive rounds)

1. Lookouts will visually survey for floating weeds, algal mats, and *Sargassum* rafts, which may be inhabited by immature sea turtles, in the target area. Intended target area shall not be within 600 yards (548 m) of known or observed floating weeds, algal mats, *Sargassum* rafts, or coral reefs.
2. If applicable, target-towing vessels shall maintain a trained lookout for marine mammals and sea turtles. If a marine mammal or sea turtle is sighted in the vicinity, the tow vessel will immediately notify the firing vessel, which will suspend the exercise until the area is clear.
3. A 600 yard (548 m) radius buffer zone will be established around the intended target.
4. From the intended firing position, trained lookouts will survey the buffer zone for marine mammals and sea turtles prior to commencement and during the exercise as long as practicable. Due to the distance between the firing position and the buffer zone, lookouts are only expected to visually detect breaching whales, whale blows, and large pods of dolphins and porpoises.
5. The exercise will be conducted only when the buffer zone is visible and marine mammals and sea turtles are not detected within the target area and the buffer zone.

5.7.2 Surface-to-Surface Gunnery (up to and including 5-inch non-explosive rounds)

1. Lookouts will visually survey for floating weeds, algal mats, and *Sargassum* rafts which may be inhabited by immature sea turtles in the target area. Intended target area shall not be within 200 yards (182 m) of known or observed floating weeds, algal mats, *Sargassum* rafts, or coral reefs.
2. A 200 yard (182 m) radius buffer zone will be established around the intended target.
3. From the intended firing position, trained lookouts will survey the buffer zone for marine mammals and sea turtles prior to commencement and during the exercise as long as practicable. Due to the distance between the firing position and the buffer zone, lookouts are only expected to visually detect breaching whales, whale blows, and large pods of dolphins and porpoises.
4. If applicable, target-towing vessels shall maintain a trained lookout for marine mammals and sea turtles. If a marine mammal or sea turtle is sighted in the vicinity, the tow vessel will immediately notify the firing vessel, which will suspend the exercise until the area is clear.
5. The exercise will be conducted only when the buffer zone is visible and marine mammals and sea turtles are not detected within the target area and the buffer zone.

5.7.3 Firing Exercise (FIREX) Using the Integrated Maritime Portable Acoustic Scoring System (IMPASS) (5-in. explosive rounds)

Note: This exercise is also known as Firing Exercise II (FIREX II) and Naval Surface Fire Support (NSFS).

1 FIREX using IMPASS will only be conducted in Areas BB, and CC of the JAX Range Complex.
2 Pre-exercise monitoring of the target area will be conducted with "Big Eyes" prior to the event, during deployment of the IMPASS sonobuoy array, and during return to the firing position. Ships will maintain a lookout dedicated to visually searching for marine mammals and sea turtles 180° along the ship track line and 360° at each buoy drop-off location.
3 "Big Eyes" on the ship will be used to monitor a 600 yd (548 m) buffer zone around the target area for marine mammals/sea turtles during naval-gunfire events. Due to the distance between the firing position and the buffer zone, lookouts are only expected to visually detect breaching whales, whale blows, and large pods of dolphins and porpoises.
4 Ships will not fire on the target if any marine mammals or sea turtles are detected within or approaching the 600 yd (548 m) buffer until the area is cleared. If marine mammals or sea turtles are present, operations would be suspended. Visual observation will occur for approximately 45 minutes, or until the animal has been observed to have cleared the area and is heading away from the buffer zone.
5 Post-exercise monitoring of the entire effect range will take place with "Big Eyes" and the naked eye during the retrieval of the IMPASS sonobuoy array following each firing exercise.
6 FIREX with IMPASS will take place during daylight hours only.
7 FIREX with IMPASS will only be used in Beaufort Sea State three (3)[53] or less due to equipment limitations.
8 The visibility must be such that the fall of shot is visible from the firing ship during the exercise.
9 No firing will occur if marine mammals are detected within 70 yd (64 m) of the vessel.
10 During NARW calving season, no explosive ordnance will be used.

In accordance with the NMFS Biological Opinion issued in 1997 (NMFS, 1997), all naval gunnery will be conducted in the operating areas designated BB and CC during the right whale calving season. Explosive ordnance is not allowed in the action area during North Atlantic right whale calving season.

Under the alternatives, Area AA would continue to be restricted during North Atlantic right whale calving season to avoid proximity to North Atlantic right whale critical habitat. This restriction is operationally feasible because the additional steaming time from the homeport of ships conducting FIREX with IMPASS (e.g. Naval Station Mayport, Florida) to areas BB or CC is not significantly greater than the steaming time required to reach Area AA. Further, surface ships conducting FIREX using IMPASS do not have strict distance from land restrictions like those imposed on aircraft that embark from shore-based facilities.

5.7.4 Surface-to-Air Gunnery (up to and including 5-inch explosive rounds)

1. Vessels will orient the geometry of gunnery exercises to prevent debris from falling in the area of sighted marine mammals, sea turtles, algal mats, *Sargassum* rafts, and coral reefs.

[53] The Beaufort Scale of Wind Force was developed as a means for sailors to gauge wind speeds through visual observations of the sea state. The scale runs from 0 for calm to force 12 for Hurricane. In addition, this specific measure results from technological limitations of the sonobuoy array in higher sea states and is not intended as a measure for minimizing potential effects on the marine environment.

2. Vessels will expedite recovery of any parachute deploying aerial targets to reduce the potential for entanglement of marine mammals and sea turtles.
3. If applicable, target towing aircraft shall maintain visual observation. If a marine mammal or sea turtle is sighted within the vicinity of the exercise, the tow aircraft will immediately notify the firing vessel in order to secure gunnery firing until the area is clear.

5.7.5 Surface-to-Air Gunnery (up to and including 5-inch non-explosive rounds)

13. Vessels will orient the geometry of gunnery exercises in order to prevent debris from falling in the area of sighted marine mammals, sea turtles, algal mats, *Sargassum* rafts and coral reefs.
14. Vessels will expedite the recovery of any parachute deploying aerial targets to reduce the potential for entanglement of marine mammals and sea turtles.
15. If applicable, target towing aircraft shall maintain visual observation. If a marine mammal or sea turtle is sighted in the vicinity of the exercise, the tow aircraft will immediately notify the firing vessel in order to stop gunnery firing until the area is clear.

5.7.6 Small Arms Training – (such as 9 mm, .45 cal pistol, 12GA Shotgun, 5.56 mm, 7.62 mm, and .50 cal)

1. Lookouts will visually survey for floating weeds, algal mats, *Sargassum* rafts, marine mammals, and sea turtles. Weapons will not be fired in the direction of known or observed floating weeds, algal mats, *Sargassum* rafts, marine mammals, sea turtles or coral reefs.

5.7.7 Small Arms Training – Explosive Hand Grenades (e.g. MK3A2 grenades)

1. Lookouts will visually survey for floating weeds, algal mats, Sargassum rafts, marine mammals, and sea turtles.
2. A 200 yard (182 m) radius buffer zone will be established around the intended target. The exercises will be conducted only if the buffer is clear of sighted marine mammals and sea turtles.

5.7.8 Air-to-Surface At-Sea Bombing Exercises (non-explosive munitions)

1. If surface vessels are involved, trained lookouts will survey for *Sargassum* rafts, which may be inhabited by immature sea turtles, and for sea turtles and marine mammals. Ordnance shall not be targeted to impact within 1,000 yds (914 m) of known or observed *Sargassum* Rafts, sea turtles, marine mammals or coral reefs.
2. A 1,000 yd (914 m) radius buffer zone will be established around the intended target.
3. Aircraft will visually survey the target and buffer zone for marine mammals and sea turtles prior to and during the exercise. The pre-exercise survey of the impact area will be made by flying at 1,500 feet or lower, if safe to do so, and at the slowest safe speed. Release of ordnance through cloud cover is prohibited: aircraft must be able to actually see ordnance impact areas. Survey aircraft should employ most effective search tactics and capabilities.
4. The exercise will be conducted only if marine mammals and sea turtles are not visible within the buffer zone.
5. At-sea BOMBEXs will occur during daylight hours only.

Release of non-explosive ordnance within 2 nm of North Atlantic right whales is prohibited. The term "inert ordnance" means ordnance that is not configured to explode. This term includes ordnance that carries an explosive charge, but has not been armed or fused to detonate.

5.7.9 Air-to-Surface At-Sea Bombing Exercises (250-lbs to 2,000-lbs explosive bombs)

1. This activity applies only to the No Action Alternative and Alternative 1.

2. If surface vessels are involved, lookouts will survey for *Sargassum* rafts, which may be inhabited by immature sea turtles. Ordnance shall not be targeted to impact within 5,100 yards of known or observed *Sargassum* rafts or coral/live hardbottom.
3. A buffer zone of 5,100-yard radius will be established around the intended target zone.
4. Aircraft will visually survey the target and buffer zone for marine mammals and sea turtles prior to and during the exercise. The pre-exercise survey of the impact area will be made by flying at 1,500 feet or lower, if safe to do so, and at the slowest safe speed. Release of ordnance through cloud cover is prohibited; aircraft must be able to see ordnance impact areas. Survey aircraft should employ most effective search tactics and capabilities.
5. The exercises will be conducted only if the buffer zone is clear of sighted marine mammals and sea turtles.
6. Aircraft may drop explosive ordnance only in training area 31J after clearance is obtained from FACSFAC JAX. If, however, Northern Atlantic right whales, other marine mammals, or other protected species are present in area 31J, or the water temperature is 20°C or cooler in area 31J, explosive air-dropped ordnance shall be released in another area near area 31J that is seaward of both area 31J and the western edge of the Gulf Stream, consistent with FACSFAC JAX concurrence.
7. At-sea BOMBEXs using live ordnance will occur during daylight hours only.

5.7.10 Air-to-Surface Gunnery (such as .50 cal, 20 mm and 25 mm explosive or non-explosive rounds)

1. If surface vessels are involved, lookouts will visually survey for *Sargassum* rafts, which may be inhabited by immature sea turtles, in the target area. Impact should not occur within 200 yds (182 m) of known or observed floating weeds, algal mats, *Sargassum* rafts, or coral reefs.
2. A 200 yd (182 m) radius buffer zone will be established around the intended target.
3. If surface vessels are involved, lookout(s) will visually survey the buffer zone for marine mammals and sea turtles prior to and during the exercise.
4. Aerial surveillance of the buffer zone for marine mammals and sea turtles will be conducted prior to commencement of the exercise. Aerial surveillance altitude of 500 feet to 1,500 feet is optimum. Aircraft crew/pilot will maintain visual watch during exercises. Firing through cloud cover is prohibited; aircraft must be able to actually see ordnance impact areas.
5. The exercise will be conducted only if marine mammals and sea turtles are not visible within the buffer zone.
6. If applicable, target towing control craft shall maintain a lookout. If a marine mammal or sea turtle is sighted in the vicinity of the exercise, the towing control craft will immediately notify the firing vessel in order to stop gunnery firing until the area is clear.

5.7.11 Air-to-Surface Missile Exercises (explosive)

1. Ordnance shall not be targeted to impact within 1,800 yd (1,646 m) of known or observed *Sargassum* rafts, which may be inhabited by immature sea turtles, or coral reefs.
2. Aircraft will visually survey the target area for marine mammals and sea turtles. Visual inspection of the target area will be made by flying at 1,500 ft altitude or lower, if safe to do so, and at slowest safe speed. Firing or range clearance aircraft must be able to actually see ordnance impact areas. Explosive ordnance shall not be targeted to impact within 1,800 yd (1,646 m) of sighted marine mammals and sea turtles.

Historically, this activity occurs in the Missile Laser Training Range (MLTR) in the JAX Range Complex. This location was established to be far enough from shore to reduce civilian encounters (e.g., diving and recreational fishing), while remaining within 60 nm from shore-based facilities (the established flight distance restriction for helicopters during unit level training events).

5.7.12 Air-to-Air Missile Exercises (explosive and non-explosive)

1. The geometry of missile exercises will be oriented in order to minimize the potential for debris to fall within 1,000 yards (914 m) of sighted marine mammals, sea turtles, algal mats, *Sargassum* rafts, and coral reefs.

5.7.13 Mine Neutralization Training Involving Underwater Detonations (up to and including 20-lbs NEW charges)

Mine neutralization involving underwater detonations occurs in shallow water (0-120 ft or 0-36 m) and is executed by divers using scuba. NMFS issued a Biological Opinion in 2002 for underwater detonations of up to and including 20-lb explosive charges related to MINEX training (NMFS, 2002). These exercises utilize small boats that deploy from shore-based facilities. Often times these small boats are rigid-hulled inflatable boats (RHIBs) which are designed for shallow water and have limited seaworthiness necessitating a nearshore location. The exercise is a one-day event that occurs only during daylight hours therefore the distance from shore is limited.

1. Observers will survey the buffer zone, a 700 yd (640 m) radius from detonation location, for marine mammals and sea turtles from all participating vessels during the entire operation. A survey of the buffer zone (minimum of 3 parallel tracklines 219 yd (200 m) apart) using support craft will be conducted at the detonation location 30 minutes prior through 30 minutes post detonation. During late July through October, an additional surface observer will be added to more carefully look for hatchling turtles in the buffer zone. Aerial survey support will be utilized whenever assets are available.
2. Detonation operations will be conducted during daylight hours.
3. If a sea turtle or marine mammal is sighted within the buffer zone, the animal will be allowed to leave of its own volition. The Navy will suspend detonation exercises and ensure the area is clear for a full 30 minutes prior to detonation.
4. Divers placing the charges on mines and dive support vessel personnel will survey the area for sea turtles and marine mammals and will report any sightings to the surface observers. These animals will be allowed to leave of their own volition and the buffer zone will be clear for 30 minutes prior to detonation.
5. No detonations will take place within 3.2 nm of an estuarine inlet.
6. No detonations will take place within 1.6 nm of shoreline.
7. No detonations will take place within 1,000 ft of any known artificial reef, shipwreck, or live hard-bottom community.
8. Personnel will record any protected species observations during the exercise as well as measures taken if species are detected within the buffer zone.

This activity will occur in two locations: UNDET North (10L) and UNDET South (12I). These locations are offshore from Naval Weapons Station Charleston, South Carolina, a restricted-access Naval installation.

5.7.14 Mine Countermeasures – Minesweeping Using Equipment Towed by Helicopters

1. Use trained lookouts to survey for *Sargassum* rafts, sea turtles and marine mammals prior to and during the exercise.

2. Establish a 250 yd (229 m) buffer zone around the towed equipment. Exercise will not be conducted if marine mammals or sea turtles are detected within the buffer zone.

5.7.15 Non-explosive Mine Shape Deployment

1. Known shipwrecks will be avoided when deploying non-explosive mineshapes.
2. Known artificial and oyster reefs will be avoided when deploying non-explosive mineshapes.

5.7.16 Anchorage of Ships

1. These requirements are not applicable if going to an assigned anchorage.
2. Avoid *Sargassum* rafts.
3. Ships will not anchor in the vicinity of coral reefs, except in designated anchorages or for safety of ship: vicinity is defined as the anchor swing circle encompassing a portion of a coral reef.
4. Ships will not anchor in areas of known shipwrecks.

5.7.17 Mitigation Measures Related to Acoustic Effects Beyond Those Previously Described (Taken From the AFAST FEIS)

The AFAST Record of Decision (ROD), dated 23 Jan 2009, provides detailed discussion of mitigation measures to be employed during activities analyzed in the AFAST FEIS/OEIS. As discussed in the NMFS MMPA regulations for AFAST active sonar activities, ESA Biological Opinion, and the AFAST ROD, the Navy would implement various mitigation measures to maximize the ability of operators to recognize instances when marine mammals are in the vicinity. These measures include the following:

1. Training personnel in lookout/watchstander duties;
2. Stationing at least three people on watch with binoculars at all times;
3. Stationing at least two additional people on watch during ASW exercises when MFA sonar is being used;
4. Requiring all personnel engaged in passive acoustic sonar operation to monitor for marine mammal vocalizations;
5. Using all available sensor and optical systems, such as night vision goggles during MFA and HFA active sonar activities;
6. Using only passive capability of sonobuoys when marine mammals are detected within 183 meters (200 yards);
7. Limiting ship or submarine active transmission levels to at least 6 dB below normal operating levels when marine mammals are detected by any means within 914 meters (1,000 yards) of the sonar dome (the bow);
8. Limiting ship or submarine active transmission levels to at least 10 dB below normal operating levels when marine mammals are detected by any means within 457 meters (500 yards) of the sonar dome, or ceasing ship or submarine active transmissions when a marine mammal is detected by any means within 183 meters (200 yards) of the sonar dome;
9. If the need for such power-down arises, following power-down requirements as though the system is operating at 235 dB, the normal operating level (i.e., power-down would be to 229 dB);
10. Operating sonar at the lowest practicable level, not to exceed 235 dB, except as required to meet tactical training objectives;
11. Requiring helicopters to observe or survey the vicinity of an ASW activity for ten minutes before first deployment of active (dipping) sonar in the water; prohibiting dipping sonar within 183 meters (200 yd) of a marine mammal and ceasing pinging if a marine mammal closes to within 183 meters (200 yd) after pinging has begun; and

12. Coordinating with the local NMFS Stranding Coordinator; and submitting a report containing a discussion of the nature of any observed effects based on both modeled results of real-time events and sightings of marine mammals.

Special Conditions Applicable for Bow-Riding Dolphins: If, after conducting an initial maneuver to avoid close quarters with dolphins, the ship concludes that dolphins are deliberately closing in on the ship to ride the vessel's bow wave, no further mitigation actions would be necessary because dolphins are out of the main transmission axis of the active sonar while in the shallow-wave area of the vessel bow.

The Navy and NMFS worked together to identify additional practicable and effective mitigation measures to address the following three issues of concern: (1) general minimization of marine mammal impacts; (2) minimization of impacts within the southeastern North Atlantic right whales critical habitat; and (3) the potential relationship between the operation of mid and/or high-frequency active sonar and marine mammal strandings. Any mitigation measure(s) prescribed by NMFS should be able to accomplish, have a reasonable likelihood of accomplishing (based on current science), or contribute to the accomplishment of one or more of the following general goals:

- avoidance or minimization of injury or death of marine mammals wherever possible;
- a reduction in the numbers of marine mammals (total number or number at biologically important time or location) exposed to received levels of mid- or high-frequency active sonar,
- underwater detonations, or other activities expected to result in the take of marine mammals (this goal may contribute to the first goal above, or by reducing harassment takes only);
- a reduction in the number of times (total number or number at biologically important time or location) individuals would be exposed to received levels of mid- or high-frequency active sonar, underwater detonations, or other activities expected to result in the take of marine mammals (this goal may contribute to the first goal listed above or by reducing harassment takes only);
- a reduction in the intensity of exposures (either total number or number at biologically important time or location) to received levels of MFA or HFA sonar, underwater detonations, or other activities expected to result in the take of marine mammals (this goal may contribute to the first goal listed above or to reducing the severity of harassment takes only);
- a reduction in adverse effects to marine mammal habitat, paying special attention to the food base, activities that block or limit passage to or from biologically important areas, permanent destruction of habitat, or temporary destruction/disturbance of habitat during a biologically important time; and
- for monitoring directly related to mitigation, an increase in the probability of detecting marine mammals, thus allowing for more effective implementation of the mitigation (shut-down zone, etc.).

NMFS and the Navy had extensive discussions regarding mitigation as part of consultation on the proposed and final rules, in which several mitigation options and their respective practicability were explored. Ultimately, NMFS and the Navy developed the following measures which the Navy and NMFS believes supports (or contributes) to the goals mentioned above.

(A) Planning Awareness Areas (PAAs): The Navy has designated several Planning Awareness Areas (PAAs) based on areas of high productivity that have been correlated with high concentrations of marine mammals (such as persistent oceanographic features like upwellings associated with the Gulf Stream front where it is deflected off the east coast near the Outer Banks), and areas of steep bathymetric contours that are frequented by deep diving marine mammals such as beaked whales and sperm whales. In developing the PAAs, USFF was able to consider these factors because of geographic flexibility in conducting ASW training. USFF is not tied to a specific range support structure for the majority of the training for AFAST.

Additionally, the topography and bathymetry along the East Coast and in the Gulf of Mexico is unique in that there is a wide continental shelf leading to the shelf break affording a wider range of training opportunities. The Navy shall avoid planning major exercises in the specified PAAs where feasible. Should

national security require the conduct of more than four major exercises (COMPTUEX, JTFEX, SEASWITI, or similar scale event) in these areas (meaning all or a portion of the exercise) per year the Navy shall provide NMFS with prior notification and include the information in any associated after-action or monitoring reports. To the extent operationally feasible, the Navy plans to conduct no more than one of the four above-mentioned major exercises (COMPTUEX, JTFEX, SEASWITI, or similar scale event) per year in the Gulf of Mexico. Based on operational requirements, the exercise area for this one exercise may include the De Soto Canyon. If national security needs require more than one major exercise to be conducted in the PAAs, which includes portions of the DeSoto Canyon, the Navy would provide NMFS with prior notification and include the information in any associated after-action or monitoring reports. The PAAs will be included in the Navy's Protective Measures Assessment Protocol (PMAP) (implemented by the Navy for use in the protection of the marine environment) for unit level situational awareness (i.e., exercises other than COMPTUEX, JTFEX, or SEASWITI). The goal of PMAP is to raise awareness in the fleet and ensure common sense and informed oversight is injected into planning processes for testing and training evolutions.

(B) Helicopter Dipping Sonar in North Atlantic right whale Critical Habitat: Helicopter Dipping Sonar is one of the two activity types that have been identified as planned to occur in the southern North Atlantic right whale critical habitat. Historically, only maintenance of helicopter dipping sonars occurs within a portion of the North Atlantic right whale critical habitat. Tactical training with helicopter dipping sonar does not typically occur in the North Atlantic right whale critical habitat area at any time of the year. The critical habitat area is used on occasion for post maintenance operational checks and equipment testing due to its proximity to shore. Unless otherwise dictated by national security needs, the Navy will minimize helicopter dipping sonar maintenance within the southeast North Atlantic right whale critical habitat from November 15 to April 15.

(C) Object Detection Exercises in North Atlantic Right Whale Critical Habitat: Object detection training requirements are another type of activity that has been identified as planned to occur in the southern North Atlantic right whale critical habitat. The Navy recognizes the significance of the North Atlantic right whale calving area and has explored ways of affecting the least practicable impact (which includes a consideration of practicality of implementation and impacts to training fidelity) to right whales. Navy units will incorporate data from the Early Warning System (EWS) into exercise pre-planning efforts. USFF contributes more than $150,000 annually for aerial surveys that support the EWS, a communication network that assists afloat commands to avoid interactions with right whales. Fleet Area Control and Surveillance Facility, Jacksonville (FACSFAC JAX) houses the Whale Fusion Center, which disseminates the latest right whale sighting information to Navy ships, submarines, and aircraft. Through the Fusion Center, FACSFAC JAX coordinates ship and aircraft movement into the right whale critical habitat and the surrounding operating areas based on season, water temperature, weather conditions, and frequency of whale sightings and provides right whale reports to ships, submarines and aircraft, including coast guard vessels and civilian shipping. The Navy proposes:

(i) To reduce the time spent conducting object detection exercises in the North Atlantic right whale critical habitat during the time of November 15 to April 15; and

(ii) Prior to conducting surface ship object detection exercises in the southeast North Atlantic right whale critical habitat during the time of November 15 to April 15, ships will contact The Fleet Air Control Surveillance Facility (FACSFAC) JAX to obtain the latest right whale sighting information. FACSFAC JAX will advise ships of all reported whale sightings in the vicinity of the critical habitat and Associated Area of Concern. To the extent operationally feasible, ships will avoid conducting training in the vicinity of recently sighted right whales. Ships will maneuver to maintain at least 457 meters (500 yards) separation from any observed whale, consistent with the safety of the ship.

5.7.18 Mitigation Measures Related to Explosive Source Sonobuoys (AN/SSQ-110A) (Taken from the AFAST FEIS)

As discussed in the NMFS MMPA regulations for AFAST active sonar activities, ESA Biological Opinion, and the AFAST Record of Decision dated 23 Jan 2009, the Navy would implement the following mitigation measures for explosive source sonobuoys (AN/SSQ-110A) as well as for the follow on Advanced Extended Echo Ranging (AEER) system:

1 Crews will conduct visual reconnaissance of the drop area prior to laying their intended sonobuoy pattern;
2 Crews will conduct a minimum of 30 minutes of visual and aural monitoring of the search area prior to commanding the first post (source/receiver sonobuoy pair) detonation;
3 If a post (source/receiver sonobuoy pair) will be deployed within 914 meters (1,000 yards) of observed marine mammal activity, crews will deploy the receiver only and monitor while conducting a visual search;
4 When operationally feasible, crews will conduct continuous visual and aural monitoring of marine mammal activity, including monitoring of their aircraft sensors from first sensor placement to checking off-station and of radio frequency range of these sensors; aural detection of marine mammal cues the aircrew to increase the diligence of their visual surveillance;
5 If marine mammals are visually detected within 914 meter (1,000 yards) of the explosive source sonobuoy (AN/SSQ-110A) intended for use, then that payload shall not be detonated;
6 Aircrews will ensure a 914-meter (1,000-yard) safety zone, visually clear of marine mammals, is maintained;
7 Aircrews shall only leave posts with unexploded charges in the event of a sonobuoy malfunction, an aircraft system malfunction, or when an aircraft must immediately depart the area due to issues such as fuel constraints, inclement weather, and in-flight emergencies;
8 Aircrews will ensure all payloads are accounted for; and
9 Marine mammal monitoring shall continue until out of their aircraft sensor range.

5.7.19 Rodman Range Mitigation Measures

5.7.19.1 2005 Integrated Natural Resources Management Plan

The 2005 INRMP for NAS Jacksonville (DoN, 2005) was developed in cooperation with the USFWS and Florida Fish and Wildlife Conservation Commission (FFWCC). This plan includes management actions for Rodman Range and is updated annually to provide benefits to threatened and endangered species.

The requirement that ground users of Rodman Range receive an explosive safety briefing and environmental awareness/ESA species briefing prior to entering the property is considered a valid mitigation measure for conservation of protected species. For example, awareness training could help reduce the potential for vehicle/snake strikes from convoy operations.

5.7.19.2 2006 Gopher Tortoise Management Plan

The 2006 Gopher Tortoise Management Plan (DoN, 2006) for NAS Jacksonville provides indirect benefits to eastern indigo snake by monitoring the occurrence of burrows on Rodman Range. The plan was developed in cooperation with FFWCC and provides for relocation of gopher tortoises in non-compatible areas. Relocation of tortoises and removal of burrows from activity areas such as the target at Rodman Range (in the event that a burrow occurred in the target area) would benefit commensal species such as the eastern indigo snake by precluding suitable habitat in the target area. Thus, a conservation benefit is provided to the species by encouraging the tortoise and eastern indigo snake to occupy compatible areas of the range.

5.7.20 Lake George Range Mitigation Measures

5.7.20.1 Mine Laying (non-explosive)

- Prior to releasing NEPM, P-3 aircraft would do a pass at 300 ft, ~200 knots as a clearing run looking for boats, fishermen, and manatees.
- To enhance the ability of the P-3 aircrew to spot a manatee near the target area, the aircrew would use the Electro Optic/Infra Red sensors which would enable the aircrew to detect surfacing manatees.
- The tower and range cameras will observe range/impact areas for 5 minutes following the sortie (after the last NEPM is dropped) to observe if any manatee was injured by the exercise.
- The pilot and at least one observer on board are trained to look for marine mammals and have completed the US Navy Marine Species Awareness Training.

5.8 COORDINATION AND REPORTING REQUIREMENTS

The Navy will coordinate with the local NMFS Stranding Coordinator for any unusual marine mammal behavior and any stranding, beached live/dead, or floating marine mammals that may occur at any time during or within 24 hours after completion of training activities. Additionally, the Navy will follow internal chain of command reporting procedures as promulgated through Navy instructions and orders.

5.9 MEASURES CONSIDERED BUT ELIMINATED

As described in Chapter 3, the vast majority of estimated exposures to marine mammals during proposed activities would not cause injury. Potential effects on marine mammals would be further reduced with the implementation of mitigation measures described above. Therefore, the Navy concludes the proposed action and mitigation measures would achieve the least practicable adverse impact on species or stocks of marine mammals. A determination of "least practicable adverse impacts" includes consideration, in consultation with NMFS, of personnel safety, practicality of implementation, and impact of the effectiveness of the military training activity. Therefore, the following additional mitigation measures were analyzed and eliminated from further consideration because:

- they would result in impacts to training effectiveness, which would ultimately degrade military readiness;
- they present personnel safety concerns; or,
- they are impractical and provide no known protective benefit.

Reduction in training. The requirements for training have been developed iteratively over many years to ensure sailors have achieved levels of readiness that ensure they are prepared to properly respond to the many contingencies that may occur during deployment and actual combat. These training requirements are designed to provide the experience needed to ensure sailors are properly trained and proficient for operational success. There is not extra training built into the training plan, as this would not be an efficient use of resources (*e.g.* fuel, time). Therefore, any reduction of training would not allow sailors to achieve satisfactory levels of readiness needed to accomplish their mission.

Establish and implement a set vessel speed. Navy personnel are already required to use extreme caution and operate at a slow, safe speed consistent with mission and safety. Further, during periods of North Atlantic right whale migration, ships exercise heightened lookout vigilance and adjust speeds as necessary as an added measure to avoid this critically endangered species. Ships and submarines need to be able to react to changing tactical situations during training as they would in actual combat. Placing arbitrary speed restrictions would not allow them to properly react to these situations. By training differently than what would be needed in an actual combat scenario there would be a decrease in training effectiveness and a reduction in crew's abilities.

Restrict training to certain geographic areas, during certain seasons, and during certain conditions (*e.g.* low visibility, nighttime). Implementation of blanket restrictions on training as mitigation measures would dramatically reduce the realism of training with potentially severe national security consequences, and would afford at best only highly speculative benefits to marine species populations. Personnel must train under the full range of conditions that they might encounter during deployment and in combat, and be in a state of readiness that allow them to identify and respond to changing environmental conditions 24 hours per day. On-the-job training in combat is the worst possible way of training personnel and places personnel and the success of the military mission at significant risk. Nonetheless, the Navy has considered limitations during certain specific training events in all East Coast Range Complexes where feasible and when such limitations would not interfere with training missions and goals, and when other related training events provide the necessary exposure of personnel to the full spectrum of environmental conditions they may encounter during deployment and combat (particularly Unit Level Training events involving explosive ordnance, and seasonal restrictions related to North Atlantic right whale calving season and migration).

Expansion of Exclusion Area Delineated for Use with Explosive Detonations. Currently, the Navy uses certain exclusion zones for different explosive types, which means that an area of a certain size around an explosive must be clear of marine mammals for a certain amount of time prior to the detonation of that explosive. For a few of the larger charges (MK-84s and MK-48s), the distance to the isopleth within which NMFS expects TTS would likely occur is larger than the distance that the Navy must ensure is clear prior to the initiation of some of the exercise types that utilize those larger charges (*i.e.*, an animal could be within the distance from a source where TTS may occur, but outside of the distance that the Navy is required to 'clear' prior to detonation. NMFS considered requiring an enlarged exclusion zone for use with these larger charges.

Monitoring of Explosive Exclusion Area During Exercises. For some explosive detonations, the Navy's current mitigation requires clearance of an area prior to the initiation of an explosive exercise, but does not require continued monitoring of the area throughout the exercise (see Section 5.7). Under this measure, NMFS considered a requirement for Navy to continue monitoring the exclusion zone throughout the exercise and to take appropriate mitigation measures during the exercise should a marine mammal be spotted within that zone.

Visual monitoring using third-party observers from aircraft and vessels in addition to existing Navy-trained lookouts. Under the Integrated Comprehensive Monitoring Program for Marine Mammals described in Section 5.3, third-party lookouts would be used during exercises selected for data sampling. However, using third-party lookouts for all training events the Navy conducts in order to supplement Navy lookout observations and/or provide a "check" of Navy-trained lookouts would present logistical and security problems for the Navy.

- **Security.** Security clearances would need to be obtained for a large number of observers in order to cover all training events, since the exact time and location of all Navy training events is classified as SECRET.
- **Space.** Some training events span one or more 24-hour periods, with operations that are occurring underway continuously in that timeframe, therefore enough third-party personnel would be needed in order to man the observation decks or aircraft during that timeframe. There are severe space limitations onboard ships for berthing third-party crews, and there are no additional seats in aircraft that are involved in exercises. Overnight berthing of contractors and visitors are onboard ships is currently accomplished only after significant planning and juggling of bunks, space and Navy crew work shifts.
- **Scheduling.** Scheduling civilian vessels and/or aircraft to coincide with all training events would impact training effectiveness since exercise event timetables cannot be precisely fixed and are instead

based on the free-flow development of tactical situations. Waiting for civilian aircraft or vessels to complete surveys, refuel, or be on station would slow the unceasing progress of the exercise and impact the effectiveness of the training activity.

- **Safety.** Surveying during training events also raises safety concerns with multiple vessels and slow, low-flying civilian aircraft operating in the same seaspace and airspace as military vessels and aircraft engaged in combat training activities. In addition, most of the training events take place far from land, limiting both the time available for civilian aircraft to be in the exercise area and presenting a concern should aircraft mechanical problems arise.

5.10 DETECTION PROBABILITY AND MITIGATION EFFICACY

5.10.1 Factors Affecting Detection Probability

The probability of visually detecting a marine animal is dependent upon two things. First, the animal and the observer must be in the same place at the same time. If the animal is not present, it cannot be seen (availability bias) (Marsh and Sinclair, 1989). Second, when the animal is in a position to be detected by an observer and the observer in a position to detect the animal, the observer must perceive the animal (perception bias) (Marsh and Sinclair, 1989). The factors affecting the detection of the animal may be probabilistically quantified as g(0). That is, g(0) represents the chance that the animal will be available for detection (i.e., on the surface and in the observer's field of view) and that the observer will perceive the animal. A g(0) value of 1 indicates that 100 percent of the animals are detected; it is rare that this assumption holds true, as both perception and availability bias impact the overall value of g(0) for any given species.

Various factors are involved in estimating *g(0)*, including: sightability/detectability of the animal (species-specific behavior and appearance, school size, blow characteristics, dive characteristics, and dive interval); viewing conditions (sea state, wind speed, wind direction, sea swell, and glare); and observer (experience, fatigue, and concentration) and platform characteristics (pitch, roll, yaw, speed, and height above water). Thomsen *et al*. (2005) provide a complete and recent discussion of *g(0)*, factors that affect the detectability of the animals, and ideas on how to account for detection bias. Table 5.10-1 provides a range of values for *g(0)* for cetacean species in the JAX Study Area. It is important to note that *g(0)* as it is used here does not relate to the ability to identify an animal on any order, only that the animal will be detected.

TABLE 5.10-1
RANGE OF ESTIMATES FOR G(0) FOR MARINE MAMMAL SPECIES FOUND ON THE ATLANTIC COAST

g(0)[1]	Location	Platform	Source
Threatened/Endangered Cetacean Species			
Right whale (*Eubalaena* spp.)			
0.29-1.00	U.S. Atlantic Coast	Shipboard	(Palka, 2006)
0.11-0.71	U.S. Atlantic Coast	Aerial	(Hain *et al.*, 1999)
0.19-0.29	U.S. Atlantic Coast	Aerial	(Palka, 2005b)

TABLE 5.10-1 (Continued)
RANGE OF ESTIMATES FOR G(0) FOR MARINE MAMMAL SPECIES FOUND ON THE ATLANTIC COAST

g(0)[1]	Location	Platform	Source
0.95	U.S. West Coast	Aerial	(Forney *et al.*, 1995)
Humpback (*Megaptera novaeangliae*)			
0.19-0.21	U.S. Atlantic Coast	Shipboard	(Palka, 2005a)
0.90-1.00	U.S. West Coast	Shipboard	(Barlow, 1995; Calambokidis and Barlow, 2004)
0.95	U.S. West Coast	Aerial	(Forney *et al.*, 1995)
0.26	Hawaii	Aerial	(Mobley *et al.*, 2001)
Blue whale (*Balaenoptera musculus*)			
0.41	U.S. West Coast	Aerial	(Barlow et al., 1997; Carretta, *et al*., 2000)
0.9-1.00	U.S. West Coast	Shipboard	(Barlow and Taylor, 2001)
0.92	U.S. West Coast	Shipboard	(Barlow and Forney, 2007; Forney, 2007)
Sei whale (*Balaenoptera borealis*)			
0.92	U.S. West Coast	Shipboard	(Barlow and Forney, 2007; Forney, 2007)
Fin whale (*Balaenoptera physalus*)			
0.32-0.94	U.S. Atlantic Coast	Shipboard	(Blaylock et al., 1995; Palka, 2006)
0.19-0.29	U.S. Atlantic Coast	Aerial	(Palka, 2005b)
0.90-1.00	U.S. West Coast	Shipboard	(Barlow, 1995, 2003a)
0.95-0.98	U.S. West Coast	Aerial	(Forney and Barlow, 1993; Forney et al. 1995)
0.90-1.00	Hawaii	Shipboard	(Barlow, 2003b)
Sperm whale (*Physeter macrocephalus*)			
0.28-0.57	U.S. Atlantic Coast	Shipboard	(Palka, 2005a; Palka, 2006)

TABLE 5.10-1 (Continued)
RANGE OF ESTIMATES FOR G(0) FOR MARINE MAMMAL SPECIES FOUND ON THE ATLANTIC COAST

g(0)[1]	Location	Platform	Source
0.19-0.29	U.S. Atlantic Coast	Aerial	(Palka, 2005b)
0.53-1.00	U.S. West Coast	Shipboard	(Barlow, 1995; Barlow and Gerrodette, 1996; Barlow and Sexton, 1996; Barlow, 2003a; Barlow and Taylor, 2005)
0.95-0.98	U.S. West Coast	Aerial	(Forney and Barlow, 1993; Forney et al., 1995)
0.87	Hawaii	Shipboard	(Barlow, 2003b, 2006)
0.32	Antarctic	Shipboard	(Kasamatsu and Joyce, 1995)
Non-Threatened/Non-Endangered Cetacean Species			
Minke whale (*Balaenoptera acutorostrata*)			
0.31-0.70	U.S. Atlantic Coast	Shipboard	(Blaylock et al., 1995; Palka, 2006)
0.19-0.29	U.S. Atlantic Coast	Aerial	(Palka, 2005b)
0.25-0.90	Eastern North Atlantic	Shipboard	(Butterworth and Borchers,,1988; Øien, 1990; Schweder et al., 1991; Schweder and Høst, 1992; Schweder et al., 1992; Schweder et al., 1997; Skaug and Schweder, 1999; Skaug et al., 2004)
0.84	U.S. West Coast	Shipboard	(Barlow, 1995, 2003a)
0.95-0.98	U.S. West Coast	Aerial	(Forney and Barlow, 1993; Forney et al., 1995)
0.63-0.83	Antarctic	Shipboard	(Doi et al., 1982; IWC, 1982, 1983)
Bryde's whale (*Balaenoptera edeni*)			
0.90-1.00	U.S. West Coast	Shipboard	(Barlow, 1995, 2003a)

TABLE 5.10-1 (Continued)
RANGE OF ESTIMATES FOR G(0) FOR MARINE MAMMAL SPECIES FOUND ON THE ATLANTIC COAST

g(0)[1]	Location	Platform	Source
0.90	Hawaii	Shipboard	(Barlow, 2003b, 2006)
Beluga (*Delphinapterus leucas*)			
None available.			
***Kogia* spp.**			
0.29-0.55	U.S. Atlantic Coast	Shipboard	(Palka, 2006)
0.19-0.79	U.S. West Coast	Shipboard	(Barlow, 1995; Barlow and Sexton, 1996; Barlow, 1999, 2003a)
0.35	Hawaii	Shipboard	(Barlow, 2003b, 2006)
Ziphiidae (Beaked Whales)			
0.46-0.51	U.S. Atlantic Coast	Shipboard	(Palka, 2005a; Palka 2006)
0.19-0.21	U.S. Atlantic Coast	Aerial	(Palka, 2005b)
0.13-1.00	U.S. West Coast	Shipboard	(Barlow, 1995; Barlow and Sexton, 1996; Barlow, 1999; Carretta et al., 2001; Barlow, 2003a; Barlow, et al. 2006)
0.23-0.45	Hawaii	Shipboard	(Barlow, 2003b, 2006)*
0.27	Antarctic	Shipboard	(Kasamatsu and Joyce, 1995)
0.95-0.98	U.S. West Coast	Aerial	(Forney and Barlow, 1993; Forney et al., 1995)
Bottlenose dolphin (*Tursiops truncatus*)			
0.62-0.99	U.S. Atlantic Coast	Shipboard	(Palka, 2005a; Palka, 2006)
0.58-0.77	U.S. Atlantic Coast	Aerial	(Palka, 2005b)
0.74-1.00	U.S. West Coast	Shipboard	(Barlow, 1995, 2003a)
0.67-0.96	U.S. West Coast	Aerial	(Forney and Barlow, 1993; Forney et al., 1995)

TABLE 5.10-1 (Continued)
RANGE OF ESTIMATES FOR G(0) FOR MARINE MAMMAL SPECIES FOUND ON THE ATLANTIC COAST

g(0)[1]	Location	Platform	Source
0.74-1.00	Hawaii	Shipboard	(Barlow, 2003b, 2006)
Spinner dolphin (*Stenella longirostris*)			
0.61-0.76	U.S. Atlantic Coast	Shipboard	(Palka, 2006)
0.77-1.0	U.S. West Coast	Shipboard	(Barlow, 2003a)
0.77-1.0	Hawaii	Shipboard	(Barlow, 2003b, 2006)
Clymene dolphin (*Stenella clymene*)			
None available.			
Pantropical spotted dolphin (*Stenella attenuate*)			
0.37-0.94	U.S. Atlantic Coast	Shipboard	(Palka, 2006)*
0.77-1.00	U.S. West Coast	Shipboard	(Barlow, 2003a)
0.76-1.00	Hawaii	Shipboard	(Barlow, 2003b, 2006)
Atlantic spotted dolphin (*Stenella frontalis*			
0.37-0.94	U.S. Atlantic Coast	Shipboard	(Palka, 2006)**
Striped dolphin (*Stenella coeruleoalba*)			
0.61-0.77	U.S. Atlantic Coast	Shipboard	(Palka, 2005a; Palka, 2006)
0.77-1.00	U.S. West Coast	Shipboard	(Barlow, 1995, 2003a)
0.76-1.00	Hawaii	Shipboard	(Barlow, 2003b, 2006)
Common dolphin (*Delphinus delphis*)			
0.52-0.95	U.S. Atlantic Coast	Shipboard	(Palka, 2005a; Palka, 2006)
0.58-0.77	U.S. Atlantic Coast	Aerial	(Palka, 2005b)
0.79-0.81	Eastern North Atlantic	Shipboard	(Cañadas *et al*., 2004)

TABLE 5.10-1 (Continued)
RANGE OF ESTIMATES FOR G(0) FOR MARINE MAMMAL SPECIES FOUND ON THE ATLANTIC COAST

g(0)[1]	Location	Platform	Source
0.77-1.0	U.S. West Coast	Shipboard	(Barlow, 1995, 2003a)
0.67-0.96	U.S. West Coast	Aerial	(Forney and Barlow, 1993; Forney et al., 1995)
Rough-toothed dolphin (*Steno bredanensis*)			
0.74-1.00	U.S. West Coast	Shipboard	(Barlow, 2003a)
0.74-1.00	Hawaii	Shipboard	(Barlow, 2003b, 2006)
Fraser's dolphin (*Lagenodelphis hosei*)			
0.76-1.00	Hawaii	Shipboard	(Barlow, 2003b, 2006)
White-sided dolphin (*Lagenorhynchus acutus and L. obliquidens*)			
0.27-0.38	U.S. Atlantic Coast	Shipboard	(Palka, 2006)
0.58-0.77	U.S. Atlantic Coast	Aerial	(Palka, 2005b)
0.77-1.00	U.S. West Coast	Shipboard	(Barlow, 1995, 2003a)
0.67-0.96	U.S. West Coast	Aerial	(Forney and Barlow, 1993; Forney et al., 1995)
White-beaked dolphin (*Lagenorhynchus albirostris*)			
None available.			
Risso's dolphin (*Grampus griseus*)			
0.51-0.84	U.S. Atlantic Coast	Shipboard	(Palka, 2005a; Palka 2006)
0.58-0.77	U.S. Atlantic Coast	Aerial	(Palka, 2005b)
0.74-1.00	U.S. West Coast	Shipboard	(Barlow, 1995, 2003a)
0.67-0.96	U.S. West Coast	Aerial	(Forney and Barlow, 1993; Forney et al., 1995)
0.74-1.00	Hawaii	Shipboard	(Barlow, 2003b, 2006)

TABLE 5.10-1 (Continued)
RANGE OF ESTIMATES FOR G(0) FOR MARINE MAMMAL SPECIES FOUND ON THE ATLANTIC COAST

g(0)[1]	Location	Platform	Source
False killer whale (*Pseudorca crassidens*)			
0.74-1.00	Hawaii	Shipboard	(Barlow, 2003b, 2006)
Pygmy killer whale (*Feresa attenuata*)			
0.74-1.00	Hawaii	Shipboard	(Barlow, 2003b, 2006)
Killer whale (*Orcinus orca*)			
0.90	U.S. West Coast	Shipboard	(Barlow, 2003a)
0.95-0.98	U.S. West Coast	Aerial	(Forney *et al*., 1995)
0.90	Hawaii	Shipboard	(Barlow, 2003b, 2006)
0.96	Antarctic	Shipboard	(Kasamatsu and Joyce, 1995)
Melon-headed whale (*Peponocephala electra*)			
0.74-1.00	Hawaii	Shipboard	(Barlow, 2003b, 2006)
Pilot whale (*Globicephala* spp.)			
0.48-0.67	U.S. Atlantic Coast	Shipboard	(Palka, 2005a; Palka 2006)
0.19-0.29	U.S. Atlantic Coast	Aerial	(Palka, 2005b)
0.74-1.00	U.S. West Coast	Shipboard	(Barlow, 2003a)
0.74-1.00	Hawaii	Shipboard	(Barlow, 2003b, 2006)
0.93	Antarctic	Shipboard	(Kasamatsu and Joyce, 1995)
Harbor porpoise (*Phocoena phocoena*)			
0.35-0.73	U.S. Atlantic Coast	Shipboard	(Palka, 1995; Palka, 1996; Palka, 2006)
0.24-0.49	U.S. Atlantic Coast	Aerial	(Palka, 2005b)
0.41-0.71	Eastern North Atlantic	Aerial	(Grünkorn *et al*. 2005)

TABLE 5.10-1 (Continued)
RANGE OF ESTIMATES FOR G(0) FOR MARINE MAMMAL SPECIES FOUND ON THE ATLANTIC COAST

g(0)[1]	Location	Platform	Source
0.08-0.85	U.S. West Coast	Aerial	(Barlow et al. ,1988; Calambokidis et al., 1993a; Forney et al. 1995; Laake et al., 1997; Carretta et al., 2001; Carretta et al., 2007)
0.54-0.79	U.S. West Coast	Shipboard	(Calambokidis et al., 1993b; Barlow 1995; Carretta et al., 2001)

**These numbers were either determined by the source or applied by the source for abundance/density estimation analyses in the particular geographic location.*

[1] A g(0) value of 1.00 indicates that 100 percent of the animals are detected; it is rare that this assumption holds true. Departures of g(0) from 1.00 can be attributed to either perception bias or availability bias.

5.10.1.1 Marine Mammals

There are many variables that play into how easily a marine mammal may be detected by an observer at the surface [i.e., the g(0) value for that species]. As discussed previously, some of these variables affect (or are affected by) the observer, the platform, and the conditions under which the observations are being made. Many of the variables, however, are directly related to the animal, its external appearance, its behavior and its life history. The size of the animal, its surface behavior, its dive behavior, and the overall gregariousness of the species all impact the ability of the observer to detect an individual at the surface.

The following is a much generalized discussion of the behavior and external appearance of the marine mammals with the potential to occur in the East Coast Range Complexes as these characters relate to the detectability of each species. The species are grouped loosely based on either taxonomic relatedness or commonalities in size and behavior (or both). Not all statements may hold true for all species in a grouping and outstanding exceptions are mentioned where applicable. The information presented in this section may be found in Jefferson et al. (2008) and sources within unless otherwise noted.

Cetaceans

Large Whales

Species of large whales found in the JAX Study Area include all the baleen whales and the sperm whale. Baleen whales are generally large (adult size ranging from 9 to 27 m [30 to 89 ft]), often making them immediately detectable. Many species of baleen whales have a prominent blow ranging from 3 m (10 ft) to as much as 12 m (39 ft) above the surface. However, there are at least two species (Bryde's whale and common minke whale) that often have no visible blow. Baleen whales tend to travel singly or in small groups ranging from pairs to groups of five; the exception to this is the fin whale, which is known to travel in pods of seven or more individuals. However, all species of baleen whales are known to form larger-scale aggregations in areas of high localized productivity or on breeding grounds. Baleen whales may or may not fluke at the surface before they dive; some species fluke regularly (humpback whale, North Atlantic right whale), some fluke variably (blue whale, fin whale) and some rarely fluke (sei whale, common minke whale, and Bryde's whale). Baleen whales may remain at the surface for extended periods of time as they forage or socialize. North Atlantic right whales are known to form surface-active

groups (SAG) and humpback whales to corral prey at the surface. Dive behavior varies amongst species, as well. Many species will dive and remain at depth for as long as 30 minutes. Some will adjust their diving behavior according to the presence of vessels (North Atlantic right whale, humpback whale, fin whale). Sei whales are known to sink just below the surface and remain there between breaths. Baleen whales have *g(0)* values ranging from 0.11 to 1.00 (Table 5.10-1).

Sperm whales also belong to the large whales, with adult males reaching as much as 18 m (50 ft) in total length. Sperm whales at the surface would likely be easy to detect. They are large, have a prominent, 5 m (16 ft) blow, and may remain at the surface for long periods of time. They are known to raft (i.e., loll at the surface) and to form SAGs when socializing. Sperm whales may travel or congregate in large groups of as many as 50 individuals. They also engage in conspicuous surface behavior such as fluking, breaching and tail-slapping. However, sperm whales are long, deep divers and may remain submerged for over an hour. Sperm whales vocalize frequently (Teloni, 2005) and would probably be detected acoustically. Sperm whales have *g(0)* values ranging from 0.19 to 1.00 (Table 5.10-1).

Cryptic Species

Cryptic cetacean species are those that are known to be difficult to detect on the surface or that actively avoid vessels. These include beaked whales (family Ziphiidae), dwarf and pygmy sperm whales (*Kogia* spp.), and harbor porpoises.

Beaked whales are notoriously difficult to detect at sea. Beaked whales may occur in a variety of group sizes, ranging from single individuals to groups of as many as 100 (MacLeod and D'Amico, 2006). For beaked whale species occurring in the East Coast Range Complexes, group sizes may range from 1 to 22 individuals. Beaked whale diving behavior in general consists of long, deep dives that may last for nearly 90 minutes followed by a series of shallower dives and intermittent surfacings (Tyack *et al*., 2006; Baird *et al*., 2007). However, individuals may remain at the surface for an extended period of time (perhaps an hour or more) or make shorter dives (MacLeod and D'Amico, 2006). Detection of beaked whales is further complicated because beaked whales often dive and surface in a synchronous pattern (MacLeod and D'Amcio, 2006) and they travel below the surface of the water. Beaked whales are odontocetes and use acoustic signals for communication and foraging. They are known to produce sounds ranging from low to high frequency (MacLeod and D'Amico, 2006). However, many of the sounds that have been recorded for beaked whales fall at or outside the upper range of human hearing (greater than 20 kHz), making acoustic detection less likely for these species than for species with a lower peak frequency. Beaked whales have *g(0)* values ranging from 0.13 to 1.00 (Table 5.10-1).

Dwarf and pygmy sperm whales (referred to broadly as *Kogia* spp.) are small cetaceans (3 to 4 m [10 to 13 ft] adult length) that are not seen commonly at sea. *Kogia* spp. are some of the most commonly stranded species in some areas, which suggests that sightings are not indicative of their overall abundance. This supports the idea that they are cryptic, perhaps engaging in inconspicuous surface behavior or actively avoiding vessels. When *Kogia* spp. are sighted, they are seen in groups of no more than five to six individuals. They have no visible blow, do not fluke when they dive, and are known to log (i.e., lie motionless) at the surface. When they do dive, they often will sink out of sight with no prominent behavioral display. There is little acoustic information on *Kogia* spp.; what is available suggests that *Kogia* spp. emit ultrasonic clicks with a peak frequency of 125 kHz (Marten, 2000), well outside of what is audible to the human ear. *Kogia* spp. are not likely to be detected acoustically. *Kogia* spp. have *g(0)* values ranging from 0.19 to 0.79 (Table 5.10-1).

Harbor porpoises are better known than beaked whales and *Kogia* spp., but are considered to be cryptic because they are difficult to detect in all but the best of conditions (i.e., no swell, no whitecaps). Harbor porpoises travel singly or in small groups (less than six individuals), but may aggregate into groups of several hundred. They are inconspicuous at the surface, rarely lifting their heads above the surface and

often lying motionless. They are small and may actively avoid vessels. Harbor porpoises have *g(0)* values ranging from 0.08 to 0.85 (Table 5.10-1).

Delphinids

There are 18 species of the family Delphinidae that may occur in the East Coast Range Complexes. There are a variety of factors that make these species some of the most likely to be detected at sea by observers. Many species of delphinids engage in very conspicuous surface behavior, including leaping, spinning, bow riding, and traveling along the surface in large groups. Delphinid group sizes may range from 10 to 10,000 individuals, depending upon the species and the geographic region. Species such as pilot whales, rough-toothed dolphins, white-beaked dolphins, white-sided dolphins, bottlenose dolphins, Stenellid dolphins, common dolphins, and Fraser's dolphins are known to either actively approach and investigate vessels, or bow ride along moving vessels. Fraser's dolphins and common dolphins form huge groups that travel quickly along the surface, churning up the water and making them visible from a great distance. Delphinids may dive for as little as a minute to over thirty minutes, depending upon the species. Some species of delphinids are very vocal and may be easily detected acoustically if they are foraging or socializing. There are records of some species of Delphinids (spinner dolphins, pantropical spotted dolphins, common dolphins) actively avoiding vessels in the Eastern Tropical Pacific (ETP). This behavior is probably a response to the high levels of mortality associated with tuna fisheries in the ETP and has not been noted elsewhere in the world. Delphinids have *g(0)* values ranging from 0.19 to 1.00, with many species having much higher values (Table 5.10-1).

Miscellaneous

Beluga whales may occur in the East Coast Range Complexes and would probably be detected by observers. Belugas have an extremely conspicuous coloration (all white) and reach up to 5 m (16 ft) in total length. They travel in groups ranging from 15 individuals to thousands. They dive for lengths of up to 25 minutes, but are one of the most vocal cetaceans and would likely be detected acoustically. There are no *g(0)* values available for beluga whales.

In general, large whales are fairly easy to detect due to their large size and prominent blow (Taylor *et al.*, 2007). Also relatively easy to detect are large groups of individuals, particularly gregarious delphinids that may be visible from a great distance due to the disturbance they make when moving across the surface of the water. Less easy to detect are marine mammals that spend a great deal of time at depth or whose presence on the surface is solitary and inconspicuous (Taylor *et al.*, 2007).

Most information on pinnipeds is gleaned from studies done while individuals are hauled-out on land or on ice. Systematic at-sea sightings information is limited, so a *g(0)* value is available only for harbor seal (Carretta *et al*., 2000). Pinnipeds have a low profile, no dorsal appendage and small body size in comparison with most cetaceans, limiting accurate visual detection to sea states of less than Beaufort 2 (Carretta *et al*., 2000).

5.10.1.2 Sea Turtles

The detection probability of sea turtles is generally lower than that of cetaceans. Sea turtles often spend over 90 percent of their time underwater (e.g., Byles, 1988; Renaud and Carpenter, 1994; Mansfield and Musick, 2003) and are not visible more than one or two meters below the surface (Mansfield, 2006). Shoop and Kenney (1992) postulated that, due to the dive behavior of sea turtles, marine surveys underestimate the total number of animals in a given area by as much as an order of magnitude. This suggests that standard visual observation efforts may be less effective in detecting sea turtles than they are in detecting cetaceans. Sea turtles also are much smaller than cetaceans, so the effective distance from which they can be seen (from both surface and aerial platforms) is smaller (300 m [984 ft] for turtles versus over a kilometer for large whales or gregarious delphinids; Musick *et al.*, 1984). Shipboard

surveys designed for sighting marine mammals are adequate for detecting large sea turtles (e.g., adult leatherbacks), but usually not the smaller-sized turtles (e.g., juveniles, *Lepidochelys* spp.). Pelagic juveniles may be especially difficult to detect. Aerial detection may be more effective in spotting sea turtles on the surface, particularly in calm seas and clear water, but it is possible that the smallest age classes are not detected even in good conditions (Marsh and Saalfeld, 1989). Visual detection of sea turtles, especially small turtles, is further complicated by their startle behavior in the presence of ships. Turtles on the surface may react to the presence of a vessel (dive) before it is detected by shipboard or aerial observers (Kenney, 2005). However, sea turtle reaction time is reduced in proportion to increasing vessel speeds (Hazel *et al*., 2007).

There have been few dedicated surveys for sea turtles. There is no information available on specific *g(0)* values for turtles. Most of these studies have used mathematical models to calculate the proportion of surfaced turtles to submerged turtles based on the proportion of time sea turtles are expected to spend at the surface (obtained from tracking or tagging data). Byles (1988) found that for every loggerhead observed on the surface in Chesapeake Bay, approximately 19 were present, but unobservable. Mansfield (2006) found that sea turtles spent more time at the surface during the spring than during the summer within the Chesapeake Bay. Therefore, the 1:19 (at surface/ under the surface) ratio would change depending on the season. However, sea turtles only spend a portion of the year in Chesapeake Bay and their surfacing behavior may be different than that of year-round residents in other locations. Not only are there no specific estimates of *g(0)* for turtles, but it is likely that the value shifts significantly depending on species, age class, season and geographic region.

Visual mitigation efforts for sea turtles will probably detect only those individuals that are very large or that spend a significant portion of their time at the surface. Sea turtles will not be detected acoustically.

CHAPTER 6 CUMULATIVE IMPACTS

6.1 APPROACH

The approach taken in the analysis of cumulative impacts follows the objectives of NEPA and CEQ regulations and guidance. CEQ regulations (40 CFR §§ 1500-1508) provide the implementing procedures for NEPA. The regulations define cumulative impacts as:

> "'Cumulative impact' is the impact on the environment that results from the incremental impact of the action when added to the other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7)."

> "To determine the scope of environmental impact statements, agencies shall consider …cumulative actions, which when viewed with other proposed actions have cumulatively significant impacts and should, therefore, be discussed in the same impact statement."

In addition, the CEQ has published guidance addressing implementation of cumulative impact analysis under NEPA. The CEQ guidance publication entitled *Considering Cumulative Impacts Under the National Environmental Policy Act, January 1997* states that the analyses should:

> "…determine the magnitude and significance of the environmental consequences of the proposed action in the context of the cumulative impacts of other past, present, and future actions… identify significant cumulative impacts…[and]…focus on truly meaningful impacts."

Based on the guidance provided within that CEQ publication, the Navy determined the following types of potential cumulative impacts need to be analyzed:

- "additive" (the total loss of a resource from more than one incident),
- "countervailing" (adverse impacts that are compensated for by beneficial effects), and
- "synergistic" (when the total effect is greater than the sum of the effects taken independently).

However, the analysis of cumulative impacts may go beyond the scope of project-specific direct and indirect impacts to include expanded geographic and time boundaries and a focus on broad resource sustainability. The true geographic range of an action's effect may not be limited to an arbitrary political or administrative boundary. Similarly, the impacts of an action may continue beyond the time the action ceases. This "big picture" approach is becoming increasingly important as growing evidence suggests that the most significant impacts result not from the direct impacts of a particular action, but from the combination of individual, often minor, impacts of multiple actions over time. The underlying issue is whether or not a resource can adequately recover from the impact of an action before the environment is exposed to a subsequent action or actions.

The proposed action is to support and conduct current and emerging training and Research, Development, Testing, and Evaluation (RDT&E) operations in the JAX Range Complex. This complex consists of targets and instrumented areas, airspace, and surface and subsurface OPAREAs. The activities analyzed in this document include current and future proposed Navy training and RDT&E operations within Navy-controlled OPAREAs, airspace, and ranges, and Navy-funded range capabilities enhancements.

The proposed action would not make radical changes to the JAX Range Complex facilities, operations, training, or RDT&E capacities. Rather, the actions proposed in the No Action Alternative, Alternative 1, and Alternative 2 are incremental increases that would result in relatively small-scale, but critical,

enhancements that are necessary if the Navy is to maintain a state of military readiness commensurate with its national defense mission.

6.1.1 Assumptions Used in the Analysis

The cumulative impacts analysis in this chapter differs from the analysis conducted for the alternatives detailed in Chapter 3 because the cumulative impacts analysis considers an expanded geographic area and extended timeframe. Therefore, the cumulative impacts analysis includes additional impacts on the physical, biological, and human environments associated with JAX Range Complex activities.

In accordance with NEPA, the cumulative impacts analysis takes into consideration combined impacts of past, present, and reasonably foreseeable future activities. Therefore, the baseline utilized in the alternatives analysis presented in Chapter 3 of this EIS/OEIS could not be used in the cumulative impacts analysis. The baseline associated with the cumulative impact analysis had to take into account the effects of both past and present activities. In accordance with the NEPA, the cumulative impacts analysis must take into consideration the incremental contribution of the proposed action to the existing baseline. However, as activities increase within the Study Area, the baseline will change. Thus, the baseline for the cumulative impacts analysis must include past, present, and reasonably foreseeable future activities.

The incremental contribution of the proposed action in each area is relatively small and would most likely continue to reduce in size as non-military activities increase within the JAX Study Area. Overall, it is more difficult to analyze cumulative impacts versus project-specific impacts. The Navy recognizes the need to identify and quantify the factors causing environmental change and the threshold triggers associated with the environmental response.

6.1.2 Summary and Significance of Past Cetacean Stranding Events Related to Military Use of Sonar

With the exception of historic whaling in the 19th and early part of the 20th century, during the past few decades there has been an increase in marine mammal mortalities associated with a variety of human activities (Geraci *et al*., 1989; NMFS, 2008a). These include fisheries interactions (bycatch and directed catch), pollution (marine debris, toxic compounds), habitat modification (degradation, prey reduction), vessel strikes (Laist *et al*., 1999), and gunshots. In addition, during the past 10 years, naval sonar has been putatively linked to only 5 stranding events worldwide, with a total of 51 stranded animals and 37 mortalities. The 37 mortalities equate to an average of fewer than 4 marine mammal mortalities per year over the past 10 years.

These five strandings are unique from other strandings because in these cases, unique conditions may have existed in the active sonar activity area that, in their aggregate, may have contributed to the marine mammal strandings. For example, the stranding of whales occurred over a short period of time, stranded individuals were spatially co-located, traumas in stranded animals were consistent between events, and active sonar was known or suspected to be in use. Moreover, in several of these strandings, activities involved multiple ships operating in the same area over extended periods of time in close proximity. Furthermore, operations occurred across a relatively short horizontal distance, in areas surrounded by landmasses, and of at least 3,281 feet (ft) (1,000 meters [m]) in depth near a shoreline with a rapid change in bathymetry. However, these conditions are not present in the majority of other documented marine mammal strandings, and current science suggests that multiple factors, both natural and man-made, may each be acting alone or in combination to cause marine mammals to strand.

Overall, the number of deaths during stranding events associated with mid-frequency active sonar exposure is small in comparison to the number of marine mammals killed annually through fishing by-catch and whaling operations. For example, the mean annual bycatch from 1990 through 1999 was 3,029 marine mammals (Read *et al*., 2006). Bycatch data from 1990 through 1994 was extrapolated by Read *et*

al., (2006) to consider global impacts; when this was done, approximately 308,000 marine mammal deaths have resulted annually. Waring *et al*., (2008) provided a mean annual mortality of 702 to Western North Atlantic cetaceans (excluding pinnipeds) by observed fisheries in 2001 through 2005. In addition to by-catch, some countries still engage in whaling operations for research and commercial purposes. Such operations led to the death of almost 1,500 marine mammals in 2006 (IWC, 2008). Thus, the overall contribution of cetaceans' stranding resulting in death associated with exposure to naval mid-frequency sonar is relatively small when compared to all the other non-military activity related to marine mammal stranding and effects, as shown in Figure 6.1-1.

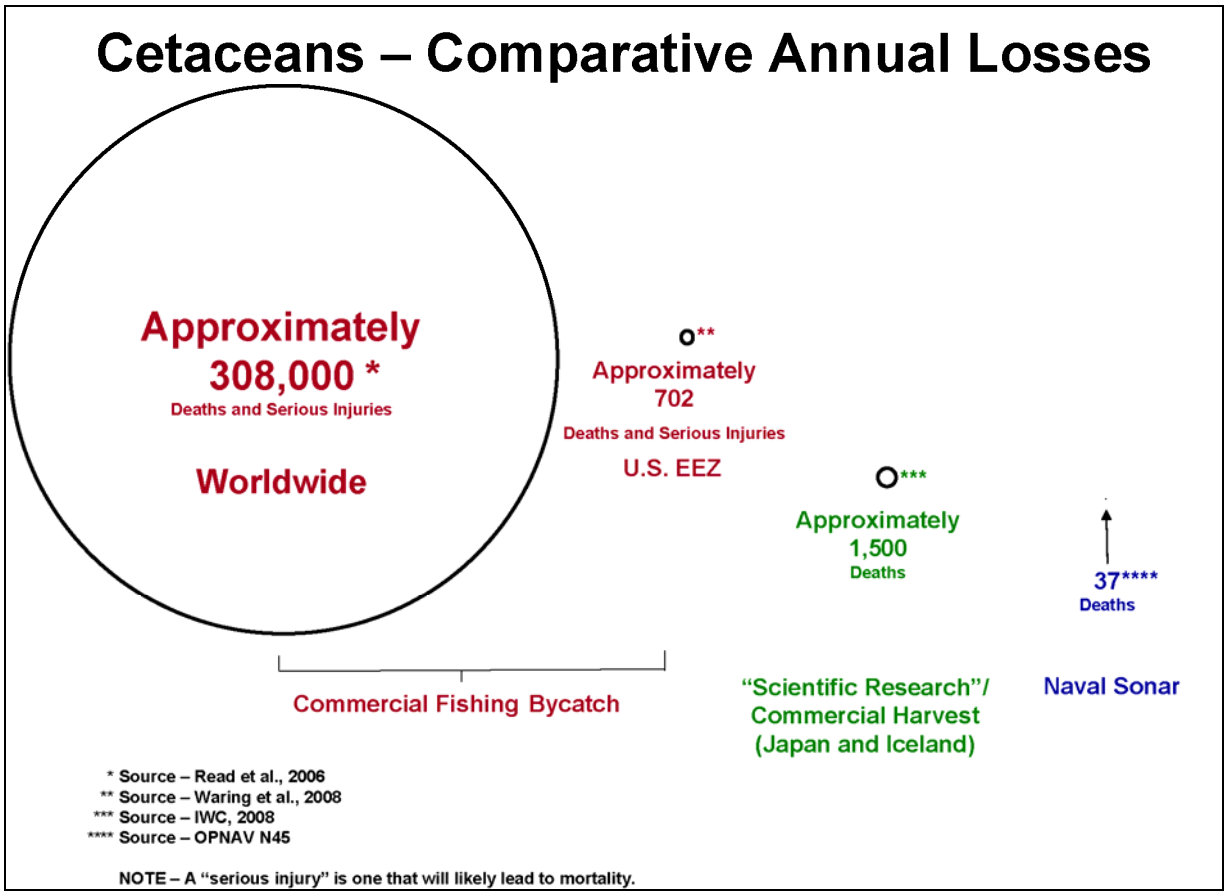


Figure 6.1-1. Annual Comparison of Cetacean Death By Activity

The Navy has made the protection of marine mammals a top priority. The Navy has led the way in marine mammal research, and in conjunction with the National Oceanic and Atmospheric Administration (NOAA), has developed 29 mandatory science-based mitigation measures that allow the Navy to conduct active sonar activities with the utmost care for the ocean environment. Refer to Chapter 5, Mitigation Measures, for additional information.

6.1.3 Organization of Chapter 6

Presenting past, present and reasonably foreseeable future actions and their potential impacts can be very confusing. The following organization may help the reader understand how the data are presented. Past and present actions are presented in Section 6.2. Actions for civilian commercial and recreational activities are presented in Section 6.2.1; outer continental shelf activities are presented in Section 6.2.2;

scientific research is discussed in Section 6.2.3; recreational diving is discussed in Section 6.2.4; NASA activities are presented in Section 6.2.5; and military operations are discussed in section 6.2.6. Reasonably foreseeable future actions are presented in Section 6.3. This section is further divided into military operations (Section 6.3.1) and other federal and state agency actions (Section 6.3.2). Section 6.4 is a discussion of cumulative impacts relative to the Proposed Action. Cumulative impacts relative to the Proposed Action is discussed in Section 6.4. Finally, Section 6.5 is a summary of cumulative impacts by resource area.

6.2 PAST AND PRESENT ACTIONS

Various types of past and present actions not related to the proposed action have the potential to affect the resources identified in Chapter 3. The overview of these actions in this section emphasizes components of the activities that are relevant to the effects analysis in Chapter 3. Geographic distribution, intensity, duration, and the historical effects of similar activities are considered when determining whether a particular activity may contribute cumulatively and significantly to the impacts on resource areas identified in Chapter 3. The past and present actions discussed in this section are based upon the best available data that are available to the public as of December 1, 2008.

6.2.1 Commercial and Recreational Activities

The fishing industry affects resources, including marine mammals and sea turtles. The mean annual mortality of Western North Atlantic marine mammals as a result of by-catch is estimated at 2,615 *(i.e.*, 702 cetaceans and 1,913 pinnipeds) (Waring *et al*., 2008). Adverse effects to protected marine species are possible due to gillnet, longline, trawlgear, and pot fisheries. Additionally, commercial fisheries may incidentally entangle and drown or injure cetaceans by lost and expended fishing gear (e.g., Northridge and Hofman, 1999). For example, entanglement in fixed fishing gear, in particular in sink gillnets and a variety of pot and trap fisheries, is one of the most important factors depressing the growth rate of the North Atlantic right whale population (Kenney, 2002). Additionally, fisheries may indirectly compete with cetaceans by reducing the amount of primary food source accessible to cetaceans, thereby negatively affecting their numbers (Trites *et al*., 1997). Southeastern shrimp trawl and summer flounder/scup/black sea bass fisheries are considered to be most likely to adversely affect sea turtles; however, shrimp trawling has the greatest effect. However, the use of turtle-excluder devices in the shrimp fishery was estimated to reduce sea turtle bycatch by approximately 97 percent (NOAA, 2004). As an example of the success of turtle-excluder devices, in South Carolina waters, mortality was reduced by approximately 44 percent in the law's first four years (Gibbons, 2008).

Fisheries are classified first, according to the total effect of all fisheries on each marine mammal stock and second, by addressing the effect of individual fisheries on each stock. This classification method includes consideration of the rate, in numbers of animals per year, of incidental mortalities and serious injuries of marine mammals due to commercial fishing operations relative to the potential biological removal level for each stock. This level is the maximum number of animals, not including natural mortalities, which may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population (NMFS, 2007b). Category I fisheries are the most detrimental to marine mammals and are defined as having an annual mortality and serious injury of a stock in a given fishery of greater than or equal to 50 percent of the potential biological removal level (NMFS, 2007b). Table 6.2-1 shows the Category I commercial fisheries in the Atlantic Ocean and Gulf of Mexico and the marine mammal species affected.

Along the Atlantic and Gulf Coast, almost 2.8 billion pounds of fish were commercially caught with a value of over $2.1 billion (NMFS, 2007d). In addition, over 12 million Americans participate in saltwater recreational fishing along the Atlantic and Gulf Coast (NMFS, 2007d). In the past ten years, the number of participants has increased 54 percent and the number of recreational fishing trips has increased to 82

million trips (NMFS, 2007d). Nationwide, recreational saltwater recreational fishing generated over $30 billion in sales in 2000 and supported about 350,000 jobs (Steinbeck *et al*., 2004).

TABLE 6.2-1
CATEGORY I COMMERCIAL FISHERIES
IN THE ATLANTIC OCEAN AND GULF OF MEXICO

Fishery Description	Estimated Number of Vessels/ Persons	Marine Mammal Species Incidentally Killed/Injured		
Gillnet Fisheries	>1,011	Fin whale Humpback whale Long-finned pilot whale Minke whale Atlantic Ocean right whale Short-finned pilot whale	Bottlenose dolphin Common dolphin Harbor porpoise Risso's dolphin White-sided dolphin	Gray seal Harbor seal Harp seal Hooded seal
Longline Fisheries	94*	Cuvier's beaked whale Long-finned pilot whale Mesoplodon beaked whale Northern bottlenose whale Pygmy sperm whale Short-finned pilot whale	Atlantic spotted dolphin Bottlenose dolphin Common dolphin Pantropical spotted dolphin Risso's dolphin	----
Trap/Pot Fisheries	13,000	Fin whale Humpback whale Minke whale Atlantic Ocean right whale	----	Harbor seal

NMFS, 2007b
*Some Caribbean fisheries are included in this number

6.2.1.1 Commercial and Recreational Fisheries – Atlantic Ocean, Offshore of the Southeastern United States

In 2006, commercial fishing off the southeastern U.S. Atlantic coast brought in 540 million pounds of fish with a value of $249 million (NMFS, 2007c). Examples of fish caught include menhaden, flounder, mackerel, crab, sea scallops, and shrimp. Recreational anglers brought in approximately 71 million pounds of fish in 2006 (NMFS, 2007c).

6.2.1.2 Cruise Ship/Passenger Ship Operations

Florida is the center of the cruise industry in the United States with just over 54 percent of all embarkations in the United States. Passengers, crew, and cruise lines directly spent $6.1 billion in the State of Florida in 2007 (CLIA, 2008). In addition to bringing the obvious economic benefits to the region, the cruise industry also adds volume to ocean traffic and contributes noise to the ocean. They also contribute to the loading of debris in the ocean environment. Several laws govern the disposal of solid waste from cruise ships including International Convention for the Prevention of Pollution from Ships and Act to Prevent Pollution from Ships (prohibits the at-sea disposal of plastic waste), Marine Plastic Pollution Research and Control Act of 1987 (prohibits discharging garbage within three nm of shore, certain types of garbage between 3-25 nm offshore, and discharging plastic anywhere), and the Clean Water Act (prohibits discharging pollutants from a point source into waters of the US) to name a few.

6.2.1.3 Marine Ecotourism (Whale-Watching and Dolphin-Watching)

Migrating baleen whales may be affected by whale-watching activities off the East Coast as well as in the Caribbean (Hoyt, 1995). Effects of whale-watching on cetaceans may be measured in a short time-scale

(*i.e.*, startle reaction) or as a long-term effect on reproduction or survivability (IFAW, 1995). There is little evidence to show that short-term effects have any relation to possible long-term effects on cetacean individuals, groups, or populations (IFAW, 1995). Whale-watching could have an effect on whales by distracting them, displacing them from rich food patches, or by dispersing food patches with wake or propeller wash.

6.2.1.4 Dames Point Marine Terminal Development and Increased Containerized Cargo Throughput

Dames Point Marine Terminal is one of three major JAXPORT terminals located on the St. Johns River. It includes a site that handles bulk or aggregate (sand, gravel, etc.), a cruise ship (which began homeporting ships in 2004), and the TraPac Container Terminal that is under construction. In March 2007, JAXPORT issued a construction contract to build the terminal's "horizontal" port infrastructure, to include the container storage paving area, two 1,200 ft berths and associated dredging along the terminal's waterfront. This 130 acre facility will be used by a Tokyo-based shipping line, Mitsui O.S.K. Lines, and its terminal operating partner, TraPac, to load and unload container ships sailing to and from ports in Asia. Mitsui O.S.K. Lines plans to move these containers on and off the terminal by truck. A second contract has become available for bid to complete the "vertical" construction at the site, to include terminal buildings, lighting, and related port equipment. The facility is scheduled to open for container ship service in late 2008 (JAXPORT 2007b). It is expected that the facility will increase marine vessel movements in the St. Johns River.

JAXPORT, the City of Jacksonville, and the South Korea-based ocean carrier, Hanjin Shipping Co. Ltd., signed a memorandum of understanding in October 2007 for the development of a new 170-acre container terminal facility at the Dames Point Terminal to begin operations in 2011 (JAXPORT 2007d). The terminal facility may be located at the site of the existing temporary JAXPORT cruise port facility or at a new plot of land. It could have the capacity to handle the equivalent of 1 million twenty-foot-equivalent units (TEUs), or 7.5 million tons of cargo, a year (Gibbons 2008). A TEU is an inexact unit of cargo capacity often used to describe the capacity of container ships and container terminals based on the volume of a 20-foot long shipping container. Vessels vary in capacity for TEUs, but there is a trend within the shipping industry towards vessels with 5,000-TEU and greater capacity.

In 2006, JAXPORT's throughput of TEUs was 0.77 million (JAXPORT 2007a). Once both the new Mitsui O.S.K. Lines and Hanjin Shipping Co. Ltd. terminal facilities are operational, and additional services are provided at Blount Island to increase annual container throughput, it is estimated that throughput would increase to between 2.4 and 2.8 million TEUs (JAXPORT 2007d). One longer-term projection is that by 2020, the Dames Point and Blount Island Terminals together could accommodate an annual container throughput of 3.5 million TEUs. Under these projections, Jacksonville would be the third-largest container port on the entire Eastern Seaboard, with only New York/New Jersey and Virginia's Hampton Roads handling more containerized cargo (JAXPORT 2007d).

6.2.2 Exploration, Extraction, and Production of Oil, Gas, and Alternative Energy on the Outer Continental Shelf

The Minerals Management Service (MMS), within the Department of the Interior, manages the mineral resources of the federal offshore lands of the Outer Continental Shelf (OCS). MMS leases OCS lands to commercial companies for the exploration, extraction, and production of mineral resources. The Atlantic OCS area is divided into four planning areas along the Atlantic seaboard: the Atlantic Ocean, Mid-Atlantic, South Atlantic, and the Straits of Florida (MMS, 2007a).

For the past 26 years leasing of specific portions of the Federal OCS has been prohibited via the annual Congressional appropriations process (e.g. Congress not appropriating funds for MMS to conduct leasing

for the specified OCS areas). From 1982 to 1992, Congress supported annual moratoria in specific OCS areas off the coast of California, the North Atlantic, the Mid-Atlantic, the Eastern Gulf of Mexico and all of the North Aleutian Basin (EIA, 2005).

In 1990, President George H. W. Bush issued a Presidential Directive that enacted a blanket moratorium until 2000 on all unleased areas offshore Northern and Central California, Southern California except for 87 tracts, Washington, Oregon, the North Atlantic coast, and the Eastern Gulf of Mexico coast. Separate from the annual moratoria in appropriations legislation, this directive meant that no leasing or pre-leasing activities were allowed to occur in these areas during the entire period. In 1998, President Clinton extended the moratorium through 2012 (EIA, 2005).

On August 8, 2005, President George W. Bush signed into law the Energy Policy Act of 2005. This legislation has several provisions that pertain to natural gas and oil development including alternative energy related projects in offshore areas. Of note, the Act requires MMS to conduct a comprehensive inventory and analysis of the estimated natural gas and oil resources on the OCS. The inventory includes moratoria areas which were closed to natural gas and oil leasing. Several provisions in the Act provide increased incentives for natural gas and oil development in offshore areas in order to maintain and stimulate production. Finally, the Energy Policy Act of 2005 granted authority to MMS to manage and oversee alternative-energy related projects on the OCS. Prior to this provision, there was a gap in the law with respect to alternative energy projects (EIA, 2005).

In April 2007, MMS published the Proposed Final Program (PFP) Outer Continental Shelf Oil and Gas Leasing Program 2007-2012 in conjunction with the Final FEIS 2007-2012 OCS Oil and Gas Leasing Program (MMS, 2007b; 2007c). The FEIS evaluated the possible environmental affects of a proposed leasing program that includes the entire area offshore the coast of Virginia, the Gulf of Mexico, the North Aleutian Basin, and the Chukchi Sea. With regard to the Gulf of Mexico, the MMS FEIS noted that offshore oil and gas activities have the potential to affect military activities, but that U.S. Department of Defense (DoD) and the U.S. Department of Interior (DOI) have cooperated on these issues for many years and have developed mitigation measures that minimize such conflicts. Whenever possible, close coordination between oil and gas operators and the military authorities for specific operational areas is encourages, and in some cases, is required under these lease stipulations. In some instances where the military requires unimpeded access to specific areas on the OCS, specific lease blocks have been deleted from one or more proposed lease sales.

As for the Mid-Atlantic/Virginia area, the Navy commented in 2006 on the Proposed Program for OCS Oil and Gas Leasing for 2007- 2012 and the accompanying DEIS that it had concerns about possible operational conflicts with energy activities in this area. However, the Navy supported the 40 km (22 nm) buffer and no obstruction zone and expressed it willingness to discuss possible alternatives to minimize conflicts between energy development and military operations. In the PFP published in April 2007, MMS decided on one special interest sale in 2011, but with a 50-mile buffer and a no obstruction zone from the mouth of the Chesapeake Bay off the coastline of Virginia. Also, MMS noted that the special lease sale in the Mid-Atlantic would only be held if the President chooses to modify the withdrawal and Congress discontinues the annual appropriations moratorium in the Mid-Atlantic.

In October 2007 MMS released a final programmatic EIS supporting the establishment of a program for authorizing alternative energy and alternate use (AEAU) activities on the OCS, as authorized by Section 388 of the Energy Policy Act of 2005 (EPAct), and codified in subsection 8(p) of the Outer Continental Shelf Lands Act (OCSLA) (MMS, 2007d). The final programmatic EIS examines the potential environmental effects of the program on the OCS and identifies policies and best management practices that may be adopted for the program. Under the program, MMS has jurisdiction over AEAU projects on

the OCS including, but not limited to: offshore wind energy, wave energy, ocean current energy, offshore solar energy, and hydrogen generation. MMS will also have jurisdiction over other projects that make alternate use of existing oil and natural gas platforms in Federal waters on the OCS. Future AEAU activities on the OCS will be evaluated by the Navy on a case by case basis to determine if operational conflicts with Navy activities may exist in a specific area.

MMS issued the Record of Decision to establish the AEAU program by selecting the Preferred Alternative described in the Final programmatic Environmental Impact Statement. This decision establishes an AEAU program for issuance of leases, easements, and rights-of-way (ROWs) on the OCS for alternative energy activities and the alternate use of structures on the OCS. The Preferred Alternative also provides MMS the option to authorize, on a case-by-case basis, individual AEAU projects that are in the national interest prior to promulgation of the final rule. At the same time, the MMS stated it would vigorously pursue its efforts to complete a comprehensive program with regulations for authorizing and managing AEAU activities on the OCS. Upon promulgation of the final rule, MMS leases, easements, and ROWs for AEAU activities on the OCS would be issued subject to the rule's provisions. On July 9, 2008, MMS issued the proposed regulations for establishing a program to grant leases, easements, and rights-of-ways for alternative energy on the OCS. MMS is working toward issuance of several leases for data gathering and technology testing. These leases will look at varied renewable energy sources in different portions of the OCS (MMS, 2008).

On July 14, 2008, President Bush removed the executive prohibition on producing oil from the OCS that was in effect until 2012, as mentioned earlier, and requested that Congress take action to lift the restrictions in order to give states the option to recommend the opening of the OCS off their coasts to environmentally responsible exploration (The White House, 2008). In September 2008, the congressional ban on offshore drilling was allowed to expire (Washington Post, 2008).

Many Section 7 consultations have been completed on MMS activities. Until 2002, Biological Opinions (BOs) resulting from Section 7 consultations concluded that one take of sea turtles may occur annually due to vessel strikes. Biological Opinions issued on July 11, 2002 (lease sale 184), November 29, 2002 (multi-lease sales 185, 187, 190, 192, 194, 196, 200, and 201), and August 20, 2003 (lease sales 189 and 197), have concluded that in addition to vessel strikes to sea turtles, adverse effects may occur from seismic surveys and expended materials. Explosive removal of offshore structures may adversely affect sea turtles and marine mammals (USAF, 2005B).

In April 2006, MMS applied for a Letter of Authorization (LOA) from NMFS to "take" by harassment a small number of marine mammals, incidental to explosive removal of offshore structures in the Gulf of Mexico (NMFS, 2006b). In this application it was estimated that Level A harassment takes would be five dolphins over the course of five years, and Level B harassment takes would be 457 dolphins and whales combined per year (NMFS, 2006b). However, it was stated that these numbers would be much lower in actuality due to the implementation of mitigation measures (NMFS, 2006b).

In April 2007, a final rule was printed in the Federal Register by MMS requiring the lessees to provide information on how they will conduct their proposed activities in a manner consistent with the Endangered Species Act (ESA) and the Marine Mammal Protection Act (MMPA) (Minerals Management Service (MMS), 2007e). Each lessee would be required to employ monitoring systems and mitigation measures, submit biological environmental reports and environmental effects analyses, and obtain its own authorized incidental "take" permits from NMFS (MMS, 2007e)

6.2.2.1 MMS Regulated Activities – Atlantic Ocean, Offshore of the Southeastern United States

The southeastern Atlantic Coast is divided by MMS into three planning areas: Mid-Atlantic, South Atlantic, and Straits of Florida. These areas combined cover 208,477 nm^2 (715,970 km^2) from Delaware to the southern most tip of Florida. From 1959 until 2000, 307 blocks (2,484 nm^2 or 8,531 km^2) were leased (MMS, 2007f). There are currently no active leases and no activity in this area (MMS, 2007c). However, a special interest sale in the Mid-Atlantic region off the coast of Virginia has been proposed in late 2011 (MMS, 2007c).

6.2.2.2 Dredging Operations

The construction and maintenance of federal navigation channels are ongoing activities on the U.S. Atlantic coast. NMFS has identified dredging operations as an activity that may cause sea turtle mortality. Hopper dredges move faster than sea turtles and can entrain (or trap) them. NMFS has issued BOs to the U.S. Army Corps of Engineers (USACE) for the U.S. Atlantic coast and, more recently, to the Navy for construction dredging in and near NAVSTA Mayport and has concluded that the implementation of reasonable and prudent measures will result in no jeopardy to sea turtle species. Dredging activities also have the potential to affect the protected Gulf and shortnose sturgeons, particularly juveniles that may not be able to avoid entrainment. This potential effect has not been quantified. Dredging operations obviously affect the geology of an area, as the floor topography is altered and turbidity occurs.

One southeastern Atlantic coast region in which maintenance dredging is necessary is within Cumberland Sound and NSB Kings Bay on the southeastern Georgia coast. Dredging in Kings Bay has occurred at least once a year since 1994. The USACE Jacksonville District has reported a total of 15 sea turtle takes between 2000 and 2007 due to dredging operations in the Kings Bay area (USACE, 2007).

Another southeastern Atlantic coast area that requires maintenance dredging is Jacksonville Harbor and Naval Station (NAVSTA) Mayport in northeast Florida. In 2006 Jacksonville Port Authority deepened the final stretch of Jacksonville's main shipping channel from 38 to 40 ft (11.5 to 12.2 m). USACE is proposing to deepen the St. Johns River Main channel to 45 ft (14 m) (Jacksonville Port Authority, 2007). To maintain adequate depths for naval ships, NS Mayport must dredge 600,000 cubic yards (yd^3) (458,732.92 cubic meters [m^3]) of sediment every 18 to 24 months from the entrance channel of the St. Johns River and the facility's turning basin (U.S. Environmental Protection Agency [EPA], 2000). Recently, an EIS was completed and a Record of Decision (ROD) issued that concludes the Navy will homeport a single CVN at NAVSTA Mayport. To support that decision, additional dredging to deepen the NAVSTA Mayport turning basin, the entrance channel, and the Jacksonville Harbor entrance channel is required and would result in the removal and disposal of approximately 5.2 million yd^3 (3,975,685 m^3) of material (DoN, 2008f). NMFS has authorized 22 lethal takes of sea turtles as part of the NAVSTA Mayport BO supporting this project. The USACE Jacksonville District has reported a total of six sea turtle takes between 2000 and 2007 due to dredging operations in the area of Jacksonville Harbor and NAVSTA Mayport (USACE, 2007).

6.2.2.3 Commerce and Shipping Lanes

The waters off the United States Atlantic coast support a large volume of maritime traffic heading to and from foreign ports as well as traffic traveling north and south to various United States ports. Commercial shipping comprises a large portion of this traffic, and a number of commercial ports are located along the Atlantic coast. The JAX and Charleston OPAREAs are in the direct path of commercial shipping traffic traveling between New York, Boston, and Miami and other ports in the southeast. There are seven major

shipping lanes in the OPAREAs. Most of the lanes are parallel to the coastline, but several branch off the main routes where they approach major shipping ports (DoN, 2002b, 2002c).

Marine transportation is expected to grow. Surface vessel traffic is a major contributor to noise in all oceans, particularly at low frequencies. The effect on marine species is unknown, but it is possible that this persistent noise may impact marine mammals' use of sound for communication and hunting.

6.2.2.4 Ship Strikes

NMFS identified commercial and recreational traffic and recreational pursuits as potentially having adverse effects on sea turtles and cetaceans through propeller and boat strike damage (USAF, 2004). Private vessels participating in high-speed marine activities are particular threats. Ship strikes or ship collisions with whales are a recognized source of whale mortality worldwide. The most vulnerable marine mammals are those that spend extended periods of time at the surface in order to restore oxygen levels within their tissues after deep dives (e.g., the sperm whale). Laist et al. (2001) identified 11 species known to be hit by ships. These species include fin whales, right whales, humpback whales, sperm whales, and gray whales. Of these, fin whales are hit most frequently. On the East Coast of North America, ship strikes remain a significant threat to some whale populations. For North Atlantic right whales, for example, ship strikes are believed to be a significant factor limiting the recovery of this species (Knowlton and Kraus, 2001).

A review of recent reports on ship strikes provides some insight regarding the types of whales, locations and vessels involved, but also reveals significant gaps in the data. The Large Whale Ship Strike Database report provides a summary of the 292 worldwide confirmed or possible whale/ship collisions from 1975 through 2002 (Jenson and Silber, 2004). The report also notes that these totals represent a minimum number of collisions, because the vast majorities go undetected or unreported. All types of ships can hit whales, and in most cases the animal is either seen too late, not observed until the collision occurs, or not detected. The ability of a ship to avoid a collision and to detect a collision depends on a variety of factors, including environmental conditions, ship design, size, and number of crew.

Smaller ships, such as Navy destroyers and Coast Guard cutters, have a number of advantages for avoiding ship strikes compared to most merchant vessels. For instance, naval and Coast Guard ships have their bridges positioned forward, offering good visibility ahead of the bow. Military crew sizes are also much larger than those of merchant ships, and they have dedicated lookouts posted during each watch. These vessels are generally twin screw and much more maneuverable than single screw commercial craft. Due to smaller ship size and higher deck manning, Navy and Coast Guard vessels are more likely to detect any strike that occurs, and these agencies' standard operating procedures include reporting of ship strikes. Overall, the percentage of Navy traffic relative to other large shipping traffic is very small (on the order of 2 percent).

NOAA continues to review all shipping activities and their relationship to cumulative impacts, in particular on large whale species. According to the NOAA report (Jenson and Silber, 2004), the factors that contribute to ship strikes of whales are not clear, nor is it understood why some species appear more vulnerable than others. Nonetheless, the number of known ship strikes indicates that deaths and injuries from ships and shipping activities remain a threat to endangered large whale species, and to Atlantic Ocean right whales in particular (Jenson and Silber, 2004).

Maritime traffic also increases underwater noise. The amount of noise produced by a ship depends on its type, size, and operational mode. Large commercial vessels emit low frequency noise in ranges similar to those used by some large whales (mysticetes) in communication to each other (NMFS, 2006a). This communication between whales could be masked by vessel noise. Masking not only interferes with communication, but also with the animal's ability to detect and avoid approaching ships (NMFS, 2006a).

Masking can be due to one individual ship or the constant drone in the ocean from increases in boat traffic. Boat traffic has steadily increased over the years; however, the number of large ships is predicted to double over the next two to three decades (Southall, 2005).

6.2.2.4.1 Implementation of Vessel Operational Measures to Reduce Ship Strikes to North Atlantic Right Whales

In August 2008, NMFS released a Final EIS to analyze the potential effects associated with the implementation of vessel operational measures in waters off the East Coast of the United States to reduce vessel collisions with the endangered North Atlantic right whale (NMFS 2008a). The proposed action addresses the lack of recovery of the North Atlantic right whale population by reducing the probability and threat of ship strike related deaths and serious injuries to the species.

Due to regional differences in right whale distribution and behavior, oceanographic conditions, and ship traffic patterns, the proposed vessel operational measures would apply only in certain areas and at certain times of the year, or under certain conditions. To account for regional variations, the U.S. East Coast is divided into three regions: northeastern United States (NEUS), mid-Atlantic United States (MAUS), and southeastern United States (SEUS). All vessels 65 ft (19.8 m) and greater in overall length and subject to US jurisdiction would be required to abide by the operational measures, except for vessels owned or operated by, or under contract to the Federal government, and law enforcement vessels of a state, or political subdivision thereof, when engaged in enforcement or human safety missions. An additional exemption would apply for vessels to maintain safe maneuvering speed under certain conditions. The measures considered include the following:

- **Seasonal Management Areas (SMAs).** SMAs are predetermined and established areas within which seasonal speed restrictions apply.
- **Dynamic Management Areas (DMAs).** DMAs are temporary areas consisting of a circle around a confirmed right whale sighting. The radius of this circle expands incrementally with the number of whales sighted and a buffer is included beyond the core area to allow for whale movement. Speed restrictions apply within DMAs, which may be mandatory or voluntary and apply only when and where no SMA is in effect.
- **Routing Measures.** These consist of a set of routes designed to minimize the co-occurrence of right whales and ship traffic. Use of these routes is voluntary; therefore, they constitute a non-regulatory measure. However, mandatory speed restrictions would apply in the portions of the routes located within an active SMA. NMFS would monitor these routes and consider making them mandatory if use is low.

Within the proposed SMAs (when in effect) and DMAs (when in effect), NMFS' proposed restriction is 10 knots/hour (kn) (19 kilometers/hour [km/hr]); however, for comparison purposes, the FEIS also considers speed limits of 12 and 14 kn (22 and 26 km/hr). The following six alternatives were considered:

1. Alternative 1-No Action.
2. Alternative 2-Mandatory DMA.
3. Alternative 3-Speed restrictions in designated areas.
4. Alternative 4-Recommended shipping routes.
5. Alternative 5-Combination of Alternatives 1 through 4.
6. Alternative 6-Proposed Action and Preferred Alternative.
   - In the SEUS region, Southeast SMA and recommended routes.
   - In the MAUS region, separate SMAs (20 nm [37 km] SMAs option).

- In the NEUS region, Cape Cod Bay SMA, Off Race Point SMA, and Great South Channel GSC SMA, as well as recommended routes.
- In all three regions, Voluntary DMAs.

Not all vessel operation measures are considered for all regions. The specific measures considered for each of the regions of the JAX Study Area implementation are shown in Table 6.2-2.

TABLE 6.2-2
SUMMARY OF PROPOSED OPERATIONAL MEASURES BY REGION

Region	Proposed Measures	Period of Application	Alternative
Southeast	Southeast SMA off the coast of Georgia and Florida, bounded to the north by latitude 31º27'N, to the south by latitude 29º45'N, to the east by longitude 80º51.6'W, and to the west by the shoreline.	November 15 to April 15	6
	or		
	SMA including all waters within the Mandatory Ship Reporting System WHALESSOUTH reporting area and the presently designated right whale critical habitat	November 15 to April 15	3 and 5
	and/or		
	Recommended routes into and out of the ports of Jacksonville and Fernandina Beach, Florida, and Brunswick, Georgia.	Year-round	4, 5, and 6
Mid-Atlantic	Six Separate SMAs, including under one option a 56-km (30-NM)-wide rectangular SMA south and east of the mouth of Block Island Sound; SMAs with a 37 km (20 NM) radius around the entrances to the ports of New York/New Jersey, the Delaware Bay and Chesapeake Bay, and Morehead City and Beaufort, North Carolina; finally, a continuous SMA from the shore out to 37 km (20 NM) from Wilmington, NC, south to Brunswick, GA. Under another option, the 37 km (20 NM) SMAs would be 56 km (30 NM) in size.	November 1 to April 30	6 (20-NM SMAs Option)
	or		
	One continuous 46 km (25 NM) SMA between Block Island Sound and Savannah, GA.	October 1 to April 30	3 and 5

TABLE 6.2-2 (Continued)
SUMMARY OF PROPOSED OPERATIONAL MEASURES BY REGION

Region	Proposed Measures	Period of Application	Alternative
Southeast and Mid-Atlantic	Mandatory DMAs throughout the EEZ Or Voluntary DMAs throughout the EEZ	Year-round Year –round	2 and 5 6

The EIS analyzed potential effects to the North Atlantic right whale, other marine species, physical environment, port areas and vessel operations, commercial fishing vessels, ferry vessels and ferry passengers, whale-watching vessels, charter vessels, environmental justice, and cultural resources. For the purposes of the cumulative impacts analysis in this EIS/OEIS, the Preferred Alternative, Alternative 6, will be discussed. It was determined that there would be a direct positive effect on right whale populations and indirect positive effects on marine mammals and sea turtles. In addition, implementation of Alternative 6 would result in negligible impacts on water quality in the NEUS had minor adverse impacts in the SEUS, as well as minor, direct positive effects to ocean noise. There would be only minimal impact on the financial revenues of port vessel operators, commercial fishing vessels, and charter vessels. There would be annual financial adverse effects to ferry vessels and ferry passengers and whale-watching vessels. There were no environmental justice concerns identified and no effects to cultural resources (NMFS, 2008a).

In addition, NMFS has promulgated a Final Rule to implement Speed Restrictions to Reduce the Threat of Ship Collisions with North Atlantic right whale population effective December 9, 2008 through December 9, 2013, speed restrictions of no more than 10 kn (18.5 km/hr) will apply to all vessels 65 ft (19.8 m) or greater in overall length in certain locations and at certain times of the year along the east coast of the U.S. Atlantic seaboard (NMFS, 2008b). Also see 50 Code of Federal Regulations 224.105 (2008). The purpose of the regulations is to reduce the likelihood of deaths and serious injuries to North Atlantic right whales that result from collisions with ships. These restrictions are not mandatory for naval vessels as stated by NMFS since it was recognized that national security, navigational, and human safety missions of some federal agencies may be compromised by mandatory vessel speed restrictions. The Navy currently implements mitigation measures to address ship strikes; and, NMFS has stated that most of these measures are similar to, if not more stringent than, the measures considered in the Final Rule (NMFS, 2008a, see Section 2.4.8. and Appendix A of the NMFS EIS).

6.2.2.5 Expended Materials

Expended materials include any man-made object expended, disposed of, or abandoned that enters the coastal or marine environment. It may enter directly from a ship, or indirectly when washed out to sea via rivers, streams, and storm drains. Types of expended materials include plastics, abandoned vessels, glass, metal, trash, and rubber. These materials can injure or kill marine life, interfere with navigation safety, create adverse economic impacts to shipping and coastal industries, and pose a threat to human health (NOAA, 2007a).

During the 2007 International Coastal Cleanup Campaign event, worldwide volunteers discovered 235 animals entangled in expended materials. As shown in Table 6.2-3, expended fishing line was responsible for nearly half of all entanglements, followed closely by rope and fishing nets (OC, 2007). This is an annual effort by the Ocean Conservancy and the summary of animals entangled in expended materials is published annually.

TABLE 6.2-3
SUMMARY OF ANIMALS ENTANGLED IN EXPENDED MATERIALS

Debris	Invertebrates	Fish	Reptiles	Birds	Mammals	Amphibians	Total	
Balloon/ribbon/string	0	0	0	4	1	0	5	2.1%
Beverage Can	1	1	0	0	0	0	2	0.9%
Building Materials	2	0	0	0	2	0	4	1.7%
Crab/Lobster/Fish Traps	2	1	0	0	0	0	3	1.3%
Fishing Line	22	32	5	43	8	0	110	46.8%
Fishing Nets	13	12	0	6	4	0	35	14.9%
Glass Bottles	3	2	1	0	2	0	8	3.4%
Miscellaneous	2	0	2	5	1	0	10	4.3%
Plastic Bags	2	3	0	12	5	0	22	9.4%
Plastic Container	0	0	0	0	1	0	1	0.4%
Rope	1	9	2	6	5	1	24	10.2%
Six-Pack Holders	0	2	0	1	0	0	3	1.3%
Tire	0	1	1	0	0	0	2	0.9%
Wire	1	0	0	4	1	0	6	2.6%
Totals	**49**	**63**	**11**	**81**	**30**	**1**	**235**	**100.0%**
Total Percentage	**20.9%**	**26.8%**	**4.7%**	**34.5%**	**12.8%**	**0.4%**	**100.0%**	

Source: OC, 2007

There are several events that promote cleaning up debris (trash and litter) along shorelines (ocean, lakes, and rivers) in and around the Study Area to include the *Annual St. Johns River Celebration Cleanup*, Naval Air Station Jacksonville Earth Day basewide cleanup efforts, the *Mayport Annual Coastal Cleanup*, *Shoreline Cleanup 2008 (*an annual event*)*, *The South Carolina River/Beach Sweep* (an annual statewide little cleanup/awareness campaign), *Coastal America Beach Cleanup*, *Earth Day Beach Clean-up* and *National Public Lands Day Beach Planting*.

6.2.3 Scientific Research

Scientific research on protected species such as marine mammals and sea turtles and studies on the marine environment in general have the potential to occur throughout the world. For targeted research on particular species regulated by National Marine Fisheries Service and the United States Fish and Wildlife Service, a scientific research and enhancement permit is required for any proposed research activity that involves the "take" of a marine species. Scientific Research and Enhancement Permits are required for research that results in the take of marine mammal species or involves any ESA-listed species not covered by the General Authorization. Permits cover a five-year period. The most recent permit was issued by the NMFS in August 2007 and includes the observation of behavioral responses by beaked whales and other odontocetes to underwater sound. The permit, which covers activities being conducted by the NMFS's Office of Science and Technology, authorizes research on marine mammals in waters to the east of Andros Island, Bahamas. Activities include the attachment of tags to and photography of cetaceans, and exposing them to sound, particularly from mid-frequency sonar. Additional authorized permits of particular interest in the JAX Study Area include a wide variety of research activities on right whales. National Marine Fisheries Service is currently analyzing the cumulative impacts of these authorizations in the proposed Programmatic EIS on Northern Right Whale Research.

The 1994 amendments to the Marine Mammal Protection Act authorized, under a General Authorization, the conduct of activities that involve low-impact harassment levels of marine mammals in the wild. Activities encompassed by the General Authorization for Scientific Research do not require a scientific research and enhancement permit. The activities covered under the General Authorization are limited to bona fide research that only involves Level B harassment of non-ESA-listed marine mammals and

generally include, but are not limited to, photo-identification studies, behavioral observations, vessel surveys, and aerial surveys over water or land, as well as over pinniped rookeries if flown at altitudes greater than 1,000 feet (305 m) (DoN, 2008a). In addition to the General Authorization, National Marine Fisheries Service also issues commercial and education photography permits. These permits allow for photography of non-listed marine mammals that result at a maximum in Level B harassment. Additional activities authorized include those related to imports for public display of marine mammals, as well as import and export of marine mammal parts.

6.2.3.1 Environmental Contamination and Biotoxins

Insufficient information is available to determine how, at what levels, or in what combinations, environmental contaminants may impact cetaceans (MMS, 2003). There is growing evidence that high contaminant burdens are associated with several physiological abnormalities, including skeletal deformations, developmental impacts, reproductive and immunological disorders, and hormonal alterations (Reijnders and Aguilar, 2002). DeSwart *et al*. (1996) conducted a study where harbor seals were fed contaminated Baltic herring and their immune function was monitored over a two-and-a-half-year period. The results of this study showed that chronic exposure to environmental contaminants accumulated through the food chain had an adverse effect on the immune function of those harbor seals. This further suggests that environmental contaminates may have an adverse immunological effect on free-ranging seals in areas with similar contamination levels as that observed in this study (DeSwart *et al*., 1996). Since no similar studies have been conducted with other marine mammal species, it may be reasonably concluded that similar impacts could occur in other marine mammals, such as cetaceans.

Several mortality activities (die-offs) have been reported for cetaceans. Biotoxins, viruses, bacteria, and El Nino activities have been implicated separately in recent mass mortality activities (Domingo *et al*., 2002). A mass mortality activity for humpback whales, apparently associated with biotoxins, occurred along the beaches of Massachusetts in 1987 through 1988. Geraci *et al*. (1989) concluded that the whales died from saxitoxin poisoning after consumption of Atlantic mackerel containing the toxin. During the summer of 2003, 17 humpback whales, three fin whales, one minke whale, one long finned pilot whale, and three whales of undetermined species were found dead in the vicinity of Georges Bank. Although a biotoxin (saxitoxin) was found in several samples collected, it was not present at lethal levels. Domoic acid was also detected and suspected as a probable cause, but because no brain samples were collected, the role of this biotoxin could not be confirmed (MMS, 2004; DoN, 2005).

The Ocklawaha is a tributary the St. Johns River. Several characteristics of the St. Johns River limit its assimilation capabilities, thereby contributing to its high pollution rates like its relatively flat drainage basin, the high number of associated draining water bodies, and the excessively slow flow rate of the river. Stormwater and agricultural runoff are major pollutants into streams and rivers contributing to water quality parameters.

6.2.4 Recreational Diving

There are numerous reefs and wrecks all along the Atlantic Coast. These areas serve as important fish habitat as well as being important cultural resources, and attract numerous recreational divers. The U.S. Army Corps of Engineers (USACE) has created many of these artificial reefs. These reefs have significantly improved the growth of recreational diving. Many of the popular diving sites are located in areas in or near to the JAX Range Complex. Additional safeguards to protect wildlife in these areas as well as the safety of recreational users where Navy training occurs.

6.2.5 National Aeronautics and Space Administration (NASA) Activities

The NASA's main operational centers on the East Coast are located at Kennedy Space Center and Cape Canaveral Air Force Station in Florida and Wallops Flight Facility/Goddard Space Flight Center in

Virginia. Activities at the Florida sites in 2007 and 2008 include five space shuttle launches, and four Delta II rocket launches (NASA, 2007a). Operations at Wallops Flight Facility/Goddard Space Flight Center include many research-oriented activities such as the launching of sounding rockets and scientific balloons (NASA, 2007b).

The Wallops Flight Facility (WFF) is located on the Delmarva Peninsula in Virginia and is part of the NASA Goddard Space Flight Center. The WFF is compromised of the Main Base, Mainland, and Wallops Island. WFF is a multifaceted research and development facility with particular expertise in launching and utilizing sub-orbital rockets. It has been used as an aeronautics research center since 1945; WFF currently maintains three runways, an active launch range, communications and radar tracking systems, and approximately 556 buildings. The island covers an area of approximately 10.2 mi^2 (26.3 km^2).

An EA was completed in 2003 which proposed to make available for use the AQM-37 at Wallops Island (NASA, 2003). The AQM-37 is an air-launched, preprogrammed, nonrecoverable target with external command and control capabilities which can be used as an aerial target to test new and operational ship defense weapon systems. The purpose of the AQM-37 is to serve as a target for missile exercises being performed by the U.S. Navy and supported by WFF in the VACAPES OPAREA. This would be used to test the performance of shipboard weapons systems as well as provide simulated real-world targets for ship defense training exercises, allowing for the potential requirement of 20 target flights per year with a maximum of 30, which have been in place since 2003. After analyzing 14 environmental resources (land resources, water resources, air quality, noise, hazardous materials and waste, biological resources, population, recreation, employment and income, health and safety, cultural resources, environmental justice, transportation, and cumulative impacts), NASA determined that there were no significant environmental impacts from the AQM-37 operations at WFF (NASA, 2003). There is no additional publicly available information regarding past and present actions potentially occurring within the JAX Study Area for this facility

6.2.6 Military Operations

This section will discuss past and present military operations occurring within the JAX Study Area. Specifically, the first three sections will discuss military exercises generally since these activities are associated with ESA Section 7 consultations with NMFS. In addition, this section will also discuss the Navy's Tactical Training Theater Assessment and Planning Program, which focuses on the sustainability of ranges, OPAREAs, and special use airspace within the JAX Study Area.

6.2.6.1 Mine Exercise

Mine Exercises (MINEX) may occur as part of an Expeditionary Strike Group (ESG) Composite Training Unit Exercise (COMPTUEX) or a Combined Carrier Strike Group (CSG) COMPUTEX/ Joint Task Force Exercises (JTFEX), but they only involve underwater detonation (UNDET) activities when they are conducted as part of a Strike Group Training exercise on the East Coast. They do not involve mine laying or searching activities involving MIW sonar (this type of training conducted during Unit Level Training [ULT]) and Coordinated ULT in the Gulf of Mexico as part of a Gulf of Mexico Exercise or squadron exercise. For an ESG COMPTUEX, UNDETs would occur in the Cherry Point box that is defined by the East Coast MINEX BO (up to 9 kg [20 lb] charges). For an ESG COMPTUEX, UNDETs would occur in the Cherry Point box that is defined by the East Coast MINEX BO (up to 9 kg [20 lb] charges). For the Combined CSG COMPTUEX/JTFEX the UNDETs would occur in CHASN in the box defined by the East Coast MINEX BO (NMFS, 2002).

The potential biological effects associated with the MINEX UNDETs are addressed in the MINEX BO issued by NMFS in 2002. The BO addresses potential impacts from MIW exercises and explosive

ordnance disposal (EOD) unit-level training to loggerhead, Kemp's ridley, leatherback, hawksbill, and green sea turtles at several locations along the East Coast (Virginia Beach, Virginia; Onslow Bay, North Carolina; and Charleston, South Carolina). The BO analyzed a total of 40 MINEX events per year to be conducted between the three locations using C-4 or high explosives as well as the possible use of 4.5 or 9.1 kg (10 or 20 lb) charges, in rare instances.

NMFS states in the BO that proposed MINEX and explosive ordnance disposal training is not likely to jeopardize the continued existence of loggerhead, Kemp's ridley, leatherback, hawksbill, and green sea turtles. However, NMFS anticipates incidental take of these species and has issued an Incidental Take Statement (ITS) pursuant to Section 7 of the ESA. The ITS includes mitigation measures with implementing terms and conditions to help minimize harassment. In addition, the BO states that species of large whales, including species protected by the ESA, can be found in or near the area where this type of training would occur. However, the BO states that NMFS feels that the protective measure identified within the BO, if implemented, would allow the Navy the opportunity to reduce the chances of effects to these species to discountable levels. Mitigation measures have been designed and implemented for MINEXs in order to minimize any potential adverse effects to marine mammals and to avoid any significant or long-term adverse effects to marine mammals and the coastal, cultural, or marine environment (NMFS, 2002).

6.2.6.2 Sinking Exercise of Surface Targets

A Sinking Exercise of Surface Targets (SINKEX) is defined as the use of a vessel as a target or test platform against which live ordnance is fired. The purpose of a SINKEX is to train personnel, test weapons, and study the survivability of ship structures. The result is the sinking of the vessel. SINKEX operations differ from ship shock trials in that the warheads used in a SINKEX are significantly smaller. The environmental considerations of a SINKEX are associated with the weapons used. The exact amount of ordnance and the type of weapon used in a SINKEX is situational and training-need dependent (DoN, 2006b).

The potential expended materials created during a SINKEX are metals from the sunken vessel and shell fragments. Disposable plastics and other materials that could be considered marine debris are removed from the vessel prior to conducting a SINKEX. Expended material associated with the target vessel would not include ropes, lines, plastic or other materials with the potential to ensnare or entangle marine animals. All expended materials would sink rapidly to the ocean floor and since SINKEXs would not be continuously conducted within the same areas the sunken debris would settle over a large area. The minimal amount of materials settling to the ocean floor would not affect the sediment stability of the ocean floor or cause disturbance to natural ocean processes (DoN, 2006a).

In the late 1980's, Polychlorinated biphenyls (PCBs) was raised as a potential environmental issue. Some of the materials (i.e., insulation, wiring, felts and rubber gaskets) present on the targeted vessels were confirmed to contain PCBs. As a result, the Navy has been removing the majority of the materials containing PCBs prior to conducting a SINKEX event. However, it is still estimated that even after removal activities any given target vessel sunk during a SINKEX could contain up to 45 kg (100 lbs) of PCBs. In an effort to determine if the remaining PCBs would be an environmental issue, the Navy begun conducting a PCBs monitoring study in 1995 on sunken Navy vessels. The monitoring study has not been completed but as of November 2006 it was determined that enough data had been gathered and transferred to the EPA to indicate that there was little likelihood that PCBs from sunken Navy vessels would present an unacceptable risk to the environment or human health. The Navy SINKEX Program currently holds a General Permit from the EPA under the Marine Protection, Research and Sanctuaries Act for conducting SINKEX activities (40 CFR 229.2).

The U.S. Navy submitted a Biological Assessment (BA) to the National Oceanic and Atmospheric Administration (NOAA) pursuant to compliance with the ESA. NOAA concluded that SINKEXs in the western Atlantic Ocean are not likely to jeopardize the continued existence of ESA listed species in a BO dated September 22, 2006 (NMFS, 2006a).

6.2.6.3 Naval Surface Fire Support Training

The Navy uses the Virtual At-Sea Training/Integrated Maritime Portable Acoustic Scoring and Simulator (VAST/IMPASS) system to qualify and recertify ships in naval surface fire support. The VAST/IMPASS system is a reusable, portable system that can be deployed anywhere in the open ocean. The system is comprised of five free-floating sonobuoys that are deployed in the shape of a pentagon/house array. The sonobuoys are capable of "scoring" the landing of 5-inch (in)/54 rounds aimed at a virtual target within the sonobuoy array. The buoys serve as collectors of acoustic information. When a 5-in/54 round impacts the water, accuracy is determined by the differential time that each individual buoy receives the sound (DoN, 2005a,a).

The VAST/IMPASS system is used in open ocean areas along the eastern United States and in the Gulf of Mexico. Where live ordnance is used, the potential for marine mammal populations to be exposed to acoustic energy exists. Therefore, mitigation measures have been designed and implemented for the use of the VAST/IMPASS system to minimize any potential risks to marine mammals and to avoid any significant or long-term adverse effects to marine mammals and the coastal, cultural, and marine environment (DoN, 2005a).

The Navy initiated formal consultation with NMFS in February 2004 by submitting a BA for use of the IMPASS system in East Coast OPAREAs and the Eastern Gulf of Mexico Test and Training Area. The Navy is currently awaiting NMFS's BO, but anticipates that the conclusion will be that the use of naval gunfire is not likely to jeopardize the existence of any listed species. The mitigation/mitigation measures have and will continue to be implemented for use of the IMPASS system in order to minimize any potential risks to threatened and endangered species.

6.2.6.4 Military Operations – Atlantic Ocean, Offshore of the Southeastern United States

Designated bomb boxes have been established in each OPAREA where non-explosive bombs could be dropped during a major Atlantic Fleet training exercise. The process for selecting these sites within each OPAREA involved balancing operational suitability (close proximity to where the strike group is operating) and environmental suitability. Environmental suitability includes an area that possesses a low likelihood of encountering threatened and endangered species and that avoids the continental shelf, canyon areas, and the Gulf Stream, all of which are locations where threatened and endangered marine mammal and sea turtle species are most abundant. The use of the bomb box (Area J31) in the JAX/CHASN OPAREA is discussed in the 1997 NMFS BO, which concludes that Navy activities are not likely to jeopardize the continued existence of listed species (NMFS, 1997). Based on the combination of prudent site-selection and the mitigation measures to be implemented in all OPAREAs that were developed as part of the BO for protection of the North Atlantic right whale (NMFS, 1997), it is anticipated that dropping non-explosive bombs in the established bomb boxes associated with major Atlantic Fleet exercises would not affect listed species.

6.2.6.5 Virginia Capes Range Complex

The VACAPES Range Complex Draft EIS/OEIS was released in June 2008. The VACAPES Range Complex geographically encompasses offshore, near-shore, and onshore OPAREAs, ranges, and Special Use Airspace (SUA) located near the eastern coast of the United States. The VACAPES Range Complex is a set of operating and maneuver areas with defined ocean surface and subsurface areas. The surface water areas of the Range Complex covers the coast of Delaware, Maryland, Virginia, and North Carolina,

encompassing 27,661 nm^2 (94,995.9 km^2). The shoreward extent of the OPAREA is roughly aligned with the 3 nm (5.6 km) state territorial limits. Due to the Navy's training requirements, the objective of the VACAPES Range Complex is to provide sustainable and modernized ocean operating areas, airspace, ranges, range infrastructure, training facilities, and resources to fully support the mission. The Study Area also serves as critical support for Navy operational readiness training and for RDT&E (DoN, 2008c).

The Navy is preparing an EIS/OEIS to assess the potential environmental effects in the VACAPES Range Complex over a 10-year planning horizon. The Notice of Intent to prepare the EIS/OEIS, along with an announcement of scoping meetings, was published in the Federal Register on December 8, 2006. Four public scoping meetings were held in January 2007, and comments were received from December 8, 2006 to January 23, 2007. A revised Notice of Intent was published in the Federal Register on September 5, 2007, and public comments were received from September 5, 2007 to September 30, 2007. The VACAPES Draft EIS/OEIS was available for public comment beginning June 28, 2008 and public hearings were held in July 2008. The VACAPES Draft EIS/OEIS is incorporated by reference and is available for downloading and viewing via the internet at the following website address (http://www.vacapesrangecomplexeis.com). As stated in the VACAPES Range Complex EIS/OEIS, the No Action Alternative would continue current operations, including surge capabilities, consistent with the Fleet Response Training Plan (FRTP). For the purposes of this chapter, the No Action Alternative represents both past and present naval operations in the VACAPES Range Complex. Training operations in the VACAPES Range Complex range from unit-level exercises to integrated, major, range training events. A description of non-ASW training operations typically conducted in the VACAPES Range Complex can be found in Table 6.2-4.

TABLE 6.2-4
VACAPES RANGE COMPLEX TYPICAL OPERATIONS (NON-ASW)

Range Operation	Description
Mine Warfare (MIW)	
Mine countermeasures exercise	These exercises train forces to detect, identify, classify, mark, avoid, and disable (or verify destruction of) sea mines using a variety of methods, including, air, surface, and subsurface assets.
Mine neutralization	These operations involve the detection, identification, evaluation, rendering safe, and disposal of underwater unexploded ordnance (UXO) that constitute a threat to ships or personnel.
Surface Warfare (SUW)	
Bombing exercise (BOMBEX) (sea)	These exercises allow aircrew to train in the delivery of bombs against maritime targets.
Missile exercise (MISSILEX) (air-to-surface)	These exercises use laser and live fire to train fixed-wing aircraft and helicopter aircrews in the delivery of optical, infrared seeking, or laser guided missiles at surface targets.
Gunnery exercise (GUNEX) (air-to-surface)	Gunnery exercises train fixed-wing aircraft and helicopter aircrews to attack surface targets at sea using guns.
GUNEX (surface-to-surface) (boat)	In these exercises, small boat gun crews train by firing against surface targets at sea.

TABLE 6.2-4 (Continued)
VACAPES RANGE COMPLEX TYPICAL OPERATIONS (NON-ASW)

Range Operation	Description
GUNEX (surface-to-surface) (ship)	Ship gun crews in these exercises train by firing against surface targets at sea.
Laser targeting	Laser targeting exercises are used to train aircraft personnel in the use of laser targeting devices to illuminate designated targets for engagement with laser-guided weapons.
Visit, Board, Search, and Seizure/Maritime Interception Operations (VBSS/MIO)-Ship	Crews from Navy helicopters and surface ships identify, track, intercept, board and inspect foreign merchant vessels suspected of not complying with United Nations/allied sanctions and/or conflict rules of engagement. The boarding party will be delivered from a surface ship via Rubber-hull Inflatable Boat (RHIb) or similar small craft if the target vessel is non-hostile, or via helicopter if hostile. This training event is non-firing.
Air Warfare (AW)	
Air combat maneuver (ACM)	ACM is the general term used to describe an air-to-air event involving two or more aircraft, each engaged in continuous proactive and reactive changes in aircraft attitude, altitude, and airspeed. No weapons are fired during ACM operations.
GUNEX (air-to-air)	In these training operations, guns are fired from aircraft against unmanned aerial target drones.
MISSILEX (air-to-air)	These are training operations in which air-to-air missiles are fired from aircraft against unmanned aerial target drones such as BQM-34 and BQM-74.
GUNEX (surface-to-air)	These operations are conducted by surface ships with 5-inch, 76 mm, and 20 mm Close-In Weapons System. Targets include unmanned drones or targets towed behind aircraft.
High-speed Anti-Radiation Missile Exercise (HARMEX) (air-to-surface)	Aircraft crews train in the use of HARM missiles, the primary weapon designed to target anti-aircraft missile sites.
Amphibious Warfare (AMW)	
FIREX with Integrated Maritime Portable Acoustic Scoring and Simulator System (IMPASS)	Surface-to-surface gunnery exercises with IMPASS are training operations that direct naval gunfire to strike land targets and support military operations ashore. This training is conducted at-sea using a computer-simulated land target and a series of buoys that can acoustically score the training event.
Electronic Combat (EC)	
EC Operations	Air or ship crews attempt to control critical portions of the electronic spectrum used by threat radars, communications equipment, and electronic detection equipment to degrade or deny enemy attacks.
Chaff Exercise	Exercises train aircrews in the use of chaff to counter enemy threats by creating radar reflective false targets. Chaff may also be used offensively by aircrews or shipcrews to hide inbound stiking aircraft or ships.

TABLE 6.2-4 (Continued)
VACAPES RANGE COMPLEX TYPICAL OPERATIONS (NON-ASW)

Range Operation	Description
Flare Exercise (Aircraft Self-Defense	Fixed-wing aircraft and helicopters deploy flares to disrupt threat infrared missile guidance systems to defend against an attack.
Other Training	
Shipboard Electronic Systems Evaluation Facility Utilization (SESEF)	SESEF operations test ship antenna radiation pattern measurements and communications systems.

Physical, biological, environmental, cultural, socioeconomic, and human resources were analyzed to determine the potential effects any expended materials would cause. It was determined that there will be no significant impact and no significant harm to physical, biological, environmental, cultural, socioeconomic or human resources due to the training activities occurring in the VACAPES Range Complex (DoN, 2008c).

Acoustic analysis was performed to determine potential effects to marine mammals and sea turtles. Refer to Chapter 3 of the VACAPES Range Complex EIS/OEIS for a discussion of the methodology used to measure these effects. Acoustic analysis under the No Action Alternative indicates that 63,664 total marine mammals (including ESA-listed species) may be exposed to levels of sound likely to result in Level B harassment. Acoustic analysis also indicates that 730 total marine mammals (including ESA-listed species) may be exposed to levels of sound likely to result in Level A harassment. The analysis also indicates that seven marine mammal mortalities may result. The results of the acoustic analysis indicates the quantity of ESA-listed marine mammals that may be exposed to levels of sound, 173 exposures of an ESA-listed species may result in Level B harassment and one exposure may result in Level A harassment. The results also indicate the quantity of ESA-listed sea turtles that may be exposed under the No Action Alternative to levels of sound, 11,340 exposures may result in Level B harassment, 97 exposures may result in Level A harassment, and two may result in mortality. The exposure estimates for the No Action Alternative represent the total number of exposures and not necessarily the number of individuals exposed, as a single individual may be exposed multiple times over the course of a year (DoN, 2008a). In addition, these exposure estimates do not include the incorporation of mitigation measures, which are designed to reduce exposure of marine mammals and sea turtles to potential impacts in an effort to achieve the least practicable adverse effect on marine mammal and sea turtle species or populations.

6.2.6.6 Cherry Point Range Complex

The Cherry Point Range Complex Draft EIS/OEIS was released in August 2008. The Cherry Point Range Complex geographically encompasses offshore and near-shore OPAREAs, instrumented ranges, and SUA located near the east coast of the United States. The Cherry Point Range Complex is a set of operating and maneuver areas with defined ocean surface and subsurface areas. The surface water area of the Range Complex covers the coast of North Carolina, encompassing 18,617 nm^2 (63,936.2 km^2). The shoreward extent of the Range Complex is roughly aligned with the 3 nm (5.6 km) state territorial limits. Due to the Navy's training requirements, the objective of the Cherry Point Range Complex is to provide sustainable and modernized ocean operating areas, airspace, ranges, range infrastructure, training facilities, and resources to fully support the mission. The Study Area is centrally located between the Atlantic Fleet concentration areas in Hampton Roads, Virginia and Jacksonville, Florida, and the Marine Forces Atlantic

concentrations areas in North Carolina, making it the primary venue for all levels of amphibious training and intermediate and advanced levels of CSG, ESG, and MEU training (DoN, 2008b).

The Navy is preparing an EIS/OEIS to assess the potential environmental effects in the Cherry Point Range Complex over a 10-year planning horizon. The Notice of Intent to prepare the EIS/OEIS, along with an announcement of scoping meetings, was published in the Federal Register on April 30, 2007. Two public scoping meetings were held in May 2007, and comments were received from April 30, 2007 to June 12, 2007. The Cherry Point Draft EIS/OEIS was available for public comment beginning September 12, 2008 and public hearings were held in October 2008. The public comment period closed on October 27, 2008. The Cherry Point Draft EIS/OEIS is incorporated by reference and is available for downloading/viewing via the internet at the following website address: (http://www.navycherrypointrangecomplexeis.com). As stated in the Navy Cherry Point Range Complex EIS/OEIS, the No Action Alternative would continue current operations, including surge capabilities, consistent with the FRTP. For the purposes of this chapter, the No Action Alternative represents both past and present naval operations in the Cherry Point Range Complex. Training operations in the Cherry Point Range Complex can vary from unit level exercises to integrated major range training events. A description of non-ASW training operations typically conducted in the Cherry Point Range Complex can be found in Table 6.2-5 (DoN, 2008b).

TABLE 6.2-5
CHERRY POINT RANGE COMPLEX TYPICAL OPERATIONS (NON-ASW)

Range Operation	Description
Mine Warfare (MIW)	
Mine countermeasures (MCM)	Helicopters, surface and subsurface units detect, identify, classify, mark, disable and/or destroy sea mines using a variety of methods.
Mine neutralization	Helicopters, surface, and subsurface units, and EOD personnel identify, evaluate, localize and destroy or render safe sea mines that constitute a threat to ships, landing craft or personnel.
Surface Warfare (SUW)	
Bombing Exercise (Sea) (BOMBEX A-S)	Fixed wing aircraft deliver bombs against maritime targets.
Missile Exercise (Air-to-Surface)	Air-to-Surface Missile Exercise (Laser and Live Fire) [MISSILEX (A-S)] trains fixed-wing aircraft and helicopter aircrews in the delivery of optical, infrared seeking or laser guided missiles at surface targets.
Gunnery Exercise (Air-to-Surface)	Air-to-Surface Gunnery Exercise (GUNEX) trains fixed-wing aircraft and helicopter aircrews to attack surface targets at sea using guns.
Gunnery Exercise Ship (Surface-to-Surface) (GUNEX S-S (Ship))	Surface ships fire main battery guns and crew-served weapons against maritime targets.
Visit, Board, Search, and Seizure/Maritime Interception Operations (VBSS/MIO)-Ship and Helo	Crews from Navy helicopters and surface ships identify, track, intercept, board and inspect foreign merchant vessels suspected of not complying with United Nations/allied sanctions and/or conflict rules of engagement. The boarding party will be delivered from a surface ship via Rubber-hull Inflatable Boat (RHIB) or similar small craft if the target vessel is non-hostile, or via helicopter if hostile. This training event is non-firing.

TABLE 6.2-5 (Continued)
CHERRY POINT RANGE COMPLEX TYPICAL OPERATIONS (NON-ASW)

Range Operation	Description
Air Warfare (AW)	
Air Combat Maneuver (ACM)	Two or more aircraft engaged in continuous proactive and reactive changes in aircraft attitude, altitude, and airspeed in an attempt to destroy the opposition. Fighter aircraft do fire live weapons during ACM, just not in a training environment.
GUNEX (Air-to-Air)	GUNEX Air-to-Air training operations in which guns are fired from aircraft against unmanned aerial target drones.
MISSILEX (Air-to-Air)	Air-to-Air Missile Exercise [MISSILEX (A-A)] are training operations in which air-to-air missiles are fired from aircraft against unmanned aerial target drones such as BQM-34 and BQM-74.
Air Intercept Control (AIC)	Surface ships vector friendly aircraft to intercept and destroy adversary aircraft.
Electronic Combat (Ec)	
Electronic Combat Operations (EC)	Aircraft, surface ships, and submarines attempt to control critical portions of the electromagnetic spectrum to degrade or deny the enemy's ability to defend its forces from attach and/or recognize an emerging threat early enough to take the necessary defensive actions.
Chaff Exercise	Shipa and aircraft deploy chaff to disrupt threat targeting and missile guidance radars and to defend against an attack.
Flare Exercise	Aircraft deploy flares to disrupt threat infrared guidance systems of threat missiles.
Strike Warfare (STW)	
High-Speed Anti-Radiation Missile Exercise (HARMEX) (air-to-surface)	Aircraft crews train in the use of High-Speed Anti-Radiation Missiles (HARM), the primary weapon designed to target anti-aircraft missile sites.
Amphibious Warfare (AMW)	
Firing Exercise (FIREX)-Land (FIREX (Land))	Surface ships fire main battery guns against land targets in support of military operations ashore.
FIREX – Integrated Maritime Portable Acoustic Scoring and Simulator System (IMPASS)	Surface ships fire main battery guns against land targets in support of military operations ashore. This training is conducted at-sea using a computer simulated land target and a series of buoys that can acoustically score the training event.
Amphibious Assault	A Marine Battalion Landing Team (typically two reinforced companies, including armor and service support units) move ashore from the Expeditionary Strike Group at-sea to establish a beachhead in hostile territory, then moves further inland for an extended period. Ingress via amphibians, landing craft and/or rotary-wing aircraft. Coordinated fire support from aircraft, surface ships and artillery.

TABLE 6.2-5 (Continued)
CHERRY POINT RANGE COMPLEX TYPICAL OPERATIONS (NON-ASW)

Range Operation	Description
Firing Exercise (FIREX)-Land (FIREX (Land))	Surface ships fire main battery guns against land targets in support of military operations ashore.
Amphibious Raid	A reinforce company (100-150 Marines) makes a swift, short-term incursion from the Expeditionary Strike Group at-sea to a hostile area ashore for a specified purpose and a specified time, then makes a planned withdrawal. Ingress and extraction via small boats, amphibians, landing craft and/or helicopters.

Physical, biological, environmental, cultural, socioeconomic, and human resources were analyzed to determine the potential effects any expended materials would cause. It was determined that there will be no significant impact and no significant harm to physical, biological, environmental, cultural, socioeconomic or human resources due to the training activities occurring in the Cherry Point Range Complex (DoN, 2008b).

Acoustic analysis was performed to determine potential effects to marine mammals and sea turtles. Refer to Chapter 3 of the Navy Cherry Point Range Complex Draft EIS/OEIS for a discussion of the methodology used to measure these effects. Acoustic analysis under the No Action Alternative indicates that 2,877 exposures to marine mammals (including ESA-listed species) may result in Level B harassment. Acoustic analysis also indicates that 65 exposures to marine mammals (including ESA-listed species) may result in Level A harassment. No mortality is predicted due to the proposed activities. The Acoustic analysis was performed to determine potential effects to marine mammals and sea turtles. Refer to Chapter 3 of the Navy Cherry Point Range Complex Draft EIS/OEIS for a discussion of the methodology used to measure these effects. Acoustic analysis under the No Action Alternative indicates that 2,877 exposures to marine mammals (including ESA-listed species) may result in Level B harassment. Acoustic analysis also indicates that 65 exposures to marine mammals (including ESA-listed species) may result in Level A harassment. No mortality is predicted due to the proposed activities. The results of the acoustic analysis indicates the quantity of ESA-listed marine mammal species that may be exposed to levels of sound, four exposures to an ESA-listed species may result in Level B harassment. The results also indicate the quantity of ESA-listed sea turtles that may be exposed to levels of sound, 137 exposures may result in Level B harassment and three may result in Level A harassment. The exposure estimates for the No Action Alternative represent the total number of exposures and not necessarily the number of individuals exposed, as a single individual may be exposed multiple times over the course of a year (DoN, 2008a). These exposure estimates do not include the incorporation of mitigation measures, which are designed to reduce exposure of marine mammals and sea turtles to potential impacts in an effort to achieve the least practicable adverse effect on marine mammal and sea turtle species or populations.

6.2.6.7 USS Mesa Verde Ship Shock Trial

A Record of Decision was published in the Federal Register (FR) on July 28, 2008 (FR, Vol. 73, No. 145) in which the Navy announced its decision to conduct a shock trial for USS MESA VERDE in the area of the Atlantic Ocean offshore of Naval Station Mayport, Jacksonville, Florida during the summer (June 21 – September 20, 2008) (DoN, 2008d). The Final EIS considered all components of the physical, biological, and socioeconomic environment and concluded that potential impacts from execution of the shock trials would be less at the Mayport, Florida alternative site than at the alternative sites of Norfolk, Virginia or Pensacola, Florida.

The NMFS determined that the incidental taking of marine mammals resulting from conducting a Full Ship Shock Trial on USS MESA VERDE in the waters offshore of Mayport, Florida during the summer months would have a negligible impact on the affected marine mammal species or stocks. The Final Rule was published in the FR on July 24, 2008 (FR, Vol. 73, No. 143). The FR notice provides a list of mitigations and requirements for monitoring and reporting before, during, and after the trials are conducted.

Acoustic analysis was performed to determine potential effects to marine mammals and sea turtles. Refer to Chapter 4 of the Mesa Verde Ship Shock Trial EIS/OEIS for a discussion of the methodology used to measure these effects. Acoustic analysis indicates that 489 total marine mammals (including ESA-listed species) may be exposed to levels of sound likely to result in Level B harassment. Acoustic analysis also indicates that 8 total marine mammals (including ESA-listed species) may be exposed to levels of sound likely to result in Level A harassment. The analysis also indicates that the effect to 1 marine mammal mortality may also result. The results of the acoustic analysis indicate that no ESA-listed marine mammal species will be exposed or injured due to the training activities. The results also indicate the quantity of ESA-listed sea turtles that may be exposed to levels of sound, 2,079 species may result in Level B harassment, 46 may result in Level A harassment, and 1 may result in mortality. The exposure estimates for each alternative represents the total number of exposures and not necessarily the number of individuals exposed, as a single individual may be exposed multiple times over the course of a year. The Navy finds that ESA-listed species may experience a cumulative impact from AFAST active sonar activities; however, they are not expected to adversely affect the populations of ESA-listed species (DoN, 2008ac).

The first shot of MESA VERDE's shock trial was successfully conducted August 16, 2008. The second shot was successfully completed on August 26, 2008 and the third and final shock trial event was completed September 13, 2008 (DoN, 2008a).

As detailed in the After-Action Mitigation Report for the Shock Trial of Uss Mesa Verde submitted to the Director of NMFS' Office of Protected Resources, the NMFS' Southeast Region, and the Chief of NMFS' Endangered Species Division - Office of Protected Resources, the mitigation component of the shock trial was successful. No mortalities or injuries to marine mammals or sea turtles were detected during the shock trial events or during post-mitigation monitoring. In addition, no marine mammal or sea turtle stranding has been attributed to the shock trial.

6.2.6.8 NSB Kings Bay

NSB Kings Bay, Georgia, is located in coastal southeastern Georgia, along the western shore of Cumberland Sound approximately 2 mi (3 km) north of St. Mary's, Georgia and approximately 35 mi (56 km) north of Jacksonville, Florida. The site was designated as NSB Kings Bay in 1982, and encompasses approximately 25 mi^2 (65 km^2). Facilities at the base enable Kings Bay to serve as a homeport, refit site, and training facility for the Navy personnel who operate and maintain the Ohio-class submarines (GlobalSecurity.org, 2007a).

The Navy Strategic Systems Programs proposed to construct and maintain security facilities to support continuous security service and incident response at NSB Kings Bay. Security improvements include a Waterfront Security Force Facility, an Auxiliary Reaction Force Facility, an Armored Fighting Vehicle Operational Storage Facility (AFVOSF); an Armory; road improvements to ensure efficient access to and from the proposed facilities; and construction of a new parking lot to replace lost parking spaces. No significant effects to environmental resources were expected (DoN, 2006b).

6.2.6.9 NS Mayport

NS Mayport is located near the Port of Jacksonville on the St. Johns River in northeast Florida. NS Mayport is home to 55 tenant commands and private organizations. Some two dozen ships are berthed in the Mayport basin, including Airborne Early Warning/Ground Environment Integration Segment guided-missile cruisers, destroyers, guided-missile frigates, and aircraft carriers (GlobalSecurity.org, 2007h). NS Mayport covers 5 $mi^2$1 (4 km^2) and is the third largest naval facility in the continental United States. NS Mayport is unique in that it is home to a busy seaport as well as an air facility that conducts more than 135,000 flight operations each year (GlobalSecurity.org, 2007e).

6.2.6.10 Homebasing MH-60R/S Helicopters on the East Coast of the US

The Navy is in the process of homebasing new MH-60S and MH-60R (helicopters) on the East Coast of the United States (DoN, 2002). The MH-60S aircraft type are replacing the CH-46D, HH-60H, SH-3H, and HH-1N helicopters. The missions assigned to this aircraft include combat search and rescue (CSAR); surface ship protection; and a new, organic, airborne, mine countermeasures role. The MH-60R aircraft type will replace the SH-60B and SH-60F aircraft. The missions assigned to this aircraft include anti-submarine warfare (ASW), surface warfare (SUW) and naval gun fire support. No significant adverse short-term or long-term impacts were identified as resulting from implementing the Navy's preferred alternative, which was to homebase all or most MH-60S helicopters at Naval Station (NS) Norfolk, Virginia and all or most MH-60R helicopters at stations in the Jacksonville, Florida region.

6.2.6.11 Use of Pinecastle Impact Range for Bombing Exercises

A 2002 EIS analyzed impacts for a projected level of 10,216 annual aircraft operations for ordnance delivery training. A BO was issued by the U.S. Fish and Wildlife Service (USFWS, 2001) for the Navy's continued use of the Pinecastle Bombing Range (i.e., PIR). The BO concluded that the proposed action was not likely to jeopardize the continued existence of three listed species, the Florida scrub-jay, sand skink, or eastern indigo snake. An Incidental Take Statement was granted for all three species. Following issuance of the Record of Decision, the Navy prepared a Supplemental Information Report to "determine if newly developed information with respect to GBUs at Pinecastle Impact Range represents significant new information or changed conditions" from those addressed in the 2002 EIS (DoN, 2004). A Supplemental EIS is being prepared for Pinecastle Range to provide more current information regarding the effects of GBU operations on Range Compatibility Zones. In addition, a Biological Evaluation is being prepared in accordance with the Endangered Species Act for submission to USFWS.

6.2.6.12 Homebasing F/A-18E/F Super Hornets to the East Coast of the US

The Navy has replaced the F-14 Tomcat fighter jet with the F/A-18E/F Super Hornet a modern all-weather carrier-capable strike fighter jet, designed to attack both ground and aerial targets. An EIS was prepared which analyzed 10 Super Hornet Squadrons and one Super Hornet Fleet Replacement Squadron at several combinations of east coast Navy and Marine Corps air stations along with the impact to nearby training ranges (BT-9, BT-11, Dare County Range, and Townsend Bombing Range). Also, the EIS analyzed the amount of ordnance typically used at each range. The EIS concluded there would not be an increase in the amount of ordnance expended at any of the ranges and that there would not be a significant impact to resources at these ranges (DoN, 2003).

6.2.6.13 Navy Air-to-Ground Training at Avon Park, Florida

An EIS examined the environmental consequences of the Navy's use of the Avon Park Air Force Range for intermediate and advanced phases of the Navy's Interdeployment Training Cycle (USN, 2005). This training includes air-to-ground delivery of high-explosive ordnance as well as other mission activities that do not require the use of HE ordnance: Integrated Strike; Close Air Support; Combat Search and Rescue;

unit level training normally conducted in conjunction with intermediate and advanced phases of training; and electronic warfare support. Formal consultation with the USFWS concluded with a BO in June 2005 (USFWS, 2005). USFWS provided their opinion for the effects of air-to-ground delivery of high-explosive (HE) ordnance, as well as other mission activities that do not require the use of HE ordnance, on the 14 listed species that may occur or are known to occur at the range.

6.2.6.14 Other Department of Defense Training Activities

There are several other Department of Defense (DoD) users of the JAX Study Area. These DoD users out in the OPAREAs include U.S. Coast Guard (USCG), U.S. Air Force (USAF), U.S. Customs, and foreign military.

USCG, as part of the DoD role, often train in surface-to-surface and air-to-surface gunnery events and U.S. Customs conduct air-to-surface bombing exercises. Foreign navy military conduct surface-to-surface gunnery and anti-submarine warfare exercises in the OPAREA. On the inland ranges of the JAX Study Area, the U.S. Marine Corps conducts training activities at Lake George Range and Rodman Range.

6.2.6.15 Eglin Gulf Test and Training Range Operations

Eglin AFB supported nearly 39,000 sorties during the timeframe of fiscal years (FY) 1995 through 1999 (USAF, 2002). Most of the sorties were flown over the Gulf of Mexico, in the Eglin Gulf Test and Training Range (EGTTR). Mission activities conducted within the EGTTR can be summarized as Air Operations and Ordnance Testing and Training. Air Operations include all manned and unmanned aircraft flights through the EGTTR. Ordnance testing and training involves the release of expendables, which are defined as items that are deployed, released, or consumed (or potentially consumed) while performing an activity. Examples of expendables include bombs, missiles, bullets, chaff, flares, and other miscellaneous items.

Water quality may be negatively affected from the introduction of chemical materials from jet fuel, munitions, chaff, and flares. Fuel may be introduced into the water by the occasional downing of a target drone and by emergency in-flight fuel release (USAF, 2002). Table 6.2-6 and Table 6.2-7 show the maximum amount of fuel deposited by these actions between 1995 and 2000. In reality, the amount is far less because the extreme volatility of the substance results in a significant amount (approximately 99 percent) of evaporation during descent. The remainder would disburse through the action of waves and currents.

TABLE 6.2-6
ESTIMATED VOLUME OF FUEL RELEASED BY DRONES DURING EGTTR MISSIONS

Drone Type	Quantity	Average Fuel Amount (gallons/drone)	Total Fuel Released (gallons)
QF-4	21	1,030	21,630
QF-106/4	35	735	25,725
BQM-34	20	40	800
MQM-107	23	30	690
		TOTAL	48,845

Source: USAF, 2002

TABLE 6.2-7
ESTIMATED FUEL RELEASED FROM IN-FLIGHT EMERGENCIES (IFE) DURING EGTTR MISSIONS

Aircraft Type	IFE Sorties that Released Fuel	Average Released Fuel (gallons/sortie)	Total Fuel Released (gallons)	Fuel (gallons) Reaching Surface
F-15/F-15E	220	735	161700	1,620
F-18	4	735	2940	30
F-111	2	735	1470	20
F-117	0.2	735	150	2
AC/MC/C-130	0.5	1,470	700	10
		TOTAL	166,960	1,682

Source: USAF, 2002

Chaff is primarily used as a defense mechanism and is released from engaged aircraft. Discharge of chaff results in the release of millions of aluminum dipoles (short fibers similar in appearance to human hair) that create an electromagnetic cloud around the aircraft, shrouding the plane from enemy radar and defense systems. The main chemical component of concern in chaff is aluminum. Due to the wide dispersion over large areas of the eastern Gulf of Mexico, chaff dispersion would vary for each of the water ranges (U.S. Air Force, 2002). A small portion of the chaff may dissolve over time. An assessment suggests that approximately 0.06 percent of the initial aluminum weight would dissolve in seawater. Although no criteria exist for aluminum in oceanic waters, it is a naturally occurring trace element (river input) in seawater and found at variable concentrations. Effects are therefore considered negligible (USAF, 2002).

Flares are high-temperature heat sources that are ejected from aircraft to confuse and divert enemy heat-seeking or heat-sensitive missiles. Flares are also used to illuminate surface areas during nighttime operations. The principle chemical element of concern is magnesium. The total amounts of magnesium added to the Gulf of Mexico surface waters would be less than 0.0002 percent (Warning Area 151 [W-151] or Panama City OPAREA) and 0.0005 (W-470 or Pensacola OPAREA) percent of the background concentration (1.35 grams per liter [g/L] [11,266 lbs/gallon [gal]) of magnesium in the Gulf of Mexico surface waters. Due to this extremely small amount, no adverse effects are anticipated (USAF, 2002).

Test and training missions conducted by Eglin AFB result in numerous flight activities in the EGTTR involving a variety of aircraft and missiles flying at a wide range of altitudes and traveling at speeds ranging from slow subsonic to supersonic. Subsonic and supersonic aircraft noise is basically continuous over the EGTTR while missions are in progress. Supersonic noise from EGTTR missions was determined to be not likely to adversely affect dolphins or other biological resources, or socioeconomic (human) resources (USAF, 2002).

Underwater noise resulting from gunnery missions has been calculated. Noise results from 25-millimeter (mm), 40-mm, and/or 105-mm rounds being fired at the water surface. Various noise levels were found to be pertinent to effects to protected species. The distance from an exploding shell that these noise levels would reach was determined, and then the number of animals potentially affected was calculated. Generally, for the purposes of the EGTTR Programmatic Environmental Assessment (EA), noise levels above 205 decibels (db) referenced to 1 micropascal squared second (dB re 1 μPa^2 s) are considered injurious, levels above 182 dB re 1 μPa^2 s are considered non-injurious harassment, and levels above 176 dB re 1 μPa^2 s are considered behavioral harassment. This 176 dB re 1 μPa^2 value was employed by the U.S. Air Force for behavioral takes of marine mammal species and was based on the *EA for the Use of the AN/SSQ-110A Sonobuoys in Deep Ocean Waters*. The harassment level is now set at 177 dB for all

Air Force activities. Table 6.2-8 and Table 6.2-9 show the number of protected species potentially affected. All gunnery missions used in these calculations occur in W-151.

TABLE 6.2-8
YEARLY ESTIMATED NUMBER OF MARINE MAMMALS AFFECTED BY GUNNERY MISSION NOISE

Species	Adjusted Density (No./km^2)	Level A Harassment Injurious 205 dB* EFD for Ear Rupture	Level B Harassment Non-Injurious 182 dB* EFD for TTS	Level B Harassment Non-Injurious 176 dB* EFD for Behavior
Bryde's whale	0.007	<0.001	0.010	0.041
Sperm whale	0.011	<0.001	0.016	0.064
Dwarf/pygmy sperm whale	0.024	<0.001	0.035	0.139
Cuvier's beaked whale	0.10	<0.001	0.015	0.058
Mesoplodon spp.	0.019	<0.001	0.028	0.110
Pygmy killer whale	0.030	<0.001	0.044	0.174
False killer whale	0.026	<0.001	0.038	0.151
Short-finned pilot whale	0.027	<0.001	0.039	0.157
Rough-toothed dolphin	0.028	<0.001	0.041	0.163
Bottlenose dolphin	0.810	0.006	1.177	4.706
Risso's dolphin	0.113	0.001	0.164	0.657
Atlantic spotted dolphin	0.677	0.005	0.984	3.934
Pantropical spotted dolphin	1.077	0.008	1.565	6.258
Striped dolphin	0.237	0.002	0.344	1.377
Spinner dolphin	0.915	0.007	1.330	5.316
Clymene dolphin	0.253	0.002	0.368	1.470
Unidentified dolphin**	0.053	<0.001	0.077	0.308
Unidentified whale	0.008	<0.001	0.012	0.046
All marine mammals	4.325	0.032	6.29	25.13

Source: U.S. Air Force, 2002
EFD = Energy Flux Density; km^2 = square kilometers; No. = number; TTS = temporary threshold shift
* dB = dB re 1 μPa^2 s
** Bottlenose dolphin/Atlantic spotted dolphin

TABLE 6.2-9
YEARLY ESTIMATED NUMBER OF SEA TURTLES AFFECTED BY GUNNERY MISSION NOISE

Species	160 dB	170 dB	180 dB	190 dB	200 dB
Sea Turtles (number)	215	20.2	2.1	0.2	0.02

Source: U.S. Air Force, 2002
dB = decibels

Underwater noise may also affect non-protected resources such as fish. Impulsive noise at sufficient intensity is known to cause injury to the swim bladder and other air spaces inside fish. However, the intermittent nature of both the EGTTR missions (USAF, 2002).

Direct physical effects to protected species and sensitive habitat (sea turtles, marine mammals, and *Sargassum* mats) may occur when the surface of the water is physically struck by gunnery ordnance or other falling objects. The BO issued by NMFS estimated that one sperm whale and four sea turtles would be potentially affected (physically struck or startled) by falling objects (U.S. Air Force, 2002). The BO issued by NMFS estimates one sperm whale and four sea turtles. Eglin AFB has also requested a renewal for authorization to take up to 271 marine mammals by harassment incidental to conducting air-to-surface gunnery missions in the Gulf of Mexico.

The large number of sorties flown over the EGTTR over the course of a year requires dedicated management of military and commercial airspace. However, these activities have been occurring for years, and control of the airspace is well established. Therefore, no additional effects are anticipated (USAF, 2002).

6.2.6.16 Cape San Blas Activities

Eglin AFB maintains property on Cape San Blas (CSB), Florida. Air Force facilities on CSB indirectly support nearly all air operations within the EGTTR warning area W-151 (Panama City OPAREA), as well as some of the air operations in W-470. Additionally, CSB facilities directly support some air missions (5,415 during FY 1994 through FY 1997), including surface-to-air missile launches. Up to 26 surface-to-air missiles were launched per year (4 Patriot, 16 Caesar Trumpet, and 6 Viper). Some smaller, portable missiles were also fired at QF-4 drones, with up to two drones potentially downed in the Gulf of Mexico per year. In addition, CSB supports limited surf zone testing and training activities in the nearshore shallow waters. Although no specific test or training missions have been identified, typical activities included underwater navigation and reconnaissance missions, as well as small inert munitions activities performed by the Navy Explosive Ordnance Disposal training school (USAF, 1999).

CSB activities include effects to air quality, water quality, protected species and sensitive habitats, airspace management, and effects due to noise. The CSB Programmatic EA identified issues associated with restricted access, noise, habitat alteration, expended materials, electromagnetic radiation, chemical materials, and direct physical effects (USAF, 1999).

For the purpose of public safety and the security of test and training operations, use of land and water areas and airspace beyond Air Force property boundaries have been occasionally and briefly restricted for some surface-to-air missile activities. Water access has been restricted for approximately 69 hours per year (USAF, 1999).

Expended materials from CSB missions resulted primarily from the surface-to-air missile launch missions. Missile components and drones from missile tests typically consisted of aluminum and steel housing assemblies, optical sensors, guidance and control electronics, radio transmitters and receivers, and a power supply that may include lithium or nickel-cadmium batteries. Although most typical missions have not planned for the intentional downing of drones, surface-to-air missiles and drone targets that potentially fall on land have relatively benign environmental effects. Expended materials falling into nearshore waters had the potential to physically strike a boat, person, marine animal, or other receptor at the surface. Calculations predict, however, that the likelihood is remote (USAF, 1999).

The introduction of chemical materials into the CSB environment occurred primarily from missile and rocket exhaust emissions as a result of the surface-to-air missile launch activities. The amount of chemical materials released into the air and water is summarized in Table 6.2-10.

TABLE 6.2-10
CHEMICAL MATERIALS ASSOCIATED WITH MISSILE LAUNCH ACTIVITIES

Environmental Receptor	Chemical Material	Maximum Exposure (mg/m^3)
Air	Al_2O_3 (alumina)	0.021
	CO (carbon monoxide)	39.11
	HCl (hydrochloric acid)	0.012
	NO_x (nitrogen oxides)	0.009
Water	JP-8 Fuel (Jet Propulsion fuel, type 8)	0.023

Source: U.S. Air Force, 1999
mg/m^3 = milligrams per cubic meter

The number of aircraft and missile flights in the CSB vicinity required management of military and commercial airspace. However, these activities fell well within the management capabilities of airspace controllers (USAF, 1999).

6.2.6.17 Santa Rosa Island Activities

Eglin AFB controls 7.4 mi^2 or 19.3 km^2 (19,263,244 square meters [m^2]) of Santa Rosa Island (SRI), which includes 15 Air Force test sites. In addition to the SRI land mass, the surf zone is also considered part of the zone of effect. The surf zone is a shallow area covering the continental shelf seaward of SRI to a distance of approximately 7.8 nm (14.5 km). The distance from the SRI shoreline that corresponds to this depth varies from approximately 0.4 nm (0.8 km) at the western side of the Air Force property to 1.3 nm (2.4 km) at the eastern side (USAF, 2005a). Several activities conducted on SRI and in the surf zone have the potential to affect the resources analyzed in Chapter 3.

Electronic Countermeasures and Electronic Systems Testing is conducted in the vicinity of SRI (USAF, 2005a). Training is routinely done aircraft-against-aircraft or aircraft-against-ground/surface ship systems. Any part of the Eglin Range Complex can be used for this type of training, but it is mostly done over the water. Surface-to-air missile tests launch missiles from a variety of locations, including A-15 on SRI and surface vessels, at target aircraft in the EGTTR. A variety of surf zone testing/training activities may occur as needed and include mine clearance testing and explosive ordnance disposal training (USAF, 2005a).

Although the number of missile and aircraft flights is not quantified, air pollutant emission is a potential effect issue, as is airspace management. Air sorties associated with SRI lack the intensity and frequency of those associated with other activities, and the effects are considered minimal (USAF, 2005a).

If increased use of the surf zone occurs, the potential for effects to geology, water quality, cultural resources, marine life, and protected species and habitats exist (USAF, 2005a). Mine clearance and ordnance disposal could result in underwater detonations on or close to the sediment. This could cause turbidity and damage to essential fish habitat (EFH) (such as natural or artificial reefs) and cultural resources. Turbidity would be very brief and localized, as wave and current action would disperse the sediments (USAF, 2005a). Environmental regulations would require that such training not be undertaken in the vicinity of cultural resources, EFH, or other sensitive habitats. A small amount of chemical materials would be added to the water column, but would be diluted to the point of insignificance (U.S. Air Force, 2005a). Detonations could cause injury to protected species such as sea turtles and marine mammals, and to non-protected resources such as fish. However, surveys for the presence of protected

species would be required before such activities. Therefore, effects are considered unlikely (USAF, 2005a).

6.2.6.18 Precision Strike Weapons Test

The U.S. Air Force Air Armament Center and the U.S. Navy, in cooperation with the 46th Test Wing Precision Strike Division (46 OG/OGMTP), proposes to conduct a series of Precision Strike Weapons (PSW) test missions during the next five years utilizing resources within the Eglin Military Complex, including two sites in the EGTTR (USAF, 2005b). The weapons to be tested are the Joint Air-to-Surface Stand-off Missile (JASSM) AGM-158 A and B, and the small-diameter bomb (SDB) GBU-39/B. The JASSM is a precision cruise missile designed for launch from outside area defenses to kill hard, medium-hardened, soft, and area type targets. The SDB weapon is a 250 lb (113 kg) class, air-to-surface, precision-guided munition. As many as two live and four non-explosive JASSM missiles per year would be launched from an aircraft above the Gulf of Mexico at a target located approximately 15 to 28 nm (28 to 44 km) offshore of Eglin AFB (USFA, 2005b). Detonation of the JASSM would occur under one of three scenarios:

- Detonation upon impact with the target, about 5 ft (1.5 m) above the Gulf of Mexico surface.
- Detonation upon impact with a barge target at the surface of the Gulf of Mexico.
- Detonation at 120 milliseconds (msec) after contact with the surface of the Gulf of Mexico.

In addition to the JASSM explosive, as many as six live and 12 non-explosive SDBs per year would also be dropped on the target. Targets would be located in less than 200 ft (61 m) of water and more than 12 nm (22 km) offshore (USAF, 2005b). Detonation of the SDBs would occur under one of two scenarios:

- Detonation of one or two bombs upon impact with the target, about 5 ft (1.5 m) above the Gulf of Mexico surface.

Height of burst test: Detonation of one or two bombs about 10 to 26 ft (3 to 8 m) above the Gulf of Mexico surface.

Activities associated with PSW testing may potentially affect water quality, biological resources, and the anthropogenic (man-made) environment (USAF, 2005b). Chemical products may be released into the aquatic environment during explosive detonations. The detonation of explosives usually results in the complete combustion of the original material and the emission of carbon dioxide, carbon, carbon monoxide, water, and nitrogen compounds. Residual chemical products are usually extremely dilute and are dispersed within hours by wave and current action. Although data is lacking, these compounds are not expected to persist in the marine environment, and there is expected to be no effects to sea turtles, marine mammals, or the marine environment in general (USAF, 2005b). During the time of operations, a safety zone on the surrounding water surface would be closed to commercial and recreational fishing. However, the total closed area compared to other areas available in the Gulf of Mexico is insignificant. In addition, the closures would be infrequent (USAF, 2005b).

Exploding JASSM and SDB bombs will result in both pressure waves and noise in the marine environment (USAF, 2005b). Detonations would have the potential for effects to protected and non-protected marine species, including sea turtles, marine mammals, and fish. As stated before, injury can result from the shock wave interacting with air spaces in an animal's body, such as swim bladders, the inner ear, and viscera. At further distances from the detonation, noise may cause hearing impairment or behavioral modification in individuals. The BO by NMFS (2005) related to PSW activities included calculations of sea turtles potentially affected before and after mitigation measures. After the implementation of the required measures, a total of 12 sea turtles may be affected (lethally and non-lethally) over a five-year period (NMFS, 2005). The number of marine mammals potentially affected as estimated by Eglin AFB is summarized in Table 6.2-11 and Table 6.2-12. NMFS has approved an incidental take permit for Air Force/Navy activities to allow for 1 mortality, 2 injury, and 53 harassment takes of marine mammals) (NMFS, 2006b).

TABLE 6.2-11
MARINE MAMMAL DENSITIES AND RISK ESTIMATES FOR LEVEL A HARASSMENT (205 DB EFD 1/3-OCTAVE BAND) NOISE EXPOSURE DURING PSW MISSIONS

Species	Density	Number of Animals Exposed from 1-ft Depth Detonations	Number of Animals Exposed from >20-ft Depth Detonations
Summer			
Dwarf/pygmy sperm whale	0.013	0.0024	0.0247
Bottlenose dolphin	0.81	0.1491	1.5417
Atlantic spotted dolphin	0.677	0.1246	1.2886
T. truncatus/S. frontalis	0.053	0.0098	0.1009
TOTAL		0.29	3.0
Winter			
Dwarf/pygmy sperm whale	0.013	0.0024	0.0285
Bottlenose dolphin	0.81	0.1491	1.7737
Atlantic spotted dolphin	0.677	0.1246	1.4824
T. truncatus/S. frontalis	0.053	0.0098	0.1161
TOTAL		0.29	3.4

Source: U.S. Air Force, 2005b
dB = decibels; EFD = Energy Flux Density; ft = feet; PSW = Precision Strike Weapons

TABLE 6.2-12
MARINE MAMMAL DENSITIES AND RISK ESTIMATES FOR LEVEL B HARASSMENT (182 DB EFD 1/3-OCTAVE BAND) NOISE EXPOSURE DURING PSW ACTIVITIES

Species	Density	Number of Animals Exposed from 1-ft Depth Detonations	Number of Animals Exposed from >20-ft Depth Detonations
Summer			
Dwarf/pygmy sperm whale	0.013	0.0226	0.5070
Bottlenose dolphin	0.81	1.4089	31.5886
Atlantic spotted dolphin	0.677	1.1776	26.3735
T. truncatus/S. frontalis	0.053	0.0922	2.0669
TOTAL		2.7	60.5
Winter			
Dwarf/pygmy sperm whale	0.013	0.0280	0.8633
Bottlenose dolphin	0.81	1.7448	53.7906
Atlantic spotted dolphin	0.677	1.4583	44.9300
T. truncatus/S. frontalis	0.053	0.1142	3.5196
TOTAL		3.3	103.1

Source: U.S. Air Force, 2005b
dB = decibels; EFD = Energy Flux Density; ft = feet; PSW = Precision Strike Weapons

6.3 REASONABLY FORESEEABLE FUTURE ACTIONS RELEVANT TO THE PROPOSED ACTION

6.3.1 Military Operations

6.3.1.1 VACAPES Range Complex

As stated in Section 6.2.8.5, the VACAPES Range Complex Draft EIS/OEIS was released in June 2008. In that Draft EIS/OEIS, the Navy's preferred alternative was identified as Alternative 2, Increases and Modifications in Operational Training, Accommodate Force Structure Changes, and Implement Enhancements. The Navy's preferred alternative is considered representative of its future actions within the VACAPES Range Complex. The Final EIS/OEIS is expected to be released to the public in 2009; refer to this document for all cumulative impacts (DoN, 2008c).

Under Alternative 2, the Navy proposes to increase or modify training and RDT&E operations from current levels in support of the FRTP, accommodate mission requirements associated with force structure changes, including those resulting from the introduction of new platforms (aircraft and weapons systems), and implement enhanced range complex capabilities in the VACAPES Range Complex. Alternative 2 would implement enhancements to the minimal extent possible to meet the components of the FRTP to implement the FRP. It would also increase operational training, expand warfare missions, and accommodate force structure changes, which would include changing weapon systems and platforms, and homebasing new aircraft and ships, as well as additional mine warfare training capabilities, the establishment of MIW training areas with small fields of inert (non-explosive) mineshapes, and implementation of additional enhancements to enable the range complex to meet future requirements (DoN, 2008c). (Mine detection sonar will be used and use of this sonar is covered under this AFAST EIS/OEIS.)

The Navy's goal with Alternative 2 is to reduce the number of BOMBEX training events that involve dropping live, high-explosive ordnance on targets at-sea in comparison to the No Action Alternative, which depicts current operations and activities (DoN, 2008c).

Physical, biological, environmental, cultural, socioeconomic, and human resources were analyzed to determine the potential effects any expended materials would cause. It was determined that there will be no significant impact and no significant harm to physical, biological, environmental, cultural, socioeconomic or human resources due to the training activities occurring in the VACAPES Range Complex under Alternative 2 (DoN, 2008c).

Acoustic analysis was performed to determine potential effects to marine mammals and sea turtles. Refer to Chapter 3 of the VACAPES Range Complex EIS/OEIS for a discussion of the methodology used to measure these effects. Acoustic analysis under the No Action Alternative indicates that 63,664 total marine mammals (including ESA-listed species) may be exposed to levels of sound likely to result in Level B harassment. Acoustic analysis also indicates that 730 total marine mammals (including ESA-listed species) may be exposed to levels of sound likely to result in Level A harassment. The analysis also indicates that seven marine mammal mortalities may result. The results of the acoustic analysis indicates the quantity of ESA-listed marine mammals that may be exposed to levels of sound, 173 exposures of an ESA-listed species may result in Level B harassment and one exposure may result in Level A harassment. The results also indicate the quantity of ESA-listed sea turtles that may be exposed under the No Action Alternative to levels of sound, 11,340 exposures may result in Level B harassment, 97 exposures may result in Level A harassment, and two may result in mortality. The exposure estimates for the No Action Alternative represent the total number of exposures and not necessarily the number of individuals exposed, as a single individual may be exposed multiple times over the course of a year (DoN, 2008c). In addition, these exposure estimates do not include the incorporation of mitigation measures, which are designed to reduce exposure of marine mammals and sea turtles to potential impacts in an effort to achieve the least practicable adverse effect on marine mammal and sea turtle species or populations.

6.3.1.2 Cherry Point Range Complex

As stated in Section 6.2.8.6, the Cherry Point Range Complex Draft EIS/OEIS was released in August 2008. In that Draft EIS/OEIS, the Navy's preferred alternative was identified as Alternative 2, Eliminate High Explosive Bombs At-sea and Implement Enhanced Mine Warfare Training Capabilities. The Navy's preferred alternative is considered representative of its future actions within the Cherry Point Range Complex. The Final EIS/OEIS is expected to be released to the public in 2009; refer to this document for all cumulative impacts (DoN, 2008b).

Under Alternative 2, the Navy will continue conducting current activities as well as increasing range complex operations and capabilities enhancement to address Navy and DoD emerging and foreseeable future training and RDT&E requirements. Other than the continuation of current training and testing activities, the preferred alternative also allows for an across-the-board increase in most operations to provide the Navy and Marine Corps with flexibility to train for real world situations, plus change in type and quantity of operations and tactical employment of forces to accommodate expanded mission areas, force structure changes, and new range capabilities. Alternative 2 would also eliminate all high explosive (HE) bombing exercises at-sea (BOMBEX Air-to-Surface) and designate two mine warfare (MIW) training areas for major exercise MIW events. (Mine detection sonar will be used and use of this sonar is covered under this AFAST EIS/OEIS.) With the elimination of HE BOMBEX, the Navy and Marine Corps plans to continue to drop Non-Explosive Practice Munitions (NEPM or inert bombs) (DoN, 2008b).

Furthermore, the Navy intends to perform mine neutralization operations for both ESG and CSG major exercises in the area currently designated for underwater detonation (UNDET) training, 5.6 to 22.2 km (3 to 12 nm) off the coast in the Cherry Point OPAREA (DoN, 2008b).

Physical, biological, environmental, cultural, socioeconomic, and human resources were analyzed to determine the potential effects any expended materials would cause. It was determined that there will be no significant impact and no significant harm to physical, biological, environmental, cultural, socioeconomic or human resources due to the training activities occurring in the Cherry Point Range Complex (DoN, 2008b).

Acoustic analysis was performed to determine potential effects to marine mammals and sea turtles in response to Alternative 2 (Preferred Alternative). Refer to Chapter 3 of the Navy Cherry Point Range Complex Draft EIS/OEIS for a discussion of the methodology used to measure these effects. Acoustic analysis indicates that three exposures to marine mammals (including ESA-listed species) may result in Level B harassment. No mortalities are predicted due to the proposed activities. The results of the acoustic analysis indicates that no ESA-listed marine mammals will may be exposed to levels of sound resulting in any level of harassment. The results also indicate that no ESA-listed sea turtles will be exposed to levels of sound likely to result in any level of harassment. The exposure estimates for the Preferred Alternative represents the total number of exposures and not necessarily the number of individuals exposed, as a single individual may be exposed multiple times over the course of a year (DoN, 2008a). In addition, these exposure estimates do not include the incorporation of mitigation measures, which are designed to reduce exposure of marine mammals and sea turtles to potential impacts in an effort to achieve the least practicable adverse effect on marine mammal and sea turtle species or populations.

6.3.1.3 Homeporting of Additional Surface Ships at Naval Station Mayport, Florida

A Record of Decision was published in the Federal Register (FR) on January 21, 2009 (FR, Vol. 74, No. 12) in which the Navy, after carefully weighing the strategic, operational, and environmental consequences of the proposed action, announced its decision to homeport one nuclear-powered aircraft carrier (CVN) at Naval Station (NAVSTA) Mayport. The decision initiated a multi-year process for developing operational, maintenance, and support facilities at NAVSTA Mayport to support homeporting of one CVN. The multi-year process includes implementing projects for dredging and dredged material disposal, construction of CVN nuclear propulsion plant maintenance facilities, wharf improvements, transportation improvements, and construction of a parking structure to replace existing parking that would be displaced by development of the CVN nuclear propulsion plant maintenance facilities.

The projects necessary to create the capacity to support CVN homeporting could be completed as early as 2014. No CVN homeport change will occur before operational, maintenance, and support facility projects

are completed. The DON environmental analysis included extensive studies regarding impacts associated with dredging, facility construction, and homeport operations. This included determining potential environmental effects to earth resources, land and offshore use, water resources, air quality, noise, biological resources, cultural resources, traffic, socioeconomics, general services, utilities, and environmental health and safety were analyzed. Of those, potential environmental effects to biological resources are relevant to this EIS/OEIS.

The environmental analysis undertaken by the DON included lengthy and detailed consultations with regulatory agencies, such as the U.S. Fish and Wildlife Service and the National Marine Fisheries Services, regarding impacts to endangered and threatened species, and the U.S. Army Corps of Engineers and the Environmental Protection Agency regarding dredging operations and the in-water disposal of dredged materials.

In accordance with section 7 of the Endangered Species Act (ESA), the DON consulted with the USFWS and NMFS regarding potential impacts to federally listed species and designated critical habitat for proposed construction and dredging activities.

With implementation of the conditions of the USFWS Letter of Concurrence, it was determined implementation of the dredge project would have no effect on nesting listed sea turtles; may affect, but is not likely to adversely affect Florida manatee; and would not destroy or adversely modify Florida manatee designated critical habitat.

With implementation of the conditions of the NMFS Biological Opinion (BO) dated 7 January 2009, it was determined implementation of the dredge project may affect, but is not likely to adversely affect shortnose sturgeon, smalltooth sawfish, North Atlantic right whales (NARW), and humpback whales. As NMFS determined in the BO, there is currently no NARW critical habitat in the proposed action area. NMFS also found, with implementation of the reasonable and prudent measures and the terms and conditions, dredging to include bed-leveling activities, is likely to adversely affect, but is not likely to jeopardize the continued existence of sea turtles (loggerhead, green, and Kemp's ridley). Based on historical distribution data, hopper dredge observer reports, and observations of past strandings, loggerhead, green, and Kemp's ridley sea turtles may occur in the action area and may be taken by the hopper dredging operations of this project. NMFS believes that the proposed action can be expected to lethally take up to 17 loggerhead, 3 green, and 2 Kemp's ridley sea turtles during the proposed project.

For construction related to the Wharf F improvements, no anticipated impacts are expected to listed fish, sea turtles, and marine mammals. However, to further reduce any potential impacts, the use of a vibratory hammer will be implemented for pile driving operations. If a marine mammal is observed within 50 ft of the proposed pile driving operations, operations would cease if practicable until the animal leaves the area.

6.3.1.4 Undersea Warfare Training Range

The Navy released a Draft EIS/OEIS in September 2008 to evaluate the potential environmental effects associated with the construction and operations of an underwater instrumented range off the Southeastern U.S. Coast (DoN, 2008e). A revised Notice of Intent to prepare the EIS/OEIS and a thirty day scoping period was published in the Federal Register on September 21, 2007. Four public meetings were held during the months of September and October 2008, and comments were received from September 12, 2008 to October 27, 2008. The Draft EIS/OEIS is incorporated by reference and is available for downloading/viewing via the internet at the following website address: (http://projects.earthtech.com/uswtr/USWTR_index.htm). The proposed action is to place undersea cables and transducer nodes in a 500 nm^2 (1,713 km^2) area of the ocean to create an undersea warfare training range (USWTR) for use as an ASW training range. The ASW training would involve up to three vessels and two aircraft using the range for any one training event, although events would typically involve fewer

units. The instrumented area would be connected to the shore via a single trunk cable. The proposed action would require logistical support for ASW training, including the handling (launch and recovery) of exercise torpedoes (non-explosive) and submarine target simulators (DoN, 2008e). The purpose of the proposed action is to enable the Navy to train effectively in a shallow water environment at a suitable location for Atlantic Fleet ASW capable units. The 120- to 900-ft (37- to 274-m) depth parameter for the range was derived from collectively assessing depth requirements of the platforms that would be using this range, and approximate the water depth of potential areas of conflict that the Navy has identified.

The Navy analyzed potential environmental impacts at the following four sites:

- Site A – offshore of northeastern Florida (JAX OPAREA).
- Site B – offshore of central South Carolina (CHASN OPAREA).
- Site C – offshore of southeastern North Carolina (Cherry Point OPAREA).
- Site D – offshore of northeastern Virginia (VACAPES OPAREA).

The Preferred Alternative has been determined to be Site A. Potential effects to physical, ecological, and socioeconomic resources were analyzed in the USWTR OEIS/EIS. With the exception of EFH, it was determined there would be no significant impact to physical, ecological (non acoustic effects only), or socioeconomic resources. Cable installation may have a temporary impact on benthic organisms, including benthic fish, during the placement of the transducer nodes and interconnect cable and the burial of the trunk cable. As this action would result in a reduction of the quantity and/or quality of some types of EFH, installation of the proposed USWTR may adversely affect EFH at all of the four proposed sites (DoN, 2008e).

Acoustic analysis was performed to determine potential effects to marine mammals from sonar activities. Refer to Chapter 4 of the USWTR OEIS/EIS for a discussion of the methodology used to measure these effects. Acoustic analysis indicates that 108,108 non-injurious effects on marine mammals annually as a result of exposure to sonar activities that NMFS would classify as Level B harassment under the MMPA at the preferred alternative site. In addition, the Navy estimates the potential for 7 injurious effects on marine mammals annually as a result of exposure to active sonar activities that NMFS would classify as Level A harassment under the MMPA. This estimate does not take into consideration any avoidance of vessels or sound sources by marine mammals or the implementation of mitigation measures. Navy does not anticipate Level A harassment to occur with the implementation of mitigation measures. Of these marine mammals, no threatened or endangered marine mammals will be exposed to levels of sound likely to result in Level A harassment, and 156 will be exposed to levels of sound likely to result in Level B harassment (DoN, 2008a; 2008,g). Based on the acoustic screening analysis, plankton, invertebrates, seabirds, sea turtles, pinnipeds, and manatees were excluded from acoustic effect analysis (DoN, 2008a; 2008g).

6.3.1.5 Surveillance Towed Array Sensor System Low Frequency Active Sonar

The Final Supplemental Environmental Impact Statement (SEIS) for Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) Sonar was issued in April 2007, and the Record of Decision (ROD) was issued in August 2007 (DoN, 2007). Under the action, a maximum of four systems would be deployed in the Pacific-Indian ocean area and in the Atlantic-Mediterranean area. Of an estimated maximum 294 underway days per year, the SURTASS LFA sonar would be operated in the active mode about 240 days. During these 240 days, active transmissions would occur for a maximum of 432 hours per year per vessel. The duty cycle of the SURTASS LFA sonar would be limited (it would generally be on between 7.5 and 20 percent of the time [7.5 percent is based on historical LFA operations since 2003 and the physical maximum limit is 20 percent]). The LFA transmitters would be off the remaining 80 to 92.5 percent of the time (DoN, 2007). The decision, as stated in the ROD, implemented Alternative 2 as the Preferred Alternative (DoN, 2007).

Under Alternative 2, the SURTASS LFA sonar would be employed with geographical and seasonal restrictions to include maintaining sound pressure level below 180 dB within 12 nm (22 km) of any coastline and within the offshore biologically important areas that are outside of 12 nm (22 km). During the annual LOA process, the Navy will evaluate potential offshore biologically important areas within the proposed operating areas for each ship and incorporate restrictions, as required, into the LOA applications for NMFS's review and action. LFA sound fields will not exceed 145 dB within known recreational and commercial dive sites. Monitoring mitigation includes visual, passive acoustic, and active acoustic (high-frequency marine mammal monitoring [HF/M3] sonar) to prevent injury to marine animals when employing SURTASS LFA sonar by providing methods to detect these animals within the 180 dB LFA mitigation zone (DoN, 2007).

The Final SEIS analyzed potential impacts to fish, sea turtles, marine mammals, and socioeconomics (commercial and recreational fishing, research and exploration activities, other recreational activities). Under Alternative 2, the potential impact on any stock of fish, sharks or sea turtles from injury was considered negligible, and the effect on the stock of any fish, sharks or sea turtles from significant change in a biologically important behavior was considered negligible to minimal. Any auditory masking in fish, sharks or sea turtles is expected to be of minimal significance and, if occurring, would be temporary (DoN, 2007). The potential impact on any stock of marine mammals from injury is considered to be negligible, and the effect on the stock of any marine mammal from significant change in a biologically important behavior is considered to be minimal. Any momentary behavioral responses and possible indirect impacts to marine mammals due to potential impacts on prey species are considered not to be biologically significant effects. Any auditory masking in mysticetes, odontocetes, or pinnipeds is not expected to be severe and would be temporary (DoN, 2007). Further, there will be no significant impact to socioeconomic resources.

NMFS issued the Final Rule for the taking of Taking and Importing Marine Mammals; Taking Marine Mammals Incidental to the U.S. Navy Operations of Surveillance Towed Array Sensor System Low Frequency Active Sonar in August 2007 (NMFS, 2007d). NMFS has determined that the incidental taking of marine mammals resulting from SURTASS LFA sonar operations would have a negligible impact on the affected marine mammal species or stocks over the 5-year period of LFA sonar operations. That assessment is based on a number of factors: (1) The best information available indicates that effects from SPLs less than 180 dB will be limited to short-term Level B behavioral harassment averaging less than 12 percent annually for all affected marine mammal species; (2) the mitigation and monitoring is highly effective in preventing exposures of 180 dB or greater; (3) the results of monitoring as described in the Navy's Comprehensive Report supports the conclusion that takings will be limited to Level B harassment and not have more than a negligible impact on affected species or stocks of marine mammals; (4) the small number of SURTASS LFA sonar systems (two systems in FY 2008 and FY 2009 (totaling 864 hours of operation annually), 3 in FY 2010 (totaling 1296 hours of operation annually), and 4 systems in FY 2011 and FY 2012 (totaling 1728 hours of operation annually) that would be operating world-wide; (5) that the LFA sonar vessel must be underway while transmitting (in order to keep the receiver array deployed), limiting the duration of exposure for marine mammals to those few minutes when the SURTASS LFA sonar sound energy is moving through that part of the water column inhabited by marine mammals; (6) in the case of convergence zone propagation, the characteristics of the acoustic sound path, which deflect the sound below the water depth inhabited by marine mammals for much of the sound propagation (see illustration 67 FR page 46715 [July 16, 2002]); (7) the findings of the Scientific Research Program on low-frequency sounds on marine mammals indicated no significant change in biologically important behavior from exposure to sound levels up to 155 dB; and (8) during the 40 LFA sonar missions between 2002 and 2006, there were only three visual observations of marine mammals and only 71 detections by the HF/M3 sonar, which all resulted in mitigation protocol suspensions in operations. These measures all indicate that while marine mammals will potentially be affected by the

SURTASS LFA sonar sounds, these impacts will be short-term behavioral effects and are not likely to adversely affect marine mammal species or stocks through effects on annual rates of reproduction or survival. In addition, mortality of marine mammals is not expected to occur as a result of LFA sonar operations (NMFS, 2007d). At this time, the Navy has no plans to employ SURTASS LFA in the Jacksonville Range Complex study area.

6.3.1.6 Arrival of New Submarines at Naval Submarine Base (NSB) Kings Bay, Georgia

Beginning with the arrival of the *USS Tennessee* in 1989, NSB Kings Bay housed 10 Trident submarines by 1997. However, a 1992 nuclear policy review recommended that the Ohio-class fleet ballistic missile submarines be reduced from 18 to 14 by the year 2005 (Wiss, 2006). As a result of the realignment process, five submarines departed NSB Kings Bay, Georgia, for Bangor NSB, Washington, between 2002 and 2005 (DoN, 2006b). The losses of these five submarines are expected to be offset by incoming submarines, which include the *USS Florida*, *USS Georgia*, and *USS Alaska*. Each submarine is expected to provide an annual economic impact of $9.5 million to the area. The population in Camden County is expected to increase by 1,000 because it is anticipated that each guided nuclear missile submarine (SSGN) will bring two crews of 160 sailors and their families (Wiss, 2006).

The *USS Georgia* was assigned a new homeport at NSB Kings Bay in 2007, after a $1 billion renovation at Norfolk Navy Shipyards. The submarine was converted from a ballistic nuclear submarine (SSBN) to an SSGN (Wiss, 2006). An SSBN carries 24 Trident missiles, whereas an SSGN is fitted to carry up to 154 conventional cruise missiles.

The Navy commissioned the *USS Alaska* on January 25, 1986. It was the seventh Trident Nuclear Powered Fleet Ballistic Missile Submarine to be constructed and one of eight Trident submarines assigned to Bangor, Washington. This submarine is scheduled to undergo a two and a half year overhaul in Norfolk, Virginia and then be homeported to NSB Kings Bay, Georgia. The relocation is due, in part; to the 2005 Base Realignment and Closure (BRAC) process and also the Navy's desire to split the ballistic missile submarine fleet between the Pacific coast and the east coast.

6.3.1.7 Atlantic Ocean, Offshore of the Northeastern United States

Based on the discussion in Section 6.2.12.5, the need for inert bombing training in W-102 East by P-3s will cease after 2009 due to the 2005 BRAC decision to consolidate East Coast P-3 squadrons at NAS Jacksonville (DoN, 2008h).

6.3.2 Other Federal and State Agency Actions

6.3.2.1 Creation of South Atlantic Marine Protected Areas

MPAs are defined in Executive Order 13158 as "any area of the marine environment that has been reserved by federal, state, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein." The South Atlantic Fishery Management Council (SAFMC) further defines MPAs within its jurisdiction to include a network of specific areas of the marine environment reserved and managed for the primary purpose of aiding in the recovery of over fished stocks and ensuring the persistence of healthy fish stocks, fisheries, and habitats. SAFMC recently designated a series of eight MPAs located at least 38 nm off the Atlantic coast. The MPAs range in size from 5 nm^2 to 23 nm^2. The primary purpose of MPAs is to protect a portion of the population of deepwater snapper grouper species from direct fishing pressure, while minimizing adverse social and economic effects. Additional information can be obtained at:
http://www.safmc.net/MPAInformationPage/tabid/469/Default.aspx

6.3.2.2 Minerals Management Service Regulated Activities: Alternative Energy Development (Offshore Wind, Wave, and Ocean Current Energy Capture)

United States Department of the Interior, MMS, released a final programmatic EIS in support of the establishment of a program for authorizing AEAU activities on the OCS, as authorized by Section 388 of the Energy Policy Act, and codified in subsection 8(p) of the OCSLA. The final programmatic EIS examines the potential environmental effects of the program on the OCS and identifies policies and best management practices that may be adopted for the program.

Offshore wind farms are being used in a number of countries to harness the energy of the moving air over the oceans and converting it to electricity. At present, the only wind farms worldwide are located off the coasts of Europe in waters 30 m (98 ft) deep or less. These wind farms currently harness just over 600 megawatts (MW) of offshore wind energy. However, offshore wind projects proposed worldwide through 2010 would produce more than 11,000 MW. Of these proposed projects, wind farm energy production in the United States would amount to roughly 500 MW (MMS, 2007e). With the passage of the Energy Policy Act of 2005, MMS was given jurisdiction over offshore alternative energy projects, including wind farms (MMS, 2007d).

Construction and everyday operation of offshore wind farms has the potential to affect several environmental resources, especially biological resources. Potential effects might include bird collisions with rotors or towers, increases in underwater noise due to construction and operational vibrations, the creation of underwater electromagnetic fields, and sea floor alterations due to installation (MMS, 2007e).

6.3.2.3 MMS – Atlantic Ocean, Offshore of the Southeastern United States

There are currently no proposed wind farm activities in this area.

Ocean Renewable Power Company applied to the Federal Energy Regulatory Commission (FERC) for a preliminary permit for the SeaGen Ft. Lauderdale Project and SeaGen West Palm Beach Project on May 14, 2004. This permit was issued on March 16, 2005. Based on further research into this particular technology, it was determined that the SeaGen turbines were not ready for commercial deployment. As such, the OCGen™ technology was developed, which was determined to be more appropriate. A preliminary permit for the Ft. Lauderdale and West Palm Beach sites was filed on March 13, 2008 (Ocean Renewable Power Company, 2008a; 2008b). Both proposed projects would be located in the Gulf Stream Current and a cable would run to the shore. The proposed project coordinates for the Ft. Lauderdale proposed project site are as follows:

- 26º 05’ 53.18”N 79º 55’ 55.37”W
- 26º 04’ 08.56”N 79º 55’ 56.32”W
- 26º 05’ 51.41”N 79º 52’ 03.65”W
- 26º 04’ 06.8”N 79º 52’ 04.66”W

The proposed project coordinates for the Ft. Lauderdale proposed project site are as follows:

- 26° 47' 23.25" N 79° 51' 55.89" W
- 26° 45' 38.65" N 79° 51' 56.93" W
- 26° 47' 21.33" N 79° 48' 02.8" W
- 26° 45' 36.73" N 79° 48' 03.9" W

The overall surface area of the two proposed permits in the area of turbine deployment is approximately 21 km^2 (6 NM^2); however, both projects would be smaller in area (Ocean Renewable Power Company, 2008a; 2008b).

On November 3, 2008, in response to FERC’s Notice of Preliminary Permit Application Accepted for Filing and Soliciting Comments, Motions to Intervene, and Competing Applications for each project, it

was determined that FERC has no authority to permit or license ocean energy projects on the OCS; Since such permitting actions are regulated by the MMS, it was recommended that FERC deny issuance of preliminary permits (FERC, 2009). No further information regarding the issuance of these preliminary permits is available to date.

6.3.2.4 Proposed Marine Container Terminal at the Charleston Naval Complex

There are five marine terminals in the Charleston Harbor area that are owned and operated by the South Carolina State Ports Authority. North Charleston Terminal, Columbus Street Terminal, and Wando Welch Terminal are primarily container terminals and Union Pier and Veterans terminals are dedicated break-bulk facilities (South Carolina State Ports Authority [SCSPA], 2008). Combined, the terminals comprise over two million square feet of warehouse and storage space and can accommodate more than 17 vessels at a time (City of North Charleston, 2008). Channels leading to the terminals are deep and wide enough to handle 8,000 twenty-foot equivalent ships. All terminals are located within two hours of the open sea (SCSPA, 2008).

In 2004, the Port of Charleston handled approximately 1.725 million 20-foot equivalent units (USACE, 2004). The volume of containerized cargo is projected to increase 4.28 percent per year and will reach four million equivalent units by the year 2025 (SCSPA, 2008; USACE, 2007). To accommodate the increase in future demand for the number of containers that pass through the Port of Charleston each year, construction of a sixth terminal was permitted in 2007 (USACE, 2007). This port facility will be located on the Cooper River approximately (0.9 km^2) (0.3 mi^2) of land at the south end of the former Charleston Navy Base in North Charleston, South Carolina (USACE, 2007).

It is estimated that the baseline vessel traffic on the Cooper River will increase from 1,365 trips per year in 2004 to 3,219 trips per year in 2025 (USACE, 2006). This equates to an increase from 3.7 trips per day in 2004 to 8.8 trips per day in 2025, or just over five trips per day over a 21-year period. The proposed facility is estimated to be operational in 2012 (USACE, 2006).

6.3.2.5 Port Access Route Study

The Coast Guard is conducting a Port Access Route Study (PARS) on the area east and south of Cape Cod, Massachusetts, to include North Atlantic right whale critical habitat, mandatory ship reporting system area, and the Great South Channel including Georges Bank out to the exclusive economic zone (EEZ) boundary (Coast Guard, 2007). The purpose of the PARS is to analyze potential vessel routing measures that might help reduce ship strikes with the highly endangered North Atlantic right whale while minimizing any adverse effects on vessel operations. The recommendations of the study will inform the Coast Guard and may lead to appropriate international actions.

6.4 Discussion of Cumulative Impacts Relative to the Proposed Action

6.4.1 Assessing Proposed Action Impacts

Where feasible, the cumulative impacts were assessed using quantifiable data. However, in that quantifiable data was not always available; this analysis utilized qualitative information where necessary. For example, commercial shipping, commercial and recreational fishing (except for fishery management plans prepared pursuant to the Magnuson-Stevens Fishery Conservation and Management Act [MSA]), boating, and other activities occurring are not required to comply with the NEPA or analyze potential impacts; therefore, there is little to no analysis data available for these activities. Since a quantitative analysis of potential impacts for these areas is not possible; qualitative information, such as known marine species injuries or deaths was used as appropriate. In addition, since an analysis of potential environmental impacts for future actions (identified in Section 6.3) has not been completed, assumptions based on past actions were used.

Cumulative impacts resulting from sonar training were assessed using the conclusions from the Atlantic Fleet Active Sonar Training (AFAST) EIS/OEIS. Potential impacts to resources are identified in the following sections.

All past, present, and reasonably foreseeable future military activities described in this chapter are grouped together under Military Operations. It should be noted that the individual military actions tend to impact different resources, and when grouped together should not be interpreted to mean that each military activity would impact all resources.

6.4.2 Bathymetry and Sediments

In the marine environment, bathymetry is the water depth and ocean bottom topography. This section also reviewed impacts to marine sediments (sand, organic matter, and minerals that accumulate at the bottom of a body of water). At Rodman Range, this section analyzed impacts to the earth's surface and soils; at Lake George it analyzed the impacts to the Lake bottom and the sand, organic matter, and minerals that accumulate at the bottom of the lake.

6.4.2.1 JAX EIS/OEIS Conclusions

Most at-sea training exercises would have no potential to affect ocean bottom topography. Some training activities could increase local turbidity or create shallow depressions in bottom sediments; these are temporary effects that would disappear over time under the influence of natural ocean circulation and sediment transport.

An update to the 1996 Environmental Assessment (EA) for the Canadian Forces Maritime Experimental and Test Ranges (CFMETR) near Nanoose, British Columbia, was completed in 2005 by Environmental Sciences Group, Royal Military College of Canada (ESG). That document analyzed chemical impacts associated with expendable components from activities involving sonobuoys, torpedoes, EMATTs, and ADCs (ESG, 2005). Specifically, the analysis focused on lead, copper, lithium, and Otto fuel. The document stated that metal contaminants were most likely to concentrate in fine-grained particulate matter, especially when smaller than 63 μm. The findings of the EA demonstrated that CFMETR operations did not cause a measurable effect on sediment quality (ESG, 2005). Therefore, based on the conclusions of this EA and because training activities in the OPAREAs involve activities similar in nature to those analyzed in the EA, it is anticipated that metal contaminants from expended materials during training operations have the potential for a minor, but recoverable impact to sediments from military expended materials.

In the at sea portion of the JAX Study Area, the analysis of environmental stressors indicated that implementation of the Alternatives would not result in unavoidable significant adverse effects to bathymetry and sediments; no significant impact to bathymetry and sediments in U.S. territorial waters; likewise, no significant harm in non-territorial waters.

Training activities at Rodman Range result in minor soil disturbance. Range maintenance and is performed annually for the 1,000-foot diameter around the center of the target and every 5 years for the 3,000-foot diameter, which reduces the accumulation of military expended materials. At Rodman Range, the analysis of environmental stressors indicated that implementation of the Alternatives would not result in unavoidable significant adverse effects to geology and soils; no significant impact to geology and soils in U.S. territory.

Training activities at Lake George would have no potential to affect lake bottom topography. Some training activities could increase local turbidity or create shallow depressions in bottom sediments; these are temporary effects that would disappear over time under the influence of natural water circulation and sediment transport. Water sampling conducted by the St. Johns Water Management District over the last

16 years, during the time the Navy has been training at the Lake George Range, indicates that total suspended solids are typical while turbidity is lower than typically found in other Class 3 surface waters (Section 3.1.4.1). At Lake George, the analysis of environmental stressors indicated that implementation of the Alternatives would not result in unavoidable significant adverse effects to bathymetry and sediments; no significant impact to bathymetry and sediments in U.S. territorial waters; likewise, no significant harm in non-territorial waters.

6.4.2.2 JAX EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

A wide variety of debris is commonly observed off the Atlantic coast of the United States. Marine debris comes from a variety of land-based and ocean sources (Laist *et al.*, 1999). In addition to trash that finds its way into the marine environment, discarded or lost fishing gear is also an issue of concern for accumulating item on the ocean floor. Civilian and commercial recreational activities (e.g., recreational/commercial fishing, and cruise ship operations) contribute to these potential impacts to bathymetry and sediments in the OPAREAs by adding foreign materials to the environment that eventually accumulate on the ocean bottom. These foreign materials may not have even entered the environment in the OPAREAs since ocean currents have the ability to move materials for great distances.

In the marine environment, the analysis of all current and proposed operations indicates any expending of military materials at sea, over a long period of time, can cause potential incremental impacts to sediment quality. However, the at-sea JAX Study Area is vast and chemical releases from decaying debris would rapidly dilute in the water; thus, accumulation of chemicals in sediments is not likely to occur. Therefore, it is expected that although there would be a potential for minor incremental, but recoverable, adverse cumulative impacts, these impacts would not be considered significant as they would be localized and temporary.

The accumulation of materials settling on the ocean bottom would be covered by sediment deposition over time. With regard to the direct, indirect, and cumulative impacts of the proposed action, impacts are expected to be temporary in the marine environment. Most of the materials would be harmless, but some would consist of metals such as lead. However none of the materials accumulating at these densities would measurably affect sediment quality. Thus, the concentration of training military expended materials in U.S. territory would have no significant impact on bottom topography and sediment quality.

In the marine environment, although the analysis of alternatives indicated no significant impacts in U.S. territorial waters and no significant harm in non-territorial waters would be expected, there would be a potential for minor incremental, but recoverable, adverse cumulative impacts when these impacts are considered with other projects in the area. However, these impacts would not be considered significant as they would be localized and temporary.

Other projects or actions likely to impact Rodman Range or Lake George would be upstream from the Ocklawaha or St. Johns Rivers and would likely be stormwater or agricultural runoff. The analysis of alternatives indicated no significant impacts in U.S. territorial waters and no significant harm in non-territorial waters would be expected for Lake George and Rodman Ranges. There is the potential for minor incremental, but recoverable, adverse cumulative impacts when Navy training activities are considered in concert with runoff, however, these impacts would not be considered significant as they would be localized and temporary.

6.4.3 Hazardous Materials/Hazardous Waste

This section covered hazardous materials which include petroleum products, missiles, munitions, and targets. However, military munitions (virtually all missiles, munitions, and targets) are not considered hazardous waste when used for their intended purpose, which includes training of military personnel and

research and development activities. This includes virtually all missiles, munitions, and targets used at the JAX Study Area.

Non-hazardous expended material were also discussed under this resource area and are defined as parts of a device that are made of non-reactive materials, including parts made of steel or aluminum, polymers (*e.g.,* nylon, rubber, vinyl, and various other plastics), glass fiber, and concrete. While these items represent accumulate on the seafloor, their strong resistance to degradation and their chemical composition mean that they do not chemically contaminate the surrounding environment by leaching heavy metals or organic compounds.

Military expended materials (MEM) are all the materials that the Navy uses in training and testing that are not recovered at or before the end of an event. These materials include non-explosive practice munitions, remains of high explosives, training targets, chaff, remains of flares, and other material sometimes referred to as debris.

Hazardous material, waste, and MEM used and generated during the JAX Study Area operations would be managed in accordance with applicable federal and state regulations, and DoD service guidelines. Any spills or mishaps would be handled pursuant to all applicable federal and state laws, and DoD regulations.

6.4.3.1 JAX EIS/OEIS Conclusions

In the marine environment, MEM that sinks to the sea floor would gradually degrade, be overgrown by marine life, and/or be incorporated into the sediments. Military munitions are not considered hazardous waste when used for their intended purpose, which includes training of military personnel and research and development activities. Floating non-hazardous expended material may be lost from target boats and would either degrade over time or wash ashore as flotsam. The combustion products from the detonation of high explosives are commonly found in sea water. Initial concentrations of explosion by-products are not expected to be hazardous to marine life and would not accumulate in the area training because exercises are spread out over time and the chemicals would rapidly disperse in the ocean. The analysis of environmental stressors indicated that implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in unavoidable significant adverse environmental effects from military expended material and no significant harm in non-territorial waters would be expected.

At Rodman Range, only non-explosive practice munitions are used. Military munitions are not considered hazardous waste when used for their intended purpose, which includes training of military personnel and research and development activities. The analysis of environmental stressors indicated that implementation of the Alternatives would not result in unavoidable significant adverse environmental effects from military expended material and no significant harm in non-territorial waters would be expected.

At Lake George, only non-explosive practice munitions are used as well. It is expected that there will be long-term, minor, and localized accumulation of MEM on the lake bottom but because of the nature of the munitions, the implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in unavoidable significant adverse environmental effects from military expended materials and no significant harm to non-territorial waters would be expected.

6.4.3.2 JAX EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

Military expended materials would introduce small amounts of potentially hazardous chemicals into the marine environment. The water quality analysis of all current and proposed operations indicates that concentrations of constituents of concern associated with material expended in the JAX Range Complex are well below water quality criteria established to protect aquatic life (see Section 3.3, Water Resources).

The combustion products from the detonation of high explosives are commonly found in sea water. Initial concentrations of explosion by-products are not expected to be hazardous to marine life (DoN, 2001b) and would not accumulate in the training area because exercises are spread out over time and the chemicals would rapidly disperse in the ocean. Therefore, no adverse impacts from chemical by-products would be expected.

In the marine environment, other federal and state actions such as oil and gas leases, dredging operations for channel maintenance, and other Department of Defense activities have the potential for fuel spills and/or spills of other contaminants that may introduce hazardous materials or hazardous waste into the environment. Commercial and recreational activities like fishing, cruise ships, whale watching industries also have the capacity to impact water resources with fuel spills and leaving foreign materials at sea (trash and lost fishing gear accumulating on ocean the ocean floor). It is expected that although there would be a potential for minor incremental, but recoverable, adverse cumulative impacts by Navy actions, these impacts would not be considered significant as they would be localized, temporary, and quickly dispersed. Analysis of alternatives indicated no significant impacts in U.S. territorial waters and no significant harm in non-territorial waters would be expected, as such, any incremental contribution and cumulative impact of Navy training to stressors from other activities would be nominal and recoverable.

At Rodman Range and Lake George, other projects and actions impacting the Ocklawaha and St. Johns Rivers include upstream activities like stormwater and agricultural runoff. Because analysis of alternatives at Rodman Range and Lake George indicated no significant impacts in U.S. territorial waters and no significant harm in non-territorial waters would be expected, any incremental contribution and cumulative impact of Navy training to stressors from other activities would be nominal and recoverable.

6.4.4 Water Resources

Water resources were assessed for the JAX Study Area, adjacent waters and land associated with Rodman Range, and waters and adjacent shoreline associated with Lake George. Water quality in the marine environment is affected by Gulf Stream currents, temperature and salinity, sediment transport and deposition, and water and air pollutants from inland streams and emission sources. Rodman Range has approximately 1,886 acres of jurisdictional wetlands informally accepted by USACE and the St. Johns River Water Management District (Figure 3.3-5) which remain in relatively natural condition (DoN, 2002). Rodman Range is immediately adjacent to the Ocklawaha River, which is the principal tributary to the St. Johns River (DoN, 2002). Water quality for Lake George is determined by the waters of the St. Johns River. Several characteristics of the St. Johns River limit its assimilation capabilities, thereby contributing to its high pollution rates like its relatively flat drainage basin, the high number of associated draining water bodies, and the excessively slow flow rate of the river.

6.4.4.1 JAX EIS/OEIS Conclusions

In the marine environment, training activities would introduce expended materials and potential water pollutants to the water column of the at-sea portion of the JAX Study Area; however, these pollutants would be released in quantities and at rates that would not result in a violation of any water quality standard or criteria. Marine biota would not be substantially affected. The combustion products from detonation of high explosives are not expected to accumulate in the training area because exercises are spread out over time and the constituents would rapidly disperse in the ocean. Therefore, no adverse effects from chemical by-products would be expected.

The analysis of environmental stressors indicated that implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in releases of hazardous constituents in violation of state or federal water quality standards in the marine environment; therefore, unavoidable significant adverse effects to marine water resources would not occur. The analysis of environmental stressors and

alternatives indicated no significant impact to water resources in U.S. territorial waters; likewise, no significant harm in non-territorial waters would be expected.

At Rodman Range, impacts to water resources (wetlands) at Rodman Range would be attributable to training and testing ordnance resulting from small caliber gunfire and non-explosive practice munitions. Any changes in water quality would be negligible based on the number of rounds, dispersed nature of the expended rounds, slow breakdown rates, and dilution capacity of the surrounding water within the wetlands. Therefore, indirect effects resulting from changes in water quality would not occur. The analysis of environmental stressors and alternatives indicated no significant impact to water resources in U.S. territorial waters; likewise, no significant harm in non-territorial waters would be expected.

At Lake George, non-explosive practice munitions entering the water lack combustion chemicals so chemical effects to water quality are considered to be negligible. The flares expended are non-hazardous, consisting of magnesium oxide, sodium carbonate, carbon dioxide, and water. The amounts of debris are negligible, and the chemical constituents do not substantially affect water quality resources. Although these operations would occur in Lake George, which lies within Florida state territorial waters, none of the concentrations of explosive charge releases would exceed state or federal water quality standards and thus no significant impact upon water quality is anticipated. Therefore, indirect effects resulting from changes in water quality would not occur. The analysis of environmental stressors and alternatives indicated no significant impact to water resources in U.S. territorial waters; likewise, no significant harm in non-territorial waters would be expected.

6.4.4.2 JAX EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

In the marine environment, materials expended during training exercises would result in short-term, minor, and localized impacts that are unlikely to result either in any adverse environmental impacts to the sea floor or marine water resources. Over a period of years, these materials would degrade, corrode, and become incorporated into the sediments. The analysis of current and proposed operations indicates that concentrations of constituents of concern associated with material expended in the marine portion of the JAX Study Area are well below water quality criteria established to protect aquatic life. Discarded training materials would be deposited in offshore areas, become buried in the sea floor sediments, and would have no substantial effects to water quality. The overall volume of expended training items would increase in Alternatives 1 and the Preferred Alternative (Alternative 2) in correlation to changes in operations.

In the marine environment, other federal and state actions such as oil and gas leases, dredging operations for channel maintenance, other Department of Defense activities, as well as their associated vessel traffic, increases the potential for fuel spills and other contaminants that may contribute to potential impacts to water resources.

Commercial activities like fishing and cruise ships also have the capacity to impact water resources with fuel spills and depositing foreign materials at sea (trash and lost fishing gear). It is expected that although there would be a potential for minor incremental, but recoverable, adverse cumulative impacts by Navy actions at sea, these impacts would not be considered significant as they would be localized, temporary, and quickly dispersed. The analysis of environmental stressors and alternatives indicated no significant impacts to water resources in U.S. territorial waters or significant harm in non-territorial waters would be expected. As such, any incremental contribution of Navy training to existing stressors would be nominal.

At Rodman Range and Lake George, other actions upstream impacting the Ocklawaha and St. Johns Rivers can have cumulative impacts on water quality; however, the rivers currently have good and fair water quality respectively (3.3.2.4). Because the analysis of environmental stressors at Rodman Range

and Lake George for the Alternatives indicated no significant impact to water resources in U.S. territorial waters and no significant harm in non-territorial waters, any incremental contribution of Navy training to the existing water stressors in the region would be nominal.

6.4.5 Air Quality

The air quality of the JAX Study Area is considered very good and is reflective of the pollutant concentrations, size and topography, and prevailing meteorological conditions. The cities/counties in North Carolina, South Carolina, Georgia, and Florida adjoining the range complex are currently designated as in attainment by the USEPA for all criteria pollutants. Included within this characterization of regional air quality are the existing Navy aircraft, surface ship, target, and weapon emissions.

6.4.5.1 JAX EIS/OEIS Conclusions

Emissions associated with implementation of Alternatives 1 and 2 would result in minor increases in air emissions above baseline (No Action Alternative) conditions. Within U.S. territory, emissions are mainly associated with increased MH-60R operations, small boat, and range support craft motor emissions. Outside U.S. territory, emission increases are mainly associated with surface vessel operations, with additional contributions from aircraft operations. In conclusion, although Alternatives 1 and 2 would result in increases in emissions of air pollutants, all air impacts would be less than significant in scope and intensity for the following reasons:

- All training and testing events analyzed in this JAX EIS/OEIS occur within areas designated by the USEPA as being in attainment for all criteria pollutants. Therefore, the General Conformity Rule does not apply.
- The majority of training event types and the majority of training event operations/sorties occur more than 12 nm from the shore and would not affect air quality for human receptors. Furthermore, the majority of aircraft training emissions occur above 3,000 feet (above the atmospheric inversion layer), and would have no impact on local air quality.
- MH-60R emissions associated with the Homebasing of the aircraft at NS Mayport were evaluated in an EA (DoN, 2002b) and determined to be below *de minimis* levels.
- Increases in helicopter emissions would occur mostly in connection with major training events and therefore would be infrequent, temporary and dispersed in nature.

Implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in significant adverse impacts to regional air quality. Implementation of the No Action Alternative, Alternative 1 or Alternative 2 would not result in significant harm to the air quality of the global commons.

6.4.5.2 JAX EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

Past, present, and planned projects in the JAX Range Complex include various construction projects occurring onshore. Periodically, sand replenishment projects approved by the Minerals Management Service and USACE occur along the beaches of the JAX Range Complex. Offshore barges involved in the projects produce minor emissions, as do onshore sand-moving bulldozers. Examples of recent sand replenishment projects within the vicinity of the JAX Range Complex include: North Myrtle Beach, SC - 703,000 cubic yards of sand in 2007; Myrtle Beach, SC – 1,442,500 cubic yards of sand in 2007; and Surfside Beach, SC – 778,600 cubic yards of sand in 2007. Construction activities or sand replenishment projects would be temporary and would not, in combination with air emissions associated with the JAX Range Complex operations, be anticipated to cause a significant cumulative impact.

Dredging projects are conducted from time to time for maintenance purposes within the harbors and navigable waterways adjacent to the JAX Range Complex. Dredging project involve dredging vessels and equipment which produce emissions. The U.S. Army Corps of Engineers prepares NEPA documentation for these projects as they are proposed. For example, an EIS was prepared for the proposed dredging of Jacksonville Harbor in 1998. The EIS noted that Duval County, FL was designated as an attainment area for Federal air quality standards under the Clean Air Act. Because the project was located within an attainment area, EPA's General Conformity Rule to implement Section 176 (c) of the Clean Air Act does not apply and a conformity statement is not required. Another project is the Savannah Harbor Deep Draft Navigation Project located in Savannah, Georgia. The United States Congress conditionally authorized deepening the channel to a maximum of 48 feet contingent upon the completion of a General Reevaluation Report and Tier II Environmental Impact Statement (EIS), a final mitigation plan, and an incremental analysis of the channel depths from 42 to 48 feet. The Record of Decision is expected in 2009. Dredging projects are temporary and would not, in combination with air emissions associated with the JAX Range Complex operations, be anticipated to cause a significant cumulative impact to air quality.

Past, present, and planned projects also include short-term testing of weapons systems which would also be temporary. Additional past, present, and planned projects include training exercises based at onshore military installations. Air emissions within the JAX Study Area also emanate from aircraft and rockets launched from Cape Canaveral, FL; U.S. Air Force aircraft; and Marine Corps Air Station Beaufort aircraft training within offshore SUA and overland Military Operating Areas. These testing and training activities are required to demonstrate conformity with applicable SIP (unless conducted within an attainment area), which would involve a demonstration that the emissions would not result in a cumulatively significant impact for nonattainment pollutants. Offshore oil and gas industry will also contribute to the overall air emissions in the area.

Unlike other parts of the country, there are no Liquefied Natural Gas (LNG) terminals proposed for areas offshore North Carolina, South Carolina, Georgia, or Florida. One onshore project is under construction by Southern LNG, Inc., at the Elba Island Terminal, Savannah, Georgia. Air quality monitoring estimates were submitted for the project. This project and other future terminals require air permits to operate and would, therefore, be required demonstrate that they would not cause or contribute to a violation of an air quality standard. Construction of these structures would produce temporary emissions. However, upon operation, the structures would generate clean electric power in comparison with coal-burning power generation.

No significant cumulative impacts to air quality would occur to regional air quality as a result of training activities from the No Action Alternative, Alternative 1, or Alternative 2.

6.4.6 Airborne Noise

Increases in operational activity in the JAX Study Area will increase airborne noise levels. However, because Navy training takes place in remote and cleared areas, airborne noise levels will primarily affect military personnel operating the equipment/weapon systems producing the noise. Military personnel wear personal protective equipment and are not considered sensitive receptors as such term is used in this EIS/OEIS analysis. Underwater noise impacts to aquatic life are addressed in Sections 3.6 (Marine Communities), 3.7 (Marine Mammals), 3.8 (Sea Turtles), 3.9 (Fish), and 3.10 (Seabirds and Migratory Birds).

6.4.6.1 JAX EIS/OEIS Conclusions

Airborne noise levels generated by the proposed action under the No Action Alternative and Alternative 1 and 2 would be less than significant in U.S. territory and would not cause harm in the global commons because:

- Noise from training activities in the OPAREAs would be dispersed and intermittent, which would not contribute substantially to long-term noise levels, and few or no sensitive receptors (non-participants) would be exposed to these noise events;
- Training areas at the Lake George Range and Rodman Range are remote, and isolated from the general public;
- Noise would be generated in training areas that have been in similar use for more than 50 years - no new public areas would be exposed to noise from training and testing activities.
- No high explosives are used at the Lake George Range or Rodman Range;
- The incremental increases in the numbers of range events would not substantially increase long term average noise levels; hourly average equivalent noise levels are and would remain relatively low; and
- Increased helicopter operations at NS Mayport were evaluated in the MH-60R/S Siting Study Environmental Assessment and the associated noise was determined to be less than significant (DoN, 2002b).
- At the Rodman Range and Lake George Range, noise levels under both Alternatives 1 and 2 are expected to remain nearly constant with baseline levels.

There are not expected to be any unavoidable significant environmental effects associated with proposed action-generated noise.

6.4.6.2 JAX EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

Airborne noise impacts may be cumulative in the sense that the average ambient noise of an area could increase from several independent actions and the increased number of noise events of a particular kind (*e.g.*, an explosion) from unrelated actions could result in an increased sensitivity of human receptors and therefore an increase in the number of complaints. Commercial and recreational fishing and vessels, commercial shipping vessels, vessels associated with dredging operations contribute to the total anthropogenic airborne noise environment in the JAX Study Area. Aircraft, rockets, and other test vehicles from the NASA Kennedy Space Center, Cape Canaveral Air Station, Charleston Air Force Base and Marine Corps Air Station Beaufort also contribute to the overall regional noise environment. Commercial aircraft departing and arriving at airports adjacent to the JAX Study Area can also contribute to the overall JAX Study Area airborne noise levels. Noise generated from the offshore oil and gas industry will also contribute to the overall noise levels.

However, as stated previously, due to the vast size of the JAX Study Area and the flight altitudes at which many of the Navy training and testing operations take place, the average ambient airborne noise contributed by these current and proposed Navy events are negligible. Furthermore, the analysis of all current and proposed operations indicates Alternatives 1 and 2 would produce noise similar to ongoing activities within the JAX Range Complex plus noise that is unique, particularly along some land-water interfaces.

Current Standard Operating Procedures for the proposed action involving aircraft noise and live bombs would minimize potential direct and indirect impacts so there would be no adverse impacts. No significant cumulative impacts to airborne noise quality U.S. territory or the global commons would occur as a result of training activities from the No Action Alternative, Alternative 1, or Alternative 2.

6.4.7 Marine Communities

This section of the EIS/OEIS addresses plankton and macroalgae, benthic communities, and artificial habitats within the JAX Study Area. Plankton include phytoplankton (plant-like/algae), zooplankton (animals), ichthyoplankton (fish eggs and larvae, a form of zooplankton), and bacterioplankton (bacteria). Benthic communities analyzed include live/hard bottom communities, corals and coral reefs, and soft bottom communities. Most of the JAX Study Area is covered by soft bottom sediments and mostly vacant of benthic organisms.

6.4.7.1 JAX EIS/OEIS Conclusions

The analysis of environmental stressors indicated that implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in unavoidable significant adverse effects to marine communities. The analysis of environmental stressors and alternatives indicated no significant impact to marine communities in U.S. territorial waters; likewise, no significant harm in non-territorial waters would be expected.

6.4.7.2 JAX EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

Past, present, planned, and reasonably foreseeable actions within the JAX Study Area includes Navy activities, navigation, transportation, coastal development, oil/gas exploration and development, sand and mineral mining, dredging and fill operations, beach nourishment, cooling water intake and discharge, wastewater discharge, mariculture, recreational and commercial fishing, and whale and bird watching. Potential threats to marine communities include ship and boat traffic, degradation of water quality, habitat modification, pollution (chemicals, marine debris, *etc*.), introduction of exotic species, disease, natural events, and global climate change (SAFMC, 2007; Field *et al.*, 2001).

In the marine environment, although the analysis of alternatives indicated no significant impacts in U.S. territorial waters and no significant harm in non-territorial waters would be expected to marine communities, there would be a potential for minor incremental, but recoverable, cumulative impacts when these impacts are considered with other projects and actions in the area. However, because Navy training activities would be relatively isolated due to the large expanses of area between activity locations, these impacts would not be considered significant because they are localized and temporary.

6.4.8 Marine Mammals

Marine mammal species that have confirmed or potential occurrence in the JAX Study Area include six whale species and one sirenian (West Indian manatee, *Trichechus manatus*) identified as federally endangered and as well as 28 non-listed marine mammal species. Marine mammals are found throughout the OPAREAs, with large numbers of sightings occurring on the continental shelf, particularly along the coast, and near the continental shelf break (also see section 6.4.11 for a discussion of the manatee in Lake George).

Endangered Species Act

The Navy has consulted with NMFS and USFWS regarding its determination of effect for federally listed marine mammals and critical habitat in U.S. territorial waters and in non-territorial waters. Table 3.7-21 provides a summary of the Navy's determination of effect for federally listed marine mammals that potentially occur in the JAX Study Area (also see section 6.4.11 for a discussion of the West Indian manatee in Lake George). The proposed actions may alter North Atlantic right whale critical habitat, but is not likely to destroy or adversely modify critical habitat

Marine Mammal Protection Act

The Navy has consulted with NMFS through the MMPA permitting process to ensure compliance with the MMPA in U.S. territorial waters and in non-territorial waters. The Navy submitted Request for a Letter of Authorization to NMFS on 17 March 2008.

6.4.8.1 JAX EIS/OEIS Conclusions

The analysis of potential effects on marine mammals included modeling of explosions, acoustic effects analysis, disturbance analysis associated with vessel movements, analysis of vessel strikes on marine mammals, analysis of disturbance associated with aircraft overflights, and analyses of other training activities conducted in the JAX EIS/OEIS Study Area. The AFAST EIS/OEIS also analyzed the effects to marine mammals due to exposure to small explosives during deployment of the AN/SSQ-110A IEER sonobuoy. The AFAST EIS/OEIS used the same small explosives criteria (for single explosions) presented in Section 3.7.3.1 of this EIS/OEIS.

To estimate the number of exposures of marine mammals to sound that would result in regulatory levels of harassment, sonar activities were acoustically modeled for the JAX Study Area. By analyzing both the acoustic propagation of each source and the estimates of marine mammal presence, annual marine mammal exposures were calculated (Table 6.4-1). When interpreting the modeling results, it is important to recognize the limitations of the model. The model does not reflect implementation of protective measures (such as reducing power levels or ceasing sonar use in the presence of marine mammals) and it assumes the acoustic footprint extends to the seafloor regardless of the operating environment (in reality the zone of influence for physiological effects is shaped like a bubble in deeper waters). Sonar power reduction would reduce the likelihood of hearing impairment due to close aboard exposure, but some animals could be missed or could surface within the safety zone. Others could receive multiple pings that cause TTS due to added energy of multiple exposures over a short time period.

In addition, the exposure estimates rely on the best available information from marine mammal surveys. Marine species density models rely on limited survey data, and for some species data are insufficient to estimate densities (blue whale, white-beaked dolphin, hooded seal, and harp seal throughout the AFAST Study Area; harbor porpoise, gray seal, harbor seal, sei whale in the JAX OPAREA).

Due to the above reasons, quantitative exposure estimates should be used in conjunction with a qualitative analysis to assess potential impacts. Potential acoustic effects to individual marine mammal species, including those for which density data are not available to quantify potential exposures, are discussed in sections 4.4.10.3 (ESA-listed species) and 4.4.10.4 (non-ESA-listed species) of the AFAST FEIS/OEIS. Most exposures would cause short-term recoverable behavioral effects, and protective measures, such as sonar power reduction and shutdown as an animal approaches a vessel, would reduce the likelihood of physiological effects.

The quantified physiological and behavioral effects above account solely for exposures to levels of sound associated with the effects thresholds discussed previously. Other potential acoustic effects are also discussed in the AFAST FEIS/OEIS. Currently, evidence of acoustically mediated bubble growth and decompression sickness is limited and inconclusive; therefore, these phenomena are discussed but not considered as potential effects. Investigations of air cavity resonance predict it would occur at frequencies lower than those analyzed in the AFAST FEIS/OEIS. The potential for masking, in which sounds interfere with an animal's ability to hear other sounds, exists; however, due to the intermittent use and narrow-frequency band of sonars, masking effects are considered negligible. The reader should refer to Section 4.4.10.2.4 of the AFAST FEIS/OEIS for a discussion of what is known about the possibility of these phenomena.

TABLE 6.4-1
ESTIMATED ANNUAL TAKES OF MARINE MAMMALS UNDER THE AFAST SELECTED ALTERNATIVE

Species	Mortality	PTS	TTS	Risk-Function (Behavioral)
Atlantic spotted dolphin	0	11	2176	202708
Atlantic white-sided dolphin				
Bottlenose dolphin	0	35	4722	461586
Clymene dolphin	0	2	277	26064
Common dolphin	0	0	0	0
False killer whale				
Fraser's dolphin				
Killer whale				
Kogia spp.	0	0	26	2476
Melon-headed whale				
Pantropical spotted dolphin	0	5	580	54555
Pilot whales* **	0	7	796	77082
Pygmy killer whale				
Risso's dolphin	0	5	585	57169
Rough-toothed dolphin	0	0	13	1177
Short-finned pilot whale** **				
Sperm whale**	0	0*	17	1517
Spinner dolphin				
Striped dolphin	0	0	0	0
White beaked dolphin				
Beaked whale	0	0	19	1731
Harbor porpoise				
Bryde's whale				
Fin whale**	0	0	0	0
Humpback whale**	0	0*	19	2371
Minke whale	0	0	1	129
North Atlantic right whale**	0	0	3	363
Sei whale**				
Gray Seal				
Harbor Seal				

* Indicates an exposure greater than or equal to 0.05, therefore, is considered a "may affect" for ESA-listed species.
** Denotes species listed in accordance with the Endangered Species Act
*** Pilot whales include both short- and long-finned pilot whales along the East Coast

The analysis of environmental stressors indicated that implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in significant impacts to marine mammals in U.S. territorial waters; likewise no significant harm in non-territorial waters would be expected. The proposed action may affect listed species, but it is not anticipated to displace animals. When the potential impacts due to sonar activities are included with the potential impacts due to range complex activities for the No Action Alternative, Alternative 1, or Alternative 2, there would be no significant impact to marine mammals in territorial waters. In addition, there will be no significant harm to marine mammals in non-territorial waters for the No Action Alternative, Alternative 1, or Alternative 2.

6.4.8.2 JAX EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

The combination of potential impacts resulting from the proposed action in addition to prior and future Navy activities, oil/gas exploration and development activities, dredge-and-fill operations, water quality degradation, pollution (chemicals, marine debris, noise), recreational and commercial fishing, vessel traffic, as well as whale-watching, may affect the blue, fin, humpback, North Atlantic right, sei and sperm whales found in the JAX Study Area. Activities considered have the potential to harm marine mammals and their habitats. Chronic sublethal impacts (*e.g.*, stress) resulting in persistent physiological or behavioral changes and/or avoidance of impacted areas could cause declines in survival or productivity, resulting in either acute or gradual population declines (*e.g.*, Fair and Becker, 2000).

The major impact-producing factors of oil/gas exploration and development activities include degradation of water quality resulting from operational discharges; noise from helicopter and vessel traffic, operating platforms, and drillships; explosive platform removals; seismic surveys; oil spills; oil spill response activities; and discarded debris (reviewed by MMS, 2007).

A wide variety of debris is commonly observed off the Atlantic coast of the United States. Marine debris comes from a variety of land-based and ocean sources (Laist *et al*., 1999). Both entanglement in and ingestion of debris has caused the death or serious injury of large whales (Laist, 1997; Laist *et al*., 1999). Because of their buoyancy and persistence, plastic items contribute disproportionately to the overall impacts of marine debris (Laist *et al.*, 1999). In addition to trash that finds its way into the marine environment, discarded or lost fishing gear is also a concern for marine mammals (Laist, 1997; Spellman, 1999).

The fishing industry has a profound effect on marine mammals. Commercial fisheries may accidentally entangle and drown or injure cetaceans during fishing operations by lost and discarded fishing gear, or compete with cetaceans for the same fishery resources (Northridge and Hofman, 1999). Entanglement in fishing gear accounts for a significant portion of baleen whale mortality in U.S. waters (NMFS, 2007a). Changes to NMFS Atlantic Large Whale Take Reduction Plan could have a positive impact by reducing the marine mammal and commercial fishing gear interactions.

Entanglement in fixed fishing gear, in particular in sink gillnets and a variety of pot and trap fisheries, is one of the most important factors depressing the growth rate of the North Atlantic right whale population (Katona and Kraus, 1999; Kenney, 2002; Johnson *et al.,* 2007). Humpback whales, perhaps because of their abundance in coastal waters where nets are commonly used or because of the many barnacles they carry, seem to be extremely vulnerable to entanglement in fishing gear (Lien, 2002). Trites *et al*. (1997) suggested that fisheries might indirectly compete with cetaceans by reducing the amount of primary production accessible to cetaceans, thereby negatively affecting their numbers.

Insufficient information is available to determine how, or at what levels and in what combinations, environmental contaminants may affect cetaceans (MMS, 2002; 2003). There is growing evidence that high contaminant burdens are associated with several physiological abnormalities, including skeletal deformations, developmental impacts, reproductive and immunological disorders, and hormonal alterations (Reijnders and Aguilar, 2002). It is possible that anthropogenic chemical contaminants initially cause immunosuppression, rendering whales susceptible to opportunistic bacterial, viral, and parasitic infection (De Swart *et al*., 1995).

Several mortality events (die-offs) have been reported for cetaceans in the western North Atlantic. Biotoxins, viruses, bacteria, or El Niño events have been implicated (Geraci *et al.*, 1989; Domingo *et al.,* 2002; MMS, 2004; Hohn *et al*., 2006).

Habitat loss and degradation is now acknowledged to be a significant threat to marine mammal populations (Kemp, 1996). The impact of coastal development on whales has not been thoroughly investigated. Habitat alteration has the potential to disrupt the social behavior, food supply, and health of whales. Such activities may stress the animals and cause them to avoid traditional feeding and breeding areas or migratory routes. The most serious threat to cetacean populations from habitat destruction may ultimately prove to be its impact on the lower trophic levels in their food chains (Kemp, 1996).

Migrating baleen whales may be affected by whale-watching activities on the East Coast, as well as in the Caribbean (Katona and Kraus, 1999; Hoyt and Hvenegaard, 2002). Impacts of whale watching on cetaceans may be measured in a short time-scale (*i.e.*, startle reaction) or as a long-term effect on reproduction or survivability (IFAW, 1995). There is little evidence to show that short-term impacts have any relation to possible long-term impacts on cetacean individuals, groups, or populations (IFAW, 1995). Whale watching could have an effect on whales by distracting them, displacing them from rich food patches, or be dispersing food patches with wake or propeller wash (Katona and Kraus, 1999).

Climatic fluctuations have produced a growing concern about the impacts of climate change on marine mammal populations (Learmonth *et al.*, 2006). Responses of marine mammals to climate change are difficult to interpret due to the confounding impacts of natural responses and human influences. Large-scale climatic events may affect the distribution and abundance of marine mammal species, either directly or indirectly, through alterations of habitat characteristics and distribution (Harwood, 2001; Forcada *et al*., 2005; Keiper *et al.*, 2005; MacLeod *et al*., 2005; Shelden *et al*., 2005; Simmonds and Isaac, 2007).

It is possible that harassment in any form may cause a stress response (Fair and Becker, 2000). Cetaceans can exhibit similar stress symptoms as found in terrestrial mammals (Curry, 1999). It is important to recognize that disturbance from ship traffic, ships, aircraft, and drilling rigs and/or exposure to sub lethal levels of biotoxins and anthropogenic contaminants may stress animals, weakening their immune systems, making them more vulnerable to parasites and diseases. Chronic stress may cause damage to the heart muscle and vasculature (Curry, 1999). Stressed animals may also fail to reproduce at normal rates or have been found with significantly high fetotoxicity and malformations in the young, as evidenced in some small laboratory mammals. Marine mammals may stay in an area despite disturbance (such as noise) if no alternative areas meet the requirements of the animals. Wind energy projects proposed for development in the North Atlantic Ocean could impact marine mammals. Mitigation measures would be implemented for these alternative energy development projects (MMS, 2007).

Ocean acidification may occur from an increase of CO_2 dissolved in ocean water that creates carbonic acid. The CO_2 emissions are the result of human activity and have resulted in the ocean pH dropping from 8.16 to 8.05 since the late 1980s (SD, 2009). Ocean acidification potentially could result in the ability of sound in the water to travel greater distances, thereby increasing the amount of energy to which marine mammals and sea turtles may be exposed. The Navy's quantitative analysis of acoustic sources affecting marine mammals and sea turtles is based on the best available science; *e,g*, for sonar, modeling involved analysis in areas based on potential activities and transmission loss (DoN, 2009). In response to a petition from the Center for Biological Diversity, EPA stated on January 16, 2009, that it will initiate an evaluation of ocean acidification impacts, to determine whether the current water-quality criterion for pH should be modified to address ocean acidification.

With respect to the cumulative impacts from the Navy's use of active mid and high frequency sonar, the acoustic analysis from the AFAST FEIS/OEIS is incorporated here to provide a basis for analyzing the cumulative impacts from active sonar use. The data used in this analysis includes the effects associated with active sonar use throughout the entire AFAST Study Area (Figure 1.1-2), not just those inside the JAX Study Area as discussed in section 3.20 of this document).

In the AFAST FEIS/OEIS, an acoustic analysis was performed in order to estimate the effects associated with active sonar use. Chapter 4 of the AFAST FEIS/OEIS discusses the methodology used to measure these effects in detail. The results of acoustic analysis indicate that 16,521 exposures to ESA-listed marine mammals may result in Level B harassment under the AFAST Selected Alternative. It also indicates that one exposure to an ESA-listed marine mammal may result in Level A harassment under the AFAST Selected Alternative. The exposure estimates represent the total number of exposures and not necessarily the number of individuals exposed, as a single individual may be exposed multiple times over the course of a year. In the AFAST FEIS/OEIS, the Navy finds that ESA-listed species may experience a cumulative impact from AFAST activities; however, they are not expected to adversely affect the populations of ESA-listed species. As part of the environmental documentation for the AFAST FEIS/OEIS, the Navy has completed consultation with NMFS in accordance with Section 7 of the ESA. See the AFAST website (http://afasteis.gcsaic.com) for additional information on the Biological Opinion.

The AFAST FEIS/OEIS acoustic analysis indicates that 1,911,195 exposures to marine mammals (including ESA-listed species) may result in Level B harassment under the AFAST Selected Alternative. This acoustic analysis also indicates that 126 exposures to marine mammals (including ESA-listed species) may result in Level A harassment under the AFAST Selected Alternative. No mortalities are predicted due to AFAST active sonar activities. The exposure estimates represent the total number of exposures and not necessarily the number of individuals exposed, as a single individual may be exposed multiple times over the course of a year. The Navy has determined that AFAST activities will have a negligible impact on marine mammal species or stock. The Navy completed consultation with NMFS in accordance with the MMPA for concurrence. See the AFAST website (http://afasteis.gcsaic.com) for additional information on the Letter of Authorization

With regard to the cumulative impacts of the proposed action, impacts are expected to be limited to temporary behavioral impacts. Mitigation measures (discussed in Chapter 5) would be implemented during the proposed exercises to minimize any potential adverse impacts to marine mammals and to avoid any significant or long-term adverse impacts to threatened and endangered species. Thus, no significant cumulative impacts to marine mammals would occur in U.S. territorial waters as a result of training activities from the No Action Alternative, Alternative 1, or Alternative 2. Likewise, no significant cumulative harm in non-territorial waters would be expected.

6.4.9 Sea Turtles

The ESA established protection over and conservation of threatened and endangered species. All five species of sea turtles that potentially occur in the Study Area are listed as threatened or endangered. Therefore, the ESA requirements discussed in Section 3.7.1.1 are applicable to the analysis of sea turtles. The Navy has initiated the ESA Section 7 consultation process with NMFS. Critical habitat for listed species has not been designated under the ESA in the Study Area.

6.4.9.1 JAX EIS/OEIS Conclusions

The analysis of potential effects on sea turtles included modeling of explosions, acoustic effects analysis, disturbance analysis associated with vessel movements, analysis of vessel strikes on sea turtles, analysis of disturbance associated with aircraft overflights, and analyses of other training activities conducted in the JAX Study Area. The AFAST FEIS/OEIS evaluated potential direct and indirect effects to sea turtles as a result of exposure to in-water sound and non-acoustic interactions during sonar activities in Section 4.5.

Assessing whether a sound may disturb or injure a sea turtle involves understanding the characteristics of the acoustic sources, the presence of sea turtles in the vicinity of the sound, and the effects that sound may have on the physiology and behavior of those animals. Little is known about the role of sound and

hearing in sea turtles; however, their greatest sensitivity appears to be at frequencies below the frequencies used by sonar systems during Atlantic fleet sonar activities. Use of these systems, therefore is not expected to acoustically affect sea turtles. Sea turtles are, however, expected to be physiologically or behaviorally affected by use of explosive source sonobuoys. Effects to sea turtles were analyzed in the AFAST EIS/OEIS using the same methods and criteria presented for small explosive impacts (single explosions) to sea turtles in the JAX Range Complex EIS/OEIS (Section 3.8).

Table 6.4-2 shows that no acoustic exposures resulting in a physiological effect are anticipated in the JAX Study Area. In the case of single explosions, behavioral effects are expected to be limited to short-term startle effects.

The analysis of environmental stressors indicated that implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in significant impacts to sea turtles in U.S. territorial waters; likewise no significant harm in non-territorial waters would be expected. The proposed action may affect listed species, but it is not anticipated to displace animals. When the potential impacts due to sonar activities are included with the potential impacts due to range complex activities for the No Action Alternative, Alternative 1, or Alternative 2, there would be no significant impact to sea turtles in territorial waters. In addition, there will be no significant harm to sea turtles in non-territorial waters for the No Action Alternative, Alternative 1, or Alternative 2.

TABLE 6.4-2
ESTIMATED SEA TURTLE ACOUSTIC EXPOSURES FROM EXPLOSIVE SOURCE SONOBUOYS

Species	Mortality	PTS	TTS
Loggerhead sea turtle	0	0*	1
Kemp's ridley sea turtle[1]	0	0	0
Leatherback sea turtle	0	0	0
Hardshell sea turtles[2]	0	0*	0*

** Indicates an exposure greater than or equal to 0.05, therefore is considered a "may affect" for ESA listed species*

1. *This category does not include Kemp's ridley sea turtles in the Gulf of Mexico. They are included in the hardshell sea turtle class.*
2. *This category includes green, hawksbill, and unidentified hardshell species for all regions. It also includes Kemp's ridley sea turtles in the Gulf of Mexico, and may include extralimital occurrences of olive ridley turtles along the Atlantic coast.*

6.4.9.2 JAX EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

The combination of potential impacts resulting from the proposed action in addition to prior and future Navy activities, oil/gas exploration and development activities, dredge-and-fill operations, water quality degradation, natural catastrophes, pollution (chemicals, marine debris, noise), recreational and commercial fishing, vessel traffic, beach nourishment, beach lighting, power plant entrainment, and human consumption, would affect sea turtles that might be found in the JAX Study Area. Activities considered under this analysis have the potential to harm sea turtles and their nesting and foraging

habitats. Chronic sublethal impacts (*e.g.*, stress) resulting in persistent physiological or behavioral changes and/or avoidance of impacted areas could cause declines in survival or productivity, resulting in either acute or gradual population declines (Milton and Lutz, 2003).

Sea turtles face harm from human activities throughout their migratory ranges, both in their foraging habitats and on their nesting beaches. Sea turtles are particularly vulnerable because of their wide ranging movements in coastal waters (NRC, 1990).

Incidental catch in fisheries is widely recognized as a major mortality factor for sea turtles. A major source of mortality for loggerhead and Kemp's ridley turtles is incidental capture and drowning in shrimp trawls (Henwood and Stuntz, 1987; Frazier *et al*., 2007). Other fisheries and fishery-related activities are also important sources of mortality (Witzell, 1992), but collectively only one-tenth as important as shrimp trawling (NRC, 1990).

Man-made debris (from offshore and coastal sources) has become an increasing concern (Laist, 1997). Both entanglement in and ingestion of debris has caused the death or serious injury of sea turtles (Lutcavage *et al*. 1997; Laist *et al*. 1999). Because of their buoyancy and persistence, plastic items contribute disproportionately to the overall impacts of marine debris. Most of the debris that either entangles animals or is found in their stomachs is made of plastic (Laist, 1997). Leatherback turtles that mistake plastics for jellyfish may be more vulnerable to marine debris than other turtle species.

Dredge-and-fill activities occur in many of the coastal seasonal habitats of sea turtles in the southeastern United States and other locales. Dredging operations affect turtles through incidental take and by degrading the habitat. In addition to direct take, channelization of the inshore and nearshore areas can degrade foraging and migratory habitat through spoil dumping, degraded water quality/clarity, and altered current flow (NRC, 1990). Sea turtles can become entrained in intake pipes for cooling water at coastal power plants (NRC, 1990). An offshore intake structure may look like a reef to some turtles, suitable for resting, and these turtles are subsequently drawn into the cooling system (Witham, 1995). Feeding leatherbacks probably follow large numbers of jellyfish into the intake (Witham, 1995). Thermal effluents from power plants may cause hatchlings to become disoriented and reduce their swimming speed (O'Hara, 1980) and degrade seagrass and reef habitats (Coston-Clements and Hoss, 1983).

Sea turtles frequent coastal areas such as algae and seagrass beds to seek food and shelter (Carr and Caldwell, 1956). Submerged vegetated areas may be lost or damaged by activities that alter salinity, increase turbidity, or disturb natural tidal and sediment exchange (Gibson and Smith, 1999). Natural catastrophes, including storms, floods, droughts, and hurricanes, can also substantially damage sea turtle habitats and nesting beaches (Martin, 1996). In addition, the hurricane season for the Caribbean and western North Atlantic (June to November) overlaps closely with the sea turtle nesting season (March through November) (NRC, 1990). Hurricanes cause mortality to turtle nests in two ways: immediate drowning from ocean surges and after hatching as a result of radically altered beach topography. Species that have limited nesting ranges, such as the Kemp's ridley, would be highly impacted if a hurricane hit its nesting beach (Milton *et al.* 1994). Indirect impacts (contamination of food or poisoning of reef-building communities) on the marine and coastal habitats of sea turtles include pollution of coastal waters from storm-associated runoff.

Construction, vehicle traffic, beachfront erosion, and artificial lighting are activities that disturb sea turtles or their nesting beaches. Traffic may cause compression damage to nests, and beach cleaning may destroy nests or cause compaction, lowering hatching success (Coston-Clements and Hoss, 1983). Physical obstacles, such as tire tracks and sand piles, may slow the rate of sea-approach for hatchling turtles and increase their susceptibility to stress and predation (Witham, 1995). Obstructions to the high water mark prevent nesting, and breakwalls are the most common and drastic type of obstruction. Erosion of nesting beaches results in the loss of nesting habitat. Human interference has hastened erosion

in many places. Artificial lighting from buildings, streetlights, and beachfront properties has a disorienting effect on hatchlings, as well as adults (Witherington and Martin, 2003). Females tend to avoid areas where beachfront lighting is most intense; turtles also abort nesting attempts more often in lighted areas. Hatchlings are attracted to lights, and any delay for them to make it to the water increases vulnerability to terrestrial predators. Condominiums block sun on turtle nesting beaches, which could presumably affect sex ratios of hatchlings (the sex of a turtle is dependent on egg temperature) by increasing the number of males produced (Mrosovsky *et al*., 1995). Increased human activities, including organized turtle watches, on nesting beaches may affect nesting activity, specifically, a female turtle not spending as much time camouflaging nest sites (Johnson *et al*. 1996). Nest depredation by predators such as raccoons, snakes, and fire ants is also a great concern (Boulon, 1999).

Sand mining, beach renourishment, and oil-spill cleanup operations may remove sand from the littoral zone and temporarily disturb onshore sand transport, potentially disturbing sea turtle nesting activities (Witherington, 1999). Chronic pollution, including industrial and agricultural waste and urban runoff, threatens sea turtles worldwide. Some turtle species have lifespans greater than 50 years and have a high trophic level in the marine ecosystem, creating the potential for bioaccumulation of heavy metals and pesticides (Davenport *et al*., 1990). In some marine mammals, chronic pollution has been linked with immune suppression, which raises a similar concern for sea turtles.

Chronic pollution, including industrial and agricultural waste and urban runoff, threatens sea turtles worldwide. Some turtle species have lifespans greater than 50 years and have a high trophic level in the marine ecosystem, creating the potential for bioaccumulation of heavy metals and pesticides (Davenport *et al*., 1990). Organochlorine pollutants have been documented in eggs, post-yearlings, and adult turtles (Rybitski *et al.* 1995). Not all species accumulate residues at the same rate; loggerheads consistently have higher levels of both polychlorinated biphenyls (PCb) and dichlorodiphenyldichloroethylene (DDE) than green turtles, and it has been hypothesized that the variation is due to dietary differences (George, 1997). Contaminants could stress the immune system of turtles or act as co-carcinogens indirectly by disrupting neuroendocrine functions (Colborn *et al.,* 1993; Milton and Lutz, 2003). In some marine mammals, chronic pollution has been linked with immune suppression, which raises a similar concern for sea turtles.

Green turtle fibropapillomatosis (GTFP) (debilitating tumors occurring primarily in green turtles) is a growing threat to the survival of green turtle populations worldwide (Herbst, 1994). This disease may cause an increased susceptibility to marine parasites and anemia, as well as obstructed feeding and swimming, greater vulnerability to fishing net entanglement, disorientation, and impaired vision or blindness (Norton *et al*. 1990). Similar lesions have been reported in loggerhead turtles (Herbst, 1994). Studies suggest that turtles in nearshore habitats with nearby human disturbance have a higher incidence of GTFP (Herbst and Klein, 1995). Turtles with GTFP are chronically stressed and suffer from immunosuppression (Aguirre *et al*., 1995).

Climatic fluctuations have produced a growing concern about the impacts of climate change on various marine species, including sea turtles. Responses of sea turtles to climate change are difficult to interpret due to the confounding impacts of natural responses and human influences. Additionally, the time scale on which sea turtles respond to direct or indirect impacts of climate change may be diluted or muted. Global warming will likely increase the foraging range of leatherback turtles farther into temperate and boreal waters as isotherms shift (James et al., 2006; McMahon and Hays, 2006). Large-scale climatic events may affect turtles by loss of nesting beaches as sea levels rise (Vagg and Hepworth, 2006). Nesting biology of sea turtles is strongly affected by temperature, both in timing and in the sex-ratio of hatchlings; the impacts of climate change may upset the natural ratio of male to female hatchlings, as higher temperatures during incubation tend to produce more females (Hays et al., 2003; Hawkes et al., 2007). Earlier nesting and longer nesting seasons are being correlated with warmer sea surface temperatures (Weishampel et al,. 2004; Hawkes et al., 2007).

Military operations other than those described in the proposed action may contribute to the impacts on sea turtles in the JAX Study Area. Airborne noise from aircraft operations contribute to the anthropogenic noise environment. Small boats would also contribute to the cumulative impacts with their vessel movements and engine noise.

With respect to the cumulative impacts from the Navy's use of active mid and high frequency sonar , the acoustic analysis from the AFAST FEIS/OEIS is incorporated here to provide a basis for analyzing the cumulative impacts from active sonar use. The data used in this analysis includes the effects associated with active sonar use throughout the entire AFAST Study Area (see Figure 1.2-1), not just those inside the JAX Study Area as discussed in section 3.20 of this document).

All of the turtles species found in the AFAST Study Area are ESA-listed species. As such, the Navy's has completed consultation with NMFS in accordance with Section 7 of the ESA. Acoustic analysis for mid- and high-frequency active sonar activities was not performed for sea turtles due to the fact that sea turtles appear to be most sensitive only to low frequencies. Acoustic effects on sea turtles from explosive source sonobuoys (AN/SSQ-110A) were analyzed in Chapter 4 of AFAST FEIS/OEIS. Acoustic analysis in the AFAST FEIS/OEIS indicates that five exposures to sea turtles may result in Level B harassment under the AFAST Selected Alternative. Acoustic analysis also indicates that one exposure to a sea turtle may result in Level A harassment under the AFAST Selected Alternative. Included in the Level A exposure numbers, acoustic analysis indicates that no sea turtles may be exposed to levels of sound likely to result in mortality under the AFAST Selected Alternative. The exposure estimates represent the total number of exposures and not necessarily the number of individuals exposed, as a single individual may be exposed multiple times over the course of a year. See Section 4.5.2 of AFAST FEIS/OEIS for additional information.

With regard to cumulative impacts of the proposed action, impacts are expected to be limited to temporary behavioral impacts for non-sonar related activities. Protection and conservation measures would be implemented during the proposed action to minimize potential adverse impacts to sea turtles and to avoid significant or long-term adverse impacts to threatened and endangered species. As such, there is a potential for minor, but recoverable, cumulative impacts to sea turtles under the No Action Alternative, Alternative 1, Alternative 2, and Alternative 3. Impacts would be temporary and localized and would not be considered significant. No significant cumulative impacts to sea turtles would occur as a result of training activities from the No Action Alternative, Alternative 1, or Alternative 2. No significant cumulative harm to sea turtles in non-territorial waters is expected as a result of training activities from the No Action Alternative, Alternative 1, or Alternative 2.

6.4.10 Fish and Essential Fish Habitat

The affected environment for fish and essential fish habitat (EFH) includes the marine habitats in the Atlantic Ocean and freshwater to brackish habitats in Lake George.

Essential fish habitat has been designated for at least one life stage of 120 species in the offshore OPAREAs. There are seven groups of species with designated habitat areas of particular concern and two proposed sites for deepwater coral habitat areas of particular concern extend into the JAX Study Area. Two ESA-listed fish were analyzed in the EIS/OEIS: the shortnose sturgeon, which is not likely to occur in the Atlantic Ocean portion of the JAX Study Area and the smalltooth sawfish which is only likely to occur along the central Florida coast in nearshore waters. In addition one candidate fish species and 13 fish species of concern were considered in the analysis.

The habitats and fish found in Lake George are distinctly different from those in the offshore OPAREAs. Although Lake George is primarily a freshwater fishery and is 115 miles upriver from the Atlantic Ocean, it is recognized as the upper limit of tidal waters and provides habitat for saltwater fish. Essential fish

habitat has not been designated in Lake George, but some federally managed saltwater species occur in the lake.

Potential threats to fish include fishing, vessel traffic, degradation of water quality, habitat modification, pollution (chemicals, marine debris, etc.), and introduction of exotic species, disease, natural events, and global climate change (SAFMC, 1998; Field *et al*., 2003; Jackson *et al*., 2001; IEF, 2006).

Fishing and non-fishing activities, individually or in combination, can adversely affect EFH and Managed Species (NOAA, 1998). Potential impacts of commercial fishing include over-fishing of targeted species and bycatch, both of which negatively affect fish stocks (NRC, 2002b). Mobile fishing gears such as bottom trawls disturb the seafloor and reduce structural complexity. Indirect effects of trawls include increased turbidity, alteration of surface sediment, removal of prey (leading to declines in predator abundance), removal of predators, ghost fishing, and generation of marine debris. Lost gill nets, purse seines, and long-lines may foul and disrupt bottom habitats. Recreational fishing also poses a threat because of the large number of participants and the intense, concentrated use of specific habitats.

Natural stresses include storms and climate-based environmental shifts, such as harmful algal blooms and hypoxia. Disturbance from ship traffic and exposure to biotoxins and anthropogenic contaminants may stress animals, weaken their immune systems, and make them vulnerable to parasites and diseases that would not normally compromise natural activities or be fatal.

Potential cumulative impacts of Navy training exercises include release of chemicals into the ocean, introduction of MEMs into the water column and onto the seafloor, mortality and injury of marine organisms near the detonation or impact point of ordnance or explosives, and physical and acoustic impacts of vessel activity. The incremental contribution by the proposed action (or alternatives) to impacts on the marine environment is expected to be insignificant.

6.4.10.1 JAX EIS/OEIS Conclusions

The analysis of environmental stressors indicated that implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in unavoidable significant adverse effects to fish populations, managed species, or essential fish habitat. When the potential impacts due to sonar activities (to include AFAST expended materials and IEER explosion data) are included with the potential impacts due to range complex activities for the No Action Alternative, Alternative 1, or Alternative 2, there would be no impact to EFH and fish in territorial waters. In addition, there would be no significant harm to EFH and fish in non-territorial waters for the No Action Alternative, Alternative 1, or Alternative 2. Therefore, EFH consultation with NMFS is not required.

Findings for ESA-listed fish included the following.

- Implementation of the No Action Alternative, Alternative 1, or Alternative 2 would have no effect on the shortnose sturgeon.
- Implementation of the No Action Alternative, Alternative 1, or Alternative 2 would have no effect on the smalltooth sawfish.

The Study Area does not contain designated critical habitat for any listed species. Consequently, the proposed action would have no effect on critical habitat.

The Navy is consulting with NMFS regarding its determination of effect for federally listed fish. The analysis of environmental stressors and alternatives indicated no significant impact to fish populations or habitat in U.S. territorial waters; likewise no significant harm in non-territorial waters would be expected.

6.4.10.2 JAX EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

Past, present, planned, and reasonably foreseeable actions within the JAX Study Area include Navy activities, navigation, transportation, coastal development, oil/gas exploration and development, sand and mineral mining, dredge and fill operations, beach nourishment, cooling water intake and discharge, wastewater discharge, mariculture, recreational and commercial fishing, and whale watching.

Fishing and non-fishing activities, individually or in combination, can adversely affect EFH and Managed Species (NOAA, 1998; Dayton et al., 2003; Morgan and Chuenpagdee, 2003). Potential impacts of commercial fishing include over-fishing of targeted species and by catch, both of which negatively affect fish stocks (Barnette, 2001; NRC, 2002b; Dieter et al., 2003). Mobile fishing gears such as bottom trawls disturb the seafloor and reduce structural complexity (Auster and Langton, 1998; Johnson, 2002). Indirect effects of trawls include increased turbidity, alteration of surface sediment, removal of prey (leading to declines in predator abundance), removal of predators, ghost fishing, and generation of marine debris (Hamilton, 2000). Lost gill nets, purse seines, and long-lines may foul and disrupt bottom habitats. Recreational fishing also poses a threat because of the large number of participants and the intense, concentrated use of specific habitats (Coleman et al., 2004).

Military operations other than those described in the Proposed Action may contribute, though very minor, to the impacts on fish in the JAX Study Area. Airborne noise from aircraft operations contribute to the anthropogenic noise environment. Small boats would also contribute to the cumulative impacts with their vessel movements and engine noise.

Natural stresses include storms and climate-based environmental shifts, such as harmful algal blooms and hypoxia. Disturbance from ship traffic and exposure to biotoxins and anthropogenic contaminants may stress animals, weaken their immune systems, and make them vulnerable to parasites and diseases that would not normally compromise natural activities or be fatal (Pew Oceans Commissions, 2003).

Potential cumulative impacts of Navy training exercises include release of chemicals into the ocean, introduction of MEMs into the water column and onto the seafloor, mortality and injury of marine organisms near the detonation or impact point of ordnance or explosives, and physical and acoustic impacts of vessel activity. The incremental contribution by the proposed action (or alternatives) to impacts on the marine environment is expected to be insignificant.

With respect to the cumulative impacts from the Navy's use of active mid and high frequency sonar , the acoustic analysis from the AFAST FEIS/OEIS is incorporated here to provide a basis for analyzing the cumulative impacts from active sonar use . The data used in this analysis includes the effects associated with active sonar use throughout the entire AFAST Study Area (not just those inside the JAX Study Area as discussed in section 3.19 of this document).

The overall effect on fish stocks would be negligible compared to the impact of commercial and recreational fishing in the AFAST Study Area. After completion of an active sonar activity, repopulation of an area by fish should take place within a matter of hours. Even for fish that are able to detect mid-frequency sounds, both the fish and vessels are moving. Therefore, the exposure to mid-frequency sounds is transient in nature. As such, the exposure would be temporary and not considered significant. As such, no long-term changes to species abundance or diversity, loss or degradation of sensitive habitats, or effects to threatened and endangered species are expected. There is the potential for minor, but recoverable cumulative impacts to marine fish under the AFAST FEIS/OIS Selected Alternative..

Since the majority of AFAST activities are short-term and occur underwater, interaction with EFH during active sonar activities is not expected to be significant. Any impacts would be temporary and localized

and as such, there is the potential for minor, but recoverable cumulative impacts to EFH. No significant cumulative impacts are anticipated.

The overall effect on fish stocks, Managed Species and EFH would be negligible compared to the impact of commercial and recreational fishing. Thus, no significant cumulative impacts to fish or EFH would occur in U.S. territorial waters as a result of training activities from the No Action Alternative, Alternative 1, or Alternative 2. Likewise, no significant cumulative harm in non-territorial waters would be expected.

No significant cumulative impacts to fish or fish habitat would occur as a result of training activities from the No Action Alternative, Alternative 1, or Alternative 2. No significant cumulative harm to fish or fish habitat in non-territorial waters is expected from the No Action Alternative, Alternative 1, or Alternative 2.

6.4.11 Seabirds and Migratory Birds

This section of the EIS/OEIS focuses on seabirds in the open waters of the Atlantic Ocean and migratory birds that could seasonally migrate through the OPAREAs (for information on terrestrial birds see section 3.11 and 6.4.1.12). A total of 54 seabirds could potentially occur in the OPAREAs. The area from the beach to about 10 nm offshore provides foraging areas for breeding terns, gulls, skimmers, and pelicans; a migration corridor and winter habitat for terns, gulls, skimmers, pelicans, loons, cormorants, and gannets; and supports non-breeding and transient pelagic seabirds. Offshore pelagic waters support non-breeding and transient pelagic seabirds, loons, gannets, and several tern species. One federally listed seabird species, the roseate tern, potentially occurs in the OPAREAs as a transient during migration. Critical habitat for the roseate tern has not been designated in the OPAREAs.

6.4.11.1 JAX EIS/OEIS Conclusions

Analyses of vessel movements, aircraft overflights, and other training activities in the Study Area were conducted to identify potential effects on seabirds and migratory birds. The analysis indicated that implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in unavoidable significant adverse effects to seabirds and migratory birds. When the potential impacts due to sonar activities (to include AFAST expended materials and IEER explosion data) are included with the potential impacts due to range complex activities for the No Action Alternative, Alternative 1, or Alternative 2, there would be no significant impact to sea birds in territorial waters. In addition, there would be no significant harm to sea birds in non-territorial waters for the No Action Alternative, Alternative 1, or Alternative 2. The analysis of environmental stressors and alternatives indicated no significant impact to seabirds and migratory birds in U.S. territorial waters; likewise no significant harm in non-territorial waters would be expected.

6.4.11.2 JAX EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

The overall cumulative effect on seabirds and migratory birds would be minor in the JAX Study Area. Past, present, planned, and reasonably foreseeable actions within the JAX Study Area includes commercial and recreational fishing, commercial and general aviation traffic, alternative energy development and coastal development. Military operations other than those described in the proposed action may contribute to the bird strike effects in the JAX Study Area.

As discussed in the analysis presented in Section 3.10.3 and summarized in Table 3.10-4, the No Action Alternative, Alternative 1, and Alternative 2 would not diminish the capacity of a population of a migratory bird species to maintain genetic diversity, to reproduce, and to function effectively in its native ecosystem. The proposed action would not have a significant adverse effect on migratory bird

populations. As a result and in accordance with 50 CFR Part 21, the Navy is not required confer with the USFWS on the development and implementation of conservation measures to minimize or mitigate adverse impacts to migratory birds not listed under the ESA. Therefore, there is the potential for minor, but recoverable, cumulative impacts to seabirds and migratory birds under the No Action Alternative, Alternative 1, and Alternative 2 U.S. territorial waters. Likewise, there is the potential for minor, but recoverable, cumulative harm to seabirds and migratory birds under the No Action Alternative, Alternative 1, and Alternative 2 non-territorial waters.

As such, the potential for the alternatives to contribute incrementally or synergistically to the impacts of other actions on seabirds or migratory birds is very low. Thus, no significant cumulative impacts to seabirds and migratory birds would occur in U.S. territorial waters as a result of training activities from the No Action Alternative, Alternative 1, or Alternative 2. Likewise, no significant cumulative harm in non-territorial waters would be expected.

6.4.12 Biological Resources at Rodman and Lake George Ranges

This section of the EIS/OEIS addresses biological resources at Rodman Range and Lake George Range, including vegetation, wetlands, wildlife, aquatic life, and special status species. Land within the property boundary and lands adjacent to Rodman Range were included in the analysis. The analysis for Lake George Range included area within the range boundary, the open waters of Lake George, and adjacent land areas where low altitude aircraft overflights would occur.

Rodman Range consists of 2,696 acres of land and is located approximately 58 miles south of Jacksonville, Florida. The range supports air-to-ground bombing exercises using non-explosive practice bombs, combat search and rescue training, and convoy operations. Most of Rodman Range is undeveloped and forested; approximately 70 % of the range is jurisdictional wetlands.

Lake George Range is located entirely within the waters of Lake George on the St. Johns River in north-central Florida. The range lies in the east-central portion of the lake, and is approximately 8,960 acres (2 nm by 7 nm). The Lake George Range is in waters ranging from 8 to 11 feet deep; therefore, submerged aquatic vegetation is not expected to occur within the Lake George Range boundaries.

Federally listed species in the analysis included five bird species, one federally listed mammal species, three reptile species, and four federally listed plant species. In addition 22 state listed species on Rodman Range and 12 state listed species on Lake George and the vicinity were included in the analysis.

6.4.12.1 JAX EIS/OEIS Conclusions

Endangered Species Act

Rodman Range Study Area. The No Action Alternative, Alternative 1, and Alternative 2 would have no effect on the sand skink and West Indian manatee; may affect the Florida scrub-jay, wood stork, and eastern indigo snake; and would not adversely modify critical habitat designated for the manatee. Critical habitat has not been designated for the other species. The Navy is consulting with USFWS regarding its determination of effect for federally listed species and critical habitat in the Rodman Range Study Area.

Lake George Range Study Area. The No Action Alternative, Alternative 1, and Alternative 2 would have no effect on the eastern indigo snake, sand skink, and shortnose sturgeon; may affect the Florida scrub-jay, red-cockaded woodpecker, wood stork, and West Indian manatee; and would not adversely modify critical habitat designated for the manatee (see section 6.4.7 for a discussion of the manatee in the OPAREAs). Critical habitat has not been designated for the other species. The Navy is consulting with USFWS and NMFS (shortnose sturgeon only) regarding its determination of effect for federally listed species and critical habitat in the Lake George Range Study Area.

Migratory Bird Treaty Act and Bald and Golden Eagle Protection Act

As discussed in the analysis presented in Section 3.11.3, the No Action Alternative, Alternative 1, and Alternative 2 would not diminish the capacity of a population of a migratory bird species to maintain genetic diversity, to reproduce, and to function effectively in its native ecosystem. The proposed action would not have a significant adverse effect on migratory bird populations. The proposed action is not expected to result in take of bald eagles or to disturb bald eagles as defined by the Eagle Act.

6.4.12.2 JAX EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

The biological resources at Rodman Range and Lake George Range, including vegetation, wetlands, wildlife, aquatic life, and threatened and endangered species will be exposed to a combination of potential impacts resulting from the proposed action in addition to prior and future Navy activities, up-river development activities, water quality degradation, pollution, and recreational activities affecting the JAX Study Area. Because the impacts from the proposed Navy training will be short-term and localized, the incremental contribution and cumulative impacts from other projects and activities are not likely to result in unavoidable significant adverse effects to terrestrial and freshwater biological resources.

The analysis of environmental stressors indicated that implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in unavoidable significant adverse effects to terrestrial and freshwater biological resources. Thus, no significant cumulative impacts to terrestrial and freshwater biological resources would occur in U.S. territorial waters as a result of training activities from the No Action Alternative, Alternative 1, or Alternative 2.

West Indian Manatee. With regard to the direct, indirect, and cumulative impacts of the proposed action on the manatee at Lake George, impacts are expected to be limited to temporary behavioral impacts. Mitigation measures (discussed in Chapter 5) would be implemented during the proposed exercises to minimize any potential adverse impacts and to avoid any significant or long-term adverse impacts to manatees. The St. John's River, including Lake George, is designated as critical habitat for the manatee (USFWS, 1976). Although the water column may be disrupted on a very short-term basis, it is unlikely that reproductive or foraging behaviors of the manatee would be altered. Impacts to the lake bed may be longer term in nature; however, they are unlikely to affect the function of the critical habitat. Manatees use the area for the warm springs on the western side of the lake and foraging on the boundaries.

The analysis of environmental stressors indicated that implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in significant impacts to the West Indian manatee in Lake George. The proposed action may affect the manatee, but it is not anticipated to displace animals. In the marine environment, although the analysis of alternatives indicated no significant impacts in U.S. territorial waters and no significant harm in non-territorial waters would be expected to marine communities, there would be a potential for minor incremental, but recoverable, cumulative impact when these impacts are considered with other projects and actions in the area. However, because Navy training activities would be relatively isolated in time and space, these impacts would not be considered significant because they are localized and temporary (see section 6.4.7 for further discussion of the manatee in the OPAREAs).

6.4.13 Land Use

The JAX Range Complex is a set of operating and maneuvering areas with defined air, ocean surface and subsurface areas, and inland ranges. Lands adjacent to Lake George Range and Rodman Range are predominantly rural, low density, residential home sites and small incorporated communities. The adjacent Ocala National Forest offers public recreational opportunities for camping, swimming, picnicking, hiking, mountain biking, boating, canoeing, off-road trail use, horseback riding, hunting, and

fishing. Land-based activities are conducted within areas restricted for range-compatible activities; land based modes of transportation and utility systems are not impacted by the proposed activities.

6.4.13.1 JAX EIS/OEIS Conclusions

No offshore events associated with the proposed activities are associated with land encroachment or land forms and soil. Land-based modes of transportation and utility systems are not associated with offshore events. No changes to existing real estate use or agreements are proposed as a result of implementing the No Action Alternative, Alternative 1, or Alternative 2. Additionally, the scenic quality of the offshore area is not affected by proposed activities. Therefore, the proposed activities associated with the No Action Alternative, Alternative 1, or Alternative 2 would have no impact on land use.

6.4.13.2 JAX EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

Recreational activities in Ocala National Forest and the campground adjacent to Lake George have co-existed without incident. As such, no cumulative impacts are anticipated when considered in concert with the Proposed Action.

The analysis of environmental stressors indicated that implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in unavoidable significant adverse effects to land use. The analysis of environmental stressors and alternatives indicated no significant impact to land use in U.S. territory, so no cumulative impacts are anticipated.

6.4.14 Cultural Resources

Thousands of submerged cultural resources, principally shipwrecks, lie along the South Atlantic continental shelf, including the JAX Study Area. Shipwrecks occurred in these areas throughout the historic period, which may be considered as beginning with the earliest European exploration of the area during the 16th century, and continuing until after World War II. In the JAX Study Area, approximately 900 shipwrecks are along the coastline and approximately 200 shipwrecks are offshore. Shipwrecks are vulnerable to the impacts of time, tides, storm surges, and marine organisms, damage from boats, wakes, anchor drops, and looting. Over time, elements of the ship deteriorate, break apart, and are covered by sand and marine organisms. Any future damage from mine warfare or mine neutralization efforts would contribute to the cumulative damage over time.

Materials such as shells and mine fragments expended during the proposed operations would sink to the ocean bottom. It is unlikely these materials would come into contact with a shipwreck. However, if expended materials were to sink onto a shipwreck, or in the near vicinity, it would not affect the historic properties of the shipwreck. Eventually, the expended materials would provide a substrate for benthic colonization and would likely be covered by shifting sediments.

6.4.14.1 JAX EIS/OEIS Conclusions

Potential stressors analyzed for their potential to affect shipwrecks were related to mine warfare training, use of non-explosive practice munitions, underwater detonations and high-explosive ordnance, and military expended materials. The analysis of environmental stressors indicated that implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in unavoidable significant adverse effects to cultural resources. When the potential impacts due to sonar activities (to include AFAST expended materials and IEER explosion data) are included with the potential impacts due to range complex activities for the No Action Alternative, Alternative 1, or Alternative 2, there would be less than significant impact to cultural resources in territorial waters. In addition, there would be less than significant harm to cultural resources in non-territorial waters for the No Action Alternative, Alternative 1, or Alternative 2. The analysis of environmental stressors and alternatives indicated no significant

impact to cultural resources in U.S. territorial waters; likewise no significant harm in non-territorial waters would be expected.

6.4.14.2 JAX EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

Past, present, and reasonably foreseeable future ocean activities such as commercial ship traffic, fishing, energy exploration, or scientific research, would not substantially affect underwater cultural resources. This is most likely due to lack of physical contact with shipwrecks since their locations are cataloged. Moreover, any activities with the potential for significant impacts on cultural resources will require Section 106 consultation, and would be mitigated as required by law. Where avoidance was practiced, no cumulative impact would result since there would be no contact with the cultural resource. Where cultural resources could not be avoided, Section 106 consultation would mitigate any potential adverse affects to the cultural resources.

In the marine environment, although the analysis of alternatives indicated no significant impacts in U.S. territorial waters and no significant harm in non-territorial waters would be expected to cultural resources, there would be a potential for minor incremental, but recoverable, cumulative impacts when these impacts are considered with other projects and actions in the area. However, because Navy training activities would be relatively isolated due to the large expanses of area between activity locations, these impacts would not be considered significant because they are localized and temporary.

6.4.15 Transportation

As demonstrated by current conditions, military and civilian uses of the offshore sea and air areas are compatible. Where naval vessels and aircraft are conducting operations that are not compatible (for example, hazardous weapons firing), they are confined to the OPAREAs away from shipping lanes and inside Special Use Airspace. Hazardous operations are communicated to all vessels and operators by the U.S. Coast Guard, and the FAA.

6.4.15.1 JAX EIS/OEIS Conclusions

The Navy can accomplish the proposed activities associated with the No Action Alternative, Alternative 1, or Alternative 2 without modifications or need for additional designated ocean or airspace. The proposed operations will not require either: (1) a change to an existing or planned instrumented flight rules minimum flight altitude, a published or special instrument procedure, or an instrumented flight rules departure procedure; or (2) a visual flight rules operation to change from a regular flight course or altitude. As such, the increased training operations do not conflict with any airspace use plans, policies, and controls.

The transportation analysis evaluated the potential for existing or proposed military air or vessel traffic to affect existing transportation and circulation conditions in the Study Area. The analysis of environmental stressors indicated that implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in unavoidable significant adverse effects to transportation. When the potential impacts due to sonar activities (to include AFAST expended materials and IEER explosion data) are included with the potential impacts due to range complex activities for the No Action Alternative, Alternative 1, or Alternative 2, there would be less than significant impact to transportation resources in territorial waters. In addition, there would be less than significant harm to transportation resources in non-territorial waters for the No Action Alternative, Alternative 1, or Alternative 2. The analysis of environmental stressors and alternatives indicated no significant impact to transportation in U.S. territorial waters; likewise no significant harm in non-territorial waters would be expected.

6.4.15.2 JAX EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

Most past, present, and reasonably foreseeable future ocean activities such as military operations, commercial ship traffic, fishing, energy exploration, or scientific research, would not substantially affect transportation. Although the analysis of alternatives indicated no significant impacts in U.S. territorial waters and no significant harm in non-territorial waters would be expected to transportation, there would be a potential for minor incremental, but recoverable, cumulative impacts when these impacts are consider with other projects and actions in the area. However, because Navy and Marine Corps training activities would be relatively isolated due to the large expanses of area between activity locations, these impacts would not be considered significant because they are localized and temporary.

At Rodman Range and Lake George, although the analysis of alternatives also indicated no significant impacts in U.S. territorial waters and no significant harm in non-territorial waters would be expected to transportation, there would be a potential for minor incremental, but recoverable, cumulative impacts when these impacts are considered with other projects and actions in the area. However, because Navy training activities would be relatively isolated due to the large expanses of area between activity locations, these impacts would not be considered significant because they are localized and temporary.

6.4.16 Demographics

Demographic statistics are assessed through identification and evaluation of socioeconomic factors such as population characteristics, which may include population growth, distribution, age, education, and race and ethnicity; household characteristics, which may include size, special needs, type, and vacancy; and employment rates and trends. The affected environment for demographics includes the coastal counties of the States of North Carolina, South Carolina, Georgia, and Florida; as well as Marion County in Florida, where Lake George and Rodman Ranges are located. Impacts to demographics are assessed in terms of their direct impacts on the local economy and related impacts on population and expenditure within the JAX Study Area. Demographic impacts would be considered important if the alternative chosen for implementation resulted in a substantial shift in population trends, spending and earning patterns, or community resources (notably housing and education).

6.4.16.1 JAX EIS/OEIS Conclusions

Implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in a change in the demographics within the JAX Study Area of the coastal counties of the States of North Carolina, South Carolina, Georgia, or Florida. Neither would there be a change to the local population or economy as a result of the proposed offshore training activities under the proposed action.

The analysis of environmental stressors indicated that implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in impacts to demographics of the counties within the Study Area; the alternatives performed in non-territorial waters would not cause significant harm to demographics of the counties within the Study Area. When the potential impacts due to sonar activities (to include AFAST expended materials and IEER explosion data) are included with the potential impacts due to range complex activities for the No Action Alternative, Alternative 1, or Alternative 2, there would be less than significant impact to demographics in territorial waters. In addition, there would be less than significant harm to demographics in non-territorial waters for the No Action Alternative, Alternative 1, or Alternative 2.

6.4.16.2 JAX EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

Regional economy is assessed through evaluation of economic factors including industry, commercial fishing, tourism, and recreational fishing. The JAX Study Area for assessment of the regional economy includes the States of North Carolina, South Carolina, Georgia, and Florida. Specific data for regional economic indicators on industry, commercial fishing, tourism, and recreational fishing are presented in this section of the EIS/OEIS. The environmental consequences of the regional economy are assessed in terms of the direct effect that impacts form the propose action would have on the local economy.

6.4.17 Regional Economy

The analysis of environmental stressors indicated that implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in unavoidable significant adverse effects to regional economy. The analysis of environmental stressors and alternatives indicated no significant impact to regional economy in U.S. territorial waters; likewise, no significant harm in non-territorial waters would be expected.

6.4.17.1 JAX EIS/OEIS Conclusions

Regional economy is assessed through evaluation of economic factors including industry, commercial fishing, tourism, and recreational fishing. The JAX Study Area for assessment of the regional economy includes the States of North Carolina, South Carolina, Georgia, and Florida. Specific data for regional economic indicators on industry, commercial fishing, tourism, and recreational fishing are presented in this Section 3.16 of the EIS/OEIS.

The environmental consequences on the regional economy are assessed in terms of the direct effect that impacts form the proposed action would have on the local economy. The analysis of environmental stressors indicated that implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in unavoidable significant adverse effects to regional economy. When the potential impacts due to sonar activities (to include AFAST expended materials and IEER explosion data) are included with the potential impacts due to range complex activities for the No Action Alternative, Alternative 1, or Alternative 2, there would be less than significant impact to regional economy in territorial waters. In addition, there would be less than significant harm to regional economy in non-territorial waters for the No Action Alternative, Alternative 1, or Alternative 2.

6.4.17.2 JAX EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

NMFS changes to the Atlantic Large Whale Take Reduction Plan may contribute to cumulative impacts to the commercial fishing industry economy (NMFS, 2007a). In the marine environment, although the analysis of alternatives indicated no significant impacts in U.S. territorial waters and no significant harm in non-territorial waters would be expected to regional economy, there would be a potential for minor incremental, but recoverable, cumulative impacts when these impacts are considered with other projects and actions in the area. However, because Navy training activities would be relatively isolated due to the large expanses of area between activity locations, these impacts would not be considered significant because they are localized and temporary.

At Rodman Range and Lake George, although the analysis of alternatives indicated no significant impacts in U.S. territorial waters and no significant harm in non-territorial waters would be expected to regional economy in Florida, there would be a potential for minor incremental, but recoverable, cumulative impacts when these impacts are considered with other projects and actions in the area. However, because

Navy training activities would be relatively isolated, these impacts would not be considered significant because they are localized and temporary.

6.4.18 Recreation

This section of the EIS/OEIS addresses recreational activities that occur in the JAX Study Area. These visitors took more than 52 million trips and caught a total of almost 243 million fish. Of that total, approximately 30 percent came from the JAX Study Area. Almost 30 percent of the total Atlantic catch came on saltwater trips that fished primarily in the state territorial seas, and 60 percent came on trips that fished primarily in inland waters. Statistics for recreational boating and diving were also included in the analysis.

The Ocala National Forest, adjacent to the inland ranges, offers recreational opportunities for camping, swimming, picnicking, hiking, mountain biking, boating, canoeing, off-road trail use, horseback riding, hunting, and fishing. The recreation analysis addresses the potential for existing or proposed military activities to disrupt recreational activities in the JAX Study Area.

Where naval vessels and aircraft are conducting operations that are not compatible (*e.g.*, hazardous weapons firing), they are confined to OPAREAs away from shipping lanes and inside Special Use Airspace. Advanced notice of hazardous operations is communicated to all vessels and operators by use of NOTMARs, issued by the USCG, and NOTAMs, issued by the FAA. These provide recreational boaters and other users notice that the military will be operating in a specific area, and will allow them to plan their own activities accordingly.

6.4.18.1 JAX EIS/OEIS Conclusions

The analysis of environmental stressors indicated that implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in unavoidable significant adverse effects to recreation. Thus, no significant cumulative impacts to recreation would occur in U.S. territorial waters as a result of training activities from the No Action Alternative, Alternative 1, or Alternative 2. Likewise, no significant harm in non-territorial waters would be expected. When the potential impacts due to sonar activities (to include AFAST expended materials and IEER explosion data) are included with the potential impacts due to range complex activities for the No Action Alternative, Alternative 1, or Alternative 2, there would be less than significant impact to recreational resources in territorial waters. In addition, there would be less than significant harm to recreational resources in non-territorial waters for the No Action Alternative, Alternative 1, or Alternative 2.

6.4.18.2 JAX EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

In the marine environment, other federal and state actions such as oil and gas leases, dredging operations for channel maintenance, other Department of Defense activities, as well as their associated vessel traffic, increases the potential for encounter with recreational activities that may disrupt a users' enjoyment of an area. Commercial activities like fishing and cruise ships also have the capacity to disrupt the more individual recreational activities as well.

It is expected that although there would be a potential for minor incremental, but recoverable, cumulative impacts by Navy actions at sea, these impacts would not be considered significant as they would be temporary and advanced notice is given. The analysis of environmental stressors and alternatives indicated no significant impacts to recreational use of U.S. territorial waters or significant harm to use of non-territorial. As such, any incremental and cumulative contribution of Navy training to existing stressors would be nominal.

At Rodman Range and Lake George, although the analysis of alternatives indicated no significant impacts in U.S. territorial waters and no significant harm in non-territorial waters would be expected to regional economy in Florida, there would be a potential for minor incremental, but recoverable, cumulative impacts when these impacts are considered with other projects and actions in the area. However, because Navy training activities would be relatively isolated, these impacts would not be considered significant because they are localized and temporary.

6.4.19 Environmental Justice

This section of the EIS/OEIS covers EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations and EO 13045, Protection of Children from Environmental Health Risks and Safety Risks. The affected environment is the open water of the OPAREAs (with no permanent human populations) and Lake George and Rodman Range (remote areas and do not have adjacent human populations).

Populations that could be impacted would be fisherman and recreational users of the training areas, who are most likely to live near the JAX Study Area. Because of the nature of the proposed activities and temporary safety restrictions placed on the general public, there are no populations of children expected in the affected environment. Because of the absence of people beyond the 12 nm territorial limit, environmental justice was considered only from a NEPA perspective and was not evaluated in accordance with EO 12114.

6.4.19.1 JAX EIS/OEIS Conclusions

The analysis of environmental stressors indicated that implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in unavoidable significant adverse impacts to environmental justice. The analysis of environmental stressors and alternatives indicated no significant impact to environmental justice in U.S. territorial waters.

6.4.19.2 JAX EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

Considering the scope of other actions in the geographic region and their interrelationship with the No Action Alternative, Alternative 1, and Alternative 2 and the lack of environmental justice impacts from the proposed action in this EIS/OEIS, no further analysis of cumulative impacts is relevant.

6.4.20 Public Health and Safety

Public health and safety issues include potential hazards inherent in flight operations, vessel movements, mine laying and clearance, and underwater detonations and high-explosive ordnance. It is the policy of the Navy and Marine Corps to observe every possible precaution in the planning and execution of all of its activities to prevent injury to people or damage to property. Potentially, health and safety risks could be posed to the military, commercial, institutional, and recreational activities that take place in the JAX Study Area. At Rodman Range, Navy regulations do not permit live ordnance, strafing, or lasing. Lake George Range use requires that aircraft make a preliminary run to confirm the impact areas are clear of boats.

6.4.20.1 JAX EIS/OEIS Conclusions

The analysis of environmental stressors indicated that implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not result in unavoidable significant adverse effects to public health and safety. The analysis of environmental stressors and alternatives indicated no significant impact to public health and safety in U.S. territorial waters; likewise, no significant harm in non-territorial waters would be expected.

6.4.20.2 JAX EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

The overall cumulative effect of the proposed actions on public health and safety would be minor in the JAX Study Area. Past, present, planned, and reasonably foreseeable actions within the JAX Study Area includes military operations, commercial and recreational fishing, commercial and general aviation traffic, and coastal development. There are no past, present, or foreseeable actions that would potentially compromise public health and safety. Therefore, there are no significant cumulative impacts to public health and safety as a result of No Action Alternative, Alternative 1, and Alternative 2.

6.4.21 Atlantic Fleet Active Sonar Training

In January 2009, the Navy, after carefully weighing the operational and environmental consequences of the proposed action, announced its decision to designate areas along the East Coast of the United States and in the Gulf of Mexico where MFA and HFA sonar and the IEER system training; RDT&E activities will occur, and to conduct these activities (DoN, 2009c). The Navy's decision regarding MFA sonar activities includes the advanced extended echo ranging system as a replacement for the IEER system. These activities are collectively described as "active sonar activities" in the Final EIS/OEIS for AFAST.

6.4.21.1 JAX EIS/OEIS Conclusions

The active sonar activities that are described in this EIS/OEIS are not new and do not involve significant changes in systems, tempo, or intensity from past events. Moreover, there will be no significant effects to geology, water quality, marine habitat, airspace management, cultural resources, or socioeconomics within the Study Area under the No Action Alternative, Alternative 1, or Alternative 2. As such, implementation of the proposed action will not pose disproportionate high or adverse effects to minority or low-income populations, or environmental health and safety risks to children.

6.4.21.2 JAX EIS/OEIS Incremental Contribution and Cumulative Impacts from Other Projects and Activities (Past, Present, and Reasonably Foreseeable Future)

The Navy published the Record of Decision for the AFAST EIS/OEIS in January 2009 (DoN, 2009c) and determined that the Selected Alternative, the No-Action Alternative, best meets the requirements for the proposed AFAST active sonar activities. Since the proposed action will not pose disproportionate high or adverse effects to minority or low-income populations, or environmental health and safety risks to children, the proposed action will not result in any cumulative impacts.

6.5 ASSESSING INDIVIDUAL PAST, PRESENT, AND FUTURE IMPACTS

In this chapter, past and present actions, as well as reasonably foreseeable future action, have been identified. In Table 6.5-1 a value of "NE" through "***" was assigned to each action based on its potential to cause an adverse effect to a specific resource area. An example of each value is as follows:

- A "NE" value would be given to an action that has no adverse impacts to a particular resource.
- A "*" would be given to an action that has the potential for minor, but recoverable, adverse impacts to a particular resource. Examples include negligible or less than significant effect to a resource.
- A "**" would be given to an action that has the potential for moderate, but recoverable, adverse impacts to a particular resource. Examples include a measurable effect to a resource, but an effect that would be recoverable.
- A "***" would be given to an action that has the potential for major, non-recoverable, adverse impacts to a particular resource. Examples include a significant effect to a resource, including impacts that are not recoverable.

Once a value was assigned to each resource for an individual action, as assessment was conducted to determine whether there would be cumulative impacts to the resource area in relation to the proposed action. Cumulative impacts were considered likely to occur for the following actions:

- Actions occurring at the same or overlapping areas at the same or similar time.
- Actions occurring in the vicinity at the same or similar time.
- Actions occurring at the same or overlapping areas at some other time.

The same valuation process was used to determine the overall cumulative impact to a resource. It is important to note that even if a resource was given a value of "**" or "***" for an individual action, it does not automatically generate a cumulative impact of "**" or "***". This is due to difference in space and time from other actions or the resource potentially affected. For instance, regulatory permits can be granted for certain actions that involve the likely "taking" of protected species, such as marine mammals, sea turtles, or migratory birds. Even though these individual impacts would be considered moderate to severe (depending on the action and species affected), regulations are in place to ensure the continued survival of the respective species. Moreover, the implementation of mitigation and mitigation measures for individual actions has the potential to further reduce the cumulative impact. Table 6.5-1 summarizes the results of the cumulative impacts analysis for each resource area identified previously in this EIS/OEIS that could potentially be affected by the proposed action; other past, present and reasonably expected future actions potentially affecting the same resources; and the magnitude of each individual action.

TABLE 6.5-1
SUMMARY OF CUMULATIVE IMPACTS BY RESOURCE AREA

		Bathymetry/Sediments	Hazardous Waste/Hazardous Materials	Water Resources	Air Quality	Noise Environment	Marine Communities	Marine Mammals	Sea Turtles	Fish and Essential Fish Habitat	Seabirds/Migratory Birds	Land Use	Cultural Resources	Transportation	Demographics	Regional Economy	Recreation	Environmental Justice	Public Health and Safety
Past and Present Actions	**Commercial and Recreational Fishing**	*	*	NE	NE	NE	**	**	**	**	**	NE	*	NE	NE	NE	NE	NE	NE
	Maritime Traffic	*	*	*	NE	*	NE	**	*	NE	NE	NE	*	*	NE	*	*	NE	*
	Scientific Research	NE	*	NE	NE	NE	*	*	*	*	*	NE	NE	NE	NE	NE	NE	NE	NE
	Debris	*	*	*	NE	NE	**	**	**	**	**	NE	*	NE	NE	NE	NE	NE	NE
	Environmental Contamination and Biotoxins	NE	NE	**	NE	NE	**	**	**	**	**	NE	NE	NE	NE	NE	NE	NE	NE
	Marine Ecotourism	NE	NE	*	NE	NE	NE	*	*	NE	NE	NE	NE	NE	NE	*	*	NE	NE
	Military Operations	*	*	*	*	*	*	*	*	*	*	*	*	*	NE	*	*	NE	*
	MMS: Oil and Gas	**	*	**	**	*	*	**	**	*	**	NE	*	NE	NE	NE	NE	NE	NE
	NASA	NE	*	NE	NE	*	NE	NE	NE	NE	*	NE	NE	NE	NE	NE	NE	NE	NE
	Dredging	**	**	**	**	*	**	NE	**	**	NE	NE	*	NE	NE	NE	NE	NE	NE
Future Actions	**Military Operations**	*	*	*	*	*	*	*	*	*	*	NE	*	NE	NE	NE	NE	NE	*
	MMS Oil and Gas Leases	*	NE	*	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
JAX Proposed Action		*	*	*	*	*	*	*	*	*	*	NE	*	*	NE	NE	*	NE	NE
Cumulative Impacts		*	*	*	*	*	*	**	**	*	*	NE	*	*	NE	NE	*	NE	NE

NE= No Adverse Impacts
*=Potential for minor, but recoverable, adverse impacts
**=Potential for moderate, but recoverable, adverse impacts
***=Potential for major, non-recoverable, adverse impacts

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The references are subdivided by their corresponding chapter/section where they are cited.

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CHAPTER 8 GLOSSARY OF TERMS

Access—the right to transit to and from and to make use of an area.

Accretion—growth by gradual external addition.

Activity—an individual scheduled training function or action such as missile launching, bombardment, vehicle driving, or Field Carrier Landing Practice.

Advisory Council on Historic Preservation—a 19-member body appointed, in part, by the President of the United States to advise the President and Congress and to coordinate the actions of Federal agencies on matters relating to historic preservation, to comment on the effects of such actions on historic and archaeological cultural resources, and to perform other duties as required by law (Public Law 89-655; 16 United States Code 470).

Aeronautical Chart—a map used in air navigation containing all or part of the following: topographic features, hazards and obstructions, navigation aids, navigation routes, designated airspace, and airports.

Aesthetic—a pleasing appearance, effect, or quality that allows appreciation of character-defining features, such as of the landscape.

Air Basin—a region within which the air quality is determined by the meteorology and emissions within it with minimal influence on and impact by contiguous regions.

Air Defense Identification Zone—the area of airspace over land or water, extending upward from the surface, within which the ready identification, the location, and the control of aircraft are required in the interest of national security.

Air Route Traffic Control Center (ARTCC)—a facility established to provide air traffic control service to aircraft operating on Instrument Flight Rules flight plans within controlled airspace and principally during the en route phase of flight. When equipment capabilities and controller workload permit, certain advisory/assistance services may be provided to aircraft operating under Visual Flight Rules.

Air Traffic Control—a service operated by appropriate authority to promote the safe, orderly, and expeditious flow of air traffic.

Air Traffic Control Assigned Airspace (ATCAA)—Federal Aviation Administration-defined airspace not over an Operating Area (OPAREA) within which specified activities, such as military flight training, are segregated from other Instrument Flight Rules air traffic.

Airfield—usually an active and/or inactive airfield, or infrequently used landing strip, with or without a hard surface, without Federal Aviation Administration-approved instrument approach procedures. An airfield has no control tower and is usually private.

Airport—usually an active airport with hard-surface runways of 3,000 feet or more, with Federal Aviation Administration approved instrument approach procedures regardless of runway length or composition. An airport may or may not have a control tower. Airports may be public or private.

Airspace, Controlled—airspace of defined dimensions within which air traffic control service is provided to Instrument Flight Rules flights and to Visual Flight Rules flights in accordance with the airspace classification. Controlled airspace is divided into five classes, dependent upon location, use, and degree of control: Class A, B, C, D, and E.

Airspace, Special Use—airspace of defined dimensions identified by an area on the surface of the earth wherein activities must be confined because of their nature and/or wherein limitations may be imposed upon non-participating aircraft.

Airspace, Uncontrolled—uncontrolled airspace, or Class G airspace, has no specific definition but generally refers to airspace not otherwise designated and operations below 1,200 feet above ground level. No air traffic control service to either Instrument Flight Rules or Visual Flight Rules aircraft is provided other than possible traffic advisories when the air traffic control workload permits and radio communications can be established.

Airspace—the space lying above the earth or above a certain land or water area (such as the Atlantic Ocean); more specifically, the space lying above a nation and coming under its jurisdiction.

Airway—Class E airspace established in the form of a corridor, the centerline of which is defined by radio navigational aids.

Alert Area—a designated airspace in which flights are not restricted but there is concentrated student training or other unusual area activity of significance.

Alkaline—basic, having a pH greater than 7.

Alluvium—a general term for clay, silt, sand, gravel, or similar unconsolidated material deposited during comparatively recent geologic time by a stream or other body of running water as a sorted or semi-sorted sediment in the bed of the stream or on its floodplain or delta, or as a cone or fan at the base of a maintained slope.

Altitude Reservation—altitude reservation procedures are used as authorization by the Central Altitude Reservation Function, an air traffic service facility, or appropriate air route traffic control center, under certain circumstances, for airspace utilization under prescribed conditions.

Aluminum Oxide (Al_2O_3)—a common chemical component of missile exhaust. Under natural conditions, the chemical is not a source of toxic aluminum; the U.S. Environmental Protection Agency has determined that nonfibrous Al_2O_3, as found in solid rocket motor exhaust, is nontoxic.

Ambient Air Quality Standards—legal limitations on pollutant concentration levels allowed to occur in the ambient air established by the U.S. Environmental Protection Agency or state agencies. Primary ambient air quality standards are designed to protect public health with an adequate margin of safety. Secondary ambient air quality standards are designed to protect public welfare-related values including property, materials, and plant and animal life.

Ambient Air—that portion of the encompassing atmosphere, external to buildings, to which the general public has access.

Amplitude—the maximum departure of the value of a sound wave from the average value.

Anthropogenic—human-related.

Applications of Offensive Military Power—the ability to employ various means of destructive and/or disruptive force which a Naval unit/Strike Group can apply against an opponent at a given time.

Aquaculture—the cultivation of the natural produce of water, such as fish or shellfish.

Archaeology—a scientific approach to the study of human ecology, cultural history, prehistory and cultural processes, emphasizing systematic interpretation of material remains.

Area of Potential Effect—the geographic area within which direct and indirect impacts generated by the Proposed Action and alternatives could reasonably be expected to occur and thus cause a change in historic, architectural, archaeological, or cultural qualities possessed by the property.

Artifact—any thing or item that owes its shape, form, or placement to human activity. In archaeological studies, the term is applied to portable objects (*e.g.*, tools and the by-products of their manufacture).

Attainment Area—an air quality control region that has been designated by the U.S. Environmental Protection Agency and the appropriate state air quality agency as having ambient air quality levels as good as or better than the standards set forth by the National Ambient Air Quality Standards, as defined in the Clean Air Act. A single geographic area may have acceptable levels of one criteria air pollutant, but unacceptable levels of another; thus, an area can be in attainment and non-attainment status simultaneously.

Average Daily Traffic (ADT)—the total volume of traffic passing a given point or segment of a roadway in both directions divided by a set number of days.

A-weighted Sound Level—a number representing the sound level which is frequency-weighted according to a prescribed frequency response established by the American National Standards Institute (ANS1.4-19711) and accounts for the response of the human ear.

Azimuth—a distance in angular degrees in a clockwise direction from the north point.

Backyard Range—a range within a radius of one hour's drive (50-65 miles) of a unit, such that training there can be considered non-deployed for personnel tempo (PERSTEMPO) purposes.

Benthic Communities—of or having to do with populations of bottom-dwelling flora or fauna of oceans, seas, or the deepest parts of a large body of water.

Benthopelagic—living and feeding near the sea floor as well as in midwaters or near the surface.

Benthos—the sea floor.

Bioaccumulation—building up of a substance, such as PCBs, in the systems of living organisms (and thus, a food web) due to ready solubility in living tissues.

Biological Diversity—the complexity and stability of an ecosystem, described in terms of species richness, species evenness, and the direct interaction between species such as competition and predation.

Biological Resources—a collective term for native or naturalized vegetation, wildlife, and the habitats in which they occur.

Booster—an auxiliary or initial propulsion system that travels with a missile or aircraft and that may not separate from the parent craft when its impulse has been delivered; may consist of one or more units.

Brackish—slightly salty; applicable to waters whose saline content is intermediate between that of streams and sea water.

Calcareous—containing calcium carbonate.

Candidate Species—a species of plant or animal for which there is sufficient information to indicate biological vulnerability and threat, and for which proposing to list as "threatened" or "endangered" is or may be appropriate.

Carbon Dioxide—a colorless, odorless, incombustible gas which is a product of respiration, combustion, fermentation, decomposition and other processes, and is always present in the atmosphere.

Carbon Monoxide—a colorless, odorless, poisonous gas produced by incomplete fossil-fuel combustion; it is one of the six pollutants for which there is a national ambient standard (see Criteria Pollutants).

CATM-9—Captive Carry Training Missile (Sidewinder). Used for pilot training in aerial target acquisition and use of aircraft controls/displays. All components are inert.

Carrier Strike Group Composite Training Unit Exercise (CSG COMPTUEX) —an Integrated Phase, at-sea, major range event that integrates the aircraft carrier and carrier air wing with surface and submarine units in a challenging environment. Commander Strike Force Training Atlantic schedules and conducts the CSG COMPTUEX in accordance with a schedule of events plan. It is nominally 26 days long with two scenario-driven "mini" multi-threat battle problems, one that is about 24 hours long and the other about 18 hours long. Typically, live-fire operations that take place during COMPTUEX include long-range air strikes, naval surface fire support, and other surface gunnery and missile exercises.

Cetacean—an order of aquatic, mostly marine, animals including the whales, dolphins, porpoise, and related forms with large head, fishlike nearly hairless body, and paddle-shaped forelimbs.

Class A Airspace (also Positive Controlled Area)—airspace designated in Federal Aviation Administration Regulation Part 71 within which there is positive control of aircraft

Coastal Zone—a region beyond the littoral zone occupying the area near the coastline in depths of water less than 538.2 feet. The coastal zone typically extends from the high tide mark on the land to the gently sloping, relatively shallow edge of the continental shelf. The sharp increase in water depth at the edge of the continental shelf separates the coastal zone from the offshore zone. Although comprising less than 10 percent of the ocean's area, this zone contains 90 percent of all marine species and is the site of most large commercial marine fisheries. This may differ from the way the term "coastal zone" is defined in the State Coastal Zone Management Program (Hawaii Revised Statutes Chapter 205 A).

Community—an ecological collection of different plant and animal populations within a given area or zone.

Component (Cultural Resources)—a location or element within a settlement or subsistence system. Archaeological sites may contain several components that reflect the use of the locality by different groups in different time periods.

Continental Shelf—a shallow submarine plain of varying width forming a border to a continent and typically ending in a steep slope to the oceanic abyss.

Continental Slope—the steep slope that starts at the shelf break about 492 to 656 feet and extends down to the continental rise of the deep ocean floor.

Continental United States (CONUS)—the United States and its territorial waters between Mexico and Canada, but excluding overseas states.

Control Area (CTA)—a controlled airspace extending upwards from a specified limit above the earth.

Controlled Access—area where public access is prohibited or limited due to periodic training operations or sensitive natural or cultural resources.

Controlled Airspace—airspace of defined dimensions within which air traffic control service is provided to Instrument Flight Rules flights and to Visual Flight Rules flights in accordance with the airspace classification. Controlled airspace is divided into five classes, dependent upon location, use, and degree of control: Class A, B, C, D, and E.

Controlled Firing Area (CFA)—airspace wherein activities are conducted under conditions so controlled as to eliminate hazards to non-participating aircraft and to ensure the safety of persons and property on the ground.

Copepod—a small, shrimp-like crustacean.

Coral Reef—a calcareous organic area composed of solid coral and coral sand.

Council on Environmental Quality (CEQ)—established by the National Environmental Policy Act, the CEQ consists of three members appointed by the President. A CEQ regulation (Title 40 Code of Federal Regulations 1500-1508, as of July 1, 1986) describes the process for implementing the National Environmental Policy Act, including preparation of environmental assessments and environmental impact statements, and the timing and extent of public participation.

Co-Use—Scheduled uses that safely allow other units to transit the area or conduct activities.

Criteria Pollutants—pollutants identified by the U.S. Environmental Protection Agency (required by the Clean Air Act to set air quality standards for common and widespread pollutants); also established under state ambient air quality standards. There are standards in effect for six criteria pollutants: sulfur dioxide, carbon monoxide, particulate matter, nitrogen dioxide, ozone, and lead.

Cultural Resources—prehistoric and/or historic sites, structures, districts, artifacts, or any other physical evidence of human activity considered of importance to a culture, subculture, or community for scientific, traditional, religious, or any other reason.

Culture—a group of people who share standards of behavior and have common ways of interpreting the circumstances of their lives.

Cumulative Impact—the impact of the environment which results from the incremental impact of the action when added to the other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

Current—a horizontal movement of water or air.

C-weighted—utilized to determine effects of high-intensity impulsive sound on human populations, a scale providing unweighted sound levels over a frequency range of maximum human sensitivity.

Danger Area—(1) In air traffic control, an airspace of defined dimensions within which activities dangerous to the flight of aircraft may exist at specified times; (2) (DoD only) A specified area above, below, or within which there may be potential danger.

Decibel (dB)—the accepted standard unit of measure for sound pressure levels. Due to the extremely large range of measurable sound pressures, decibels are expressed in a logarithmic scale.

Degradation—the process by which a system will no longer deliver acceptable performance.

Demersal—living close to the seafloor.

Direct Effects—immediate consequences of program activities.

Direct Impact—effects resulting solely from program implementation.

District—National Register of Historic Places designation of a geographically defined area (urban or rural) possessing a significant concentration, linkage, or continuity of sites, structures, or objects united by past events (theme) or aesthetically by plan of physical development.

Diurnal—active during the daytime.

Dunes—hills and ridges of sand-size particles (derived predominantly from coral and seashells) drifted and piled by the wind. These dunes are actively shifting or are so recently fixed or stabilized that no soil horizons develop; their surface typically consists of loose sand.

Easement—a right of privilege (agreement) that a person or organization may have over another's property; an interest in land owned by another that entitles the holder of the easement to a specific limited use; a recorded right of use by the United States over property of the State of Hawaii to limit exposure to safety hazards.

Ecosystem—all the living organisms in a given environment with the associated non-living factors.

Effects—a change in an attribute, which can be caused by a variety of events, including those that result from program attributes acting on the resource attribute (direct effect); those that do not result directly from the action or from the attributes of other resources acting on the attribute being studied (indirect effect); those that result from attributes of other programs or other attributes that change because of other programs (cumulative impacts); and those that result from natural causes (for example, seasonal change).

Effluent—an outflowing branch of a main stream or lake; waste material (such as smoke, liquid industrial refuse, or sewage) discharged into the environment.

Electromagnetic Radiation (EMR)—waves of energy with both electric and magnetic components at right angles to one another.

Electronic Countermeasures (ECM)—includes both active jamming and passive techniques. Active jamming includes noise jamming to suppress hostile radars and radios, and deception jamming, intended to mislead enemy radars. Passive ECM includes the use of chaff to mask targets with multiple false echoes, as well as the reduction of radar signatures through the use of radar-absorbent material and other stealth technologies.

En Route Airways—a low-altitude (up to, but not including 5,486.4 meters [18,000 feet] mean sea level) airway based on a center line that extends from one navigational aid or intersection to another navigational aid (or through several navigational aids and intersections) specified for that airway.

En Route Jet Routes—high altitude (above 18,000 feet mean sea level) airway based on a center line that extends from one navigational aid or intersection to another navigational aid (or through several navigational aids and intersections) specified for that airway.

Encroachment—the placement of an unauthorized structure or facility on someone's property or the unauthorized use of property.

Endangered Species—a plant or animal species that is threatened with extinction throughout all or a significant portion of its range.

Endemic—plants or animals that are native to an area or limited to a certain region.

Environmental Justice—an identification of potential disproportionately high and adverse impacts on low-income and/or minority populations that may result from proposed federal actions (required by Executive Order 12898).

Epibenthic—living on the ocean floor.

Epipelagic—living in the ocean zone from the surface to 109 fathoms (656 feet).

Erosion—the wearing away of a land surface by water, wind, ice, or other geologic agents.

Estuary—a water passage where the tide meets a river current; an arm of the sea at the lower end of a river; characterized by brackish water.

Event—a significant operational employment during which training is accomplished. "Event" is a Navy approved employment schedule term. The event may be primarily designated as operational, such as TRANSIT, MIO, or STRIKEOPS during which training may take place. Training events may be periods of operational employment that are also considered major training events such as Composite Training Unit Exercise (COMPTUEX), Joint Training Fleet Exercise (JTFEX), or other exercises such as BRIGHT STAR, COBRA GOLD, or UNIFIED ENDEAVOR.

Exclusive Use—scheduled solely for the assigned unit for safety reasons.

Exotic—not native to an area.

Expanded Warfare Mission—conducting training in a mission area not previously conducted in the range complex, either because it is a new mission area (training associated with MS SSG and OMCM) or it is a pre-existing mission area not previously conducting in a particular range complex but because of force structure changes, will start up in the foreseeable future (CSAR training in VACAPES Range Complex, previously done primarily in JAX Range Complex).

Expeditionary Strike Group Composite Training Unit Exercise (ESG COMPTUEX)—an Integrated Phase, at-sea, major range event that is a standard part of every Marine Expeditionary Unit (MEU)'s pre-deployment training program and lasts for about 18 days. The exercise centers on situational training exercises in which the MEU is issued a series of orders that are designed to replicate the types of missions they are likely to face during their deployment. The MEU then quickly plans and executes the missions to test their rapid-response capabilities. Typically, the first half of the ESG COMPTUEX focuses on preparing the amphibious ships of the ESG for the missions they will perform while on deployment. The embarked Marines normally launch ship-to-shore raids and conduct urban-combat training at areas ashore. Over the next several days, the MEU's equipment and its ground combat element are loaded into the amphibious ships of the ESG by landing craft from the beach.

Explosive Ordnance Disposal (EOD)—the process of recovering and neutralizing domestic and foreign conventional, nuclear and chemical/biological ordnance and improvised explosive devices; a procedure in Explosive Ordnance Management.

Explosive Safety Quantity-Distance (ESQD)—the quantity of explosive material and distance separation relationships providing defined types of protection based on levels of risk considered acceptable.

Facilities—physical elements that can include roads, buildings, structures, and utilities. These elements are generally permanent or, if temporary, have been placed in one location for an extended period of time.

Fathom—a unit of length equal to 6 feet; used to measure the depth of water.

Feature—in archaeology, a non-portable portion of an archaeological site, including such facilities as fire pits, storage pits, stone circles, or foundations.

Federal Candidate Species—taxa for which the U.S. Fish and Wildlife Service has on file sufficient information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened species.

Fee Simple Land—land held absolute and clear of any condition or restriction, and where the owner has unconditional power of disposition.

Feral—having escaped from domestication and become wild.

Fleet Area Control and Surveillance Facility (FACSFAC)—Navy facility that provides air traffic control services and controls and manages Navy-controlled offshore operating areas and instrumented ranges.

Fleet Response Training Plan (FRTP)—the 27-month cycle that replaces the Interdeployment Training Cycle. The FRTP includes four phases prior to deployment: Maintenance, Unit Level Training, Integrated Training, and Sustainment.

Fleet Response Plan/Fleet Readiness Program (FRP)—the Fleet Response Plan was the Navy's response to the 2002/2003 international situations in Afghanistan and Iraq. The Fleet Readiness Program was later developed by the Fleet commanders. Both names refer to the same operational construct. The FRP is designed to more rapidly develop and then sustain readiness in ships and squadrons so that, in a national crisis or contingency operation, the Navy can quickly surge significant combat power to the scene.

Flight Information Region (FIR)—an airspace of defined dimensions within which flight information service and alerting service are provided. Flight information service is provided for the purpose of giving advice and information useful for the safe and efficient conduct of flights, and alerting service is provided to notify appropriate organizations regarding aircraft in need of search and rescue aid and to assist such organizations as required.

Flight Level—a level of constant atmospheric pressure related to a reference datum of 29.92 inches of mercury stated in three digits that represent hundreds of feet. For example, flight level 250 represents a barometric altimeter indication of 25,000 feet; flight level 255 represents an indication of 25,500 feet.

Flight Termination—action taken in certain post-launch situations, such as a missile veering off of its predicted flight corridor; accomplished by stopping the propulsive thrust of a rocket motor via explosive charge. At this point, the missile continues along its current path, falling to earth under gravitational influence.

Floodplain—the lowland and relatively flat areas adjoining inland and coastal waters including flood prone areas of offshore islands; includes, at a minimum, that area subject to 1 percent or greater chance of flooding in any given year (100-year floodplain).

Force Structure Changes—improvements and/or modifications to Naval operational forces based on personnel changes, equipment/platform upgrades and weapons modernization.

Free Flight—a joint initiative of the aviation industry and the Federal Aviation Administration to allow aircraft to take advantage of advanced satellite voice and data communication to provide faster and more reliable transmission to enable reductions in vertical, lateral, and longitudinal separation of aircraft, more direct flights and tracts, and faster altitude clearance. It will allow pilots, whenever practicable, to choose their own route and file a flight plan that follows the most efficient and economical route, rather than following the published preferred instrument flight rules routes.

Frequent User—a unit that conducts training and exercises in the training areas on a regular basis but does not maintain a permanent presence.

Fugitive Dust—any solid particulate matter that becomes airborne, other than that emitted from an exhaust stack, directly or indirectly as a result of the activities of man. Fugitive dust may include emissions from haul roads, wind erosion of exposed soil surfaces, and other activities in which soil is either removed or redistributed.

Global Commons—Areas established by treaty or recognized under customary international law that are beyond the territorial jurisdiction of any nation. The High Seas (Global Commons) do not include EEZs established and recognized under international law as set forth in reference (i). In addition, although the Antarctica continental land mass is part of the global commons, by court decision, NEPA (and not E.O. 12114), applies to U.S. actions that would impact the environment of the continental land mass of Antarctica.

Ground Hazard Area—the land area contained in an arc within which all debris from a terminated launch will fall. For example, the arc for a Strategic Target System launch is described such that the radius is approximately 10,000 feet to the northeast, 9,100 feet to the east, and 9,000 feet to the south of the launch point. For the Vandal launch, the arc is 6,000 feet.

Groundwater Table—the highest part of the soil or underlying rock material that is wholly saturated with water.

Groundwater—water within the earth that supplies wells and springs; specifically, water in the zone of saturation where all openings in rocks and soil are filled, the upper surface of which forms the water table.

Habitat—the area or type of environment in which a species or ecological community normally occurs.

Hazardous Air Pollutants—other pollutants, in addition to those addressed by the NAAQS, that present the threat of adverse effects to human health or to the environment as covered by Title III of the Clean Air Act. Incorporates, but is not limited to, the pollutants controlled by the National Emissions Standards for Hazardous Air Pollutants program.

Hazardous Material—generally, a substance or mixture of substances capable of either causing or significantly contributing to an increase in mortality or an increase in serious irreversible or incapacitating reversible illness; it may pose a threat or a substantial present or potential risk to human health or the environment. Hazardous material use is regulated by the U.S. Department of Transportation, the Occupational Safety and Health Administration, and the Emergency Right-to-Know Act.

Hazardous Waste—a waste, or combination of wastes, which, because of its quantity, concentration, or physical, chemical, or infectious characteristics, may either cause or significantly contribute to an increase in mortality or an increase in serious irreversible illness or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

Hertz (Hz)—the standard radio equivalent of frequency in cycles per second of an electromagnetic wave. Kilohertz (kHz) is a frequency of 1,000 cycles per second. Megahertz (MHz) is a frequency of 1 million cycles per second.

High Explosive—used when describing explosive ordnance, *i.e.*, ordnance typically used in combat or possessing same or similar explosive-filler as combat ordnance; example - 20MM through 2,000LB MK-80 series HE.

Historic Properties—under the National Historic Preservation Act, these are properties of national, state, or local significance in American history, architecture, archaeology, engineering, or culture, and worthy of preservation

Host—the Facilities Host holds plant account of all Class I (Land) and most Class II (Buildings) property. The Operational Host determines and executes operational policy for the range/range complex.

Hydraulic Conductivity—the rate in gallons per day water flow through a cross section of one square foot under a unit hydraulic gradient, at the prevailing temperature.

Hydrocarbons—any of a vast family of compounds containing hydrogen and carbon, including fossil fuels.

Hydrochloric Acid—a common chemical component of missile exhaust believed to injure plant leaves and affect wildlife.

Hydrology—the science dealing with the properties, distribution, and circulation of water on the face of the land (surface water) and in the soil and underlying rocks (groundwater).

Hydrophone—an instrument for listening to sound transmitted through water.

Impact Area—the identified area within a range intended to capture or contain ammunition, munitions, or explosives and resulting debris, fragments, and components from various weapon system employments.

Impacts (effects)—an assessment of the meaning of changes in all attributes being studied for a given resource; an aggregation of all the adverse effects, usually measured using a qualitative and nominally subjective technique. In this Environmental Impact Statement, as well as in the Council on Environmental Quality regulations, the word impact is used synonymously with the word effect.

Implementing Enhanced Range Complex Capabilities—warfare training and doctrine improvements that result from the modernization and replacement of range support infrastructure and instrumentation at Naval air, sea and subsurface tactical ranges.

Indurated—rendered hard, as in dunes where surface sand is loose, but subsurface areas become increasingly compact (see lithified).

Infrastructure—the system of public works of a country, state, or region, such as utilities or communication systems; physical support systems and basic installations needed to operate a particular area or facility.

Inhibited Red Fuming Nitric Acid (IRFNA)—a liquid hypergolic propellant utilized as an oxidizer (as in the Lance). This reddish-brown acid is highly corrosive, spontaneously reacting with UDMH and certain other organic substances. It also dissolves in water, and care must be taken regarding its induced boiling effects. Its highly toxic, characteristically pungent vapors irritate skin and eyes.

In-Shore—lying close to the shore or coast.

Instrument Flight Rules (IFR)—rules governing the procedures for conducting instrument flight; it is a term used by pilots and controllers to indicate type of flight plan.

Interdeployment Readiness Cycle—the period by which Naval units progress through maintenance/unit level training, integrated training, and sustainment training stages prior to being deployed with the Fleet to support the gaining CINC.

Intermittent User—a unit that conducts training and exercises in the training areas throughout the year, but not on a regularly scheduled basis, and does not maintain a permanent presence.

International Waters—sea areas beyond 12 nm of the U.S. shoreline.

Intertidal Zone—occupies the space between high and low tide, also referred to as the littoral zone; found closest to the coastal fringe and thus only occurring in shallow depths.

Ionizing Radiation—particles or photons that have sufficient energy to produce direct ionization in their passage through a substance. X-rays, gamma rays, and cosmic rays are forms of ionizing radiation.

Isobath—the line on a marine map or chart joining points of equal depth, usually in fathoms below mean sea level.

Jet Routes—a route designed to serve aircraft operating from 5,486 meters (18,000 feet) up to and including flight level 450, referred to as J routes with numbering to identify the designated route.

Joint Task Force Exercise (JTFEX) —a scenario-driven, sea control, power projection exercise with the purpose of evaluating the readiness of naval forces and testing the interoperability and proficiency of these forces in realistic scenarios ranging from military operations other than war to armed conflict. JTFEX typically encompasses operations from in port to sea-air-land combat, to special warfare, to humanitarian assistance operations. JTFEX is a dynamic and complex major range event that is the culminating exercise in the Sustainment Phase training for the Carrier Strike Group (CSG) or Expeditionary Strike Group (ESG). JTFEX is nominally 10 days long, not including a 3-day in port Force Protection Exercise, and can be the last at-sea exercise for the CSG prior to deployment.

Land/Sea Use—the exclusive or prioritized commitment of a land/sea area, and any targets, systems, and facilities therein, to a continuing purpose that could include a grouping of operations, buffer zone, environmental mitigation, *etc*. The land/sea area may consist of a range/range complex, grouping of similar facilities, or natural resource-based area with no facilities.

Lead—a heavy metal which can accumulate in the body and cause a variety of negative effects; one of the six pollutants for which there is a national ambient air quality standard (see Criteria Pollutants).

Lead-based Paint—paint on surfaces with lead in excess of 1.0 milligram per square centimeter as measured by X-ray fluorescence detector, or 0.5 percent lead by weight.

Leptocephalic—small, elongate, transparent, planktonic.

Level of Service (LOS)—describes operational conditions within a traffic stream and how they are perceived by motorists and/or passengers; a monitor of highway congestion that takes into account the average annual daily traffic, the specified road segment's number of lanes, peak hour volume by direction, and the estimated peak hour capacity by a roadway's functional classification, area type, and signal spacing.

Lithified—the conversion of a newly deposited sediment into an indurated rock.

Littoral—species found in tide pools and near-shore surge channels.

Loam—a loose soil composed of a mixture of clay, silt, sand, and organic matter.

Long-Term Sustainability of Department of Defense Ranges—the ability to indefinitely support national security objectives and the operational readiness of the Armed Forces, while still protecting human health and the environment.

Major Exercise—a significant operational employment of live, virtual, and/or constructive forces during which live training is accomplished. A Major Exercise includes multiple training objectives, usually occurring over an extended period of days or weeks. An exercise can have multiple training operations (sub-events each with its own mission, objective and time period. Examples include C2X, JTFEX, SACEX, and CAX. Events (JTFEX) are composed of specific operations (*e.g.*, Air-to-Air Missile), which consist of individual activities (*e.g.*, missile launch).

Maneuver Area—range used for maneuver element training.

Maneuver Element—basic element of a larger force independently capable of maneuver. Normally, a Marine Division recognizes its infantry battalions, tank battalion, and light armored reconnaissance (LAR) battalion as maneuver elements. A rifle (or tank/LAR) battalion would recognize its companies as maneuver elements. A rifle (or tank/LAR) company would recognize its platoons as maneuver elements. Maneuver below the platoon level is not normally possible since fire and movement can be combined only at the platoon level or higher. The Army and National Guard recognize a squad and platoon as maneuver elements.

Maneuver—employment of forces on the battlefield through movement in combination with fire, or fire potential, to achieve a position of advantage with respect to the enemy in order to accomplish the mission.

Marine Corps Ground Unit—Marine Expeditionary Unit Ground Combat Element, or Battalion Landing Team, composed of an infantry battalion of about 1,200 personnel reinforced with artillery, amphibious assault vehicles, light armored reconnaissance assets and other units as the mission and circumstances require. (The analysis will scale units of different size or composition from this Battalion Landing Team standard unit to include a 12-man Special Operations platoon.)

Maritime—of, relating to, or bordering on the sea.

Material Safety Data Sheet—presents information, required under Occupational Safety and Health Act standards, on a chemical's physical properties, health effects, and use precautions.

Medical Evacuation—emergency services, typically aerial, designed to remove the wounded or severely ill to medical facilities.

Mesopelagic—the oceanic zone from 109 to 547 fathoms (656 to 3,280 feet).

Migration—repeated departure and return of individuals and their offspring to and from an area.

Migratory Birds—birds characterized by their practice of passing, usually periodically, from one region or climate to another.

Military Operating Area—airspace below 18,000 feet used to separate or segregate certain non-hazardous military flight activities from Instrument Flight Rules traffic and to identify for Visual Flight Rules traffic where these activities are conducted.

Military Training Route—an airspace corridor established for military flight training at airspeeds in excess of 250 nautical miles/hour.

Minority—minority populations, as reported by the 2000 Census of Population and Housing, includes Black, American Indian, Eskimo or Aleut, Asian or Pacific Islander, Hispanic, or other.

Mitigation—a method or action to reduce or eliminate adverse environmental impacts. Such measures may avoid impacts by not taking a certain action or parts of an action; minimize impacts by limiting the magnitude of an action; rectify impacts by restoration measures; reduce or eliminate impacts over time by preservation or maintenance measures during the action; or compensate for impacts by replacing or providing substitute resources or environments.

Mobile Sources—any movable source that emits any regulated air pollutant.

Mortality—the number of deaths in a given time or place.

Munitions Constituents—any material originating from unexploded ordnance, discarded military munitions, or other military munitions, including explosive and non-explosive material, and emission, degradation, or breakdown elements of such ordnance or munitions.

National Airspace System—the common network of U.S. airspace; air navigation facilities, equipment and services, airports or landing areas; aeronautical charts, information and services; rules, regulations and procedures, technical information, and manpower and material. Included are system components shared jointly with the military.

National Ambient Air Quality Standards (NAAQS)—as set by the Environmental Protection Agency under Section 109 of the Clean Air Act, nationwide standards for limiting concentrations of certain widespread airborne pollutants to protect public health with an adequate margin of safety (primary standards) and to protect public welfare, including plant and animal life, visibility and material (secondary standards). Currently, six pollutants are regulated by primary and secondary NAAQS: carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter, and sulfur dioxide (see Criteria Pollutants).

National Environmental Policy Act (NEPA)—Public Law 91-190, passed by Congress in 1969. The Act established a national policy designed to encourage consideration of the influences of human activities, such as population growth, high-density urbanization, or industrial development, on the natural environment. The National Environmental Policy Act procedures require that environmental information be made available to the public before decisions are made. Information contained in the National Environmental Policy Act documents must focus on the relevant issues in order to facilitate the decision-making process.

National Register of Historic Places Eligible Property—property that has been determined eligible for the National Register of Historic Places listing by the Secretary of the Interior, or one that has not yet gone through the formal eligibility determination process but which meets the National Register of Historic Places criteria for section review purposes; eligible properties are treated as if they were already listed.

National Register of Historic Places—a register of districts, sites, buildings, structures, and objects important in American history, architecture, archaeology, and culture, maintained by the Secretary of the Interior under authority of Section (b) of the Historic Sites Act of 1935 and Section 101 (a)(1) of the National Historic Preservation Act of 1966, as amended.

National Wildlife Refuge—a part of the national network of refuges and wetlands managed by the U.S. Fish and Wildlife Service in order to provide, preserve, and restore lands and waters sufficient in size, diversity and location to meet society's needs for areas where the widest possible spectrum of benefits associated with wildlife and wildlands is enhanced and made available. This includes 504 wildlife refuges nationwide encompassing 92 million acres and ranging in size from one-half acre to thousands of square miles. Dedicated to protecting wildlife and their habitat, U.S. refuges encompass numerous ecosystems and are home to a wide variety of fauna, including large numbers of migratory birds and some 215 threatened or endangered species.

Native Americans—used in a collective sense to refer to individuals, bands, or tribes who trace their ancestry to indigenous populations of North America prior to Euro-American contact.

Native Species—plants or animals living or growing naturally in a given region and often referred to as indigenous.

Native Vegetation—often referred to as indigenous, these are plants living or growing naturally in a given region without agricultural or cultivational efforts.

Navigational Aid—any visual or electronic device, airborne or on the surface, which provides point-to-point guidance information or position data to aircraft in flight.

Near-Shore—an indefinite zone that extends seaward from the shoreline.

Neritic—relating to the shallow ocean waters, usually no deeper than 109 fathoms (656 feet).

Nitrogen Dioxide—gas formed primarily from atmospheric nitrogen and oxygen when combustion takes place at high temperatures.

Nitrogen Oxides—gases formed primarily by fuel combustion and which contribute to the formation of acid rain. In the presence of sunlight, hydrocarbons and nitrogen oxides combine to form ozone, a major constituent of photochemical smog.

Nitrogen Tetroxide—a dark brown, fuming liquid or gas with a pungent, acrid odor, utilized in rocket fuels.

Nonattainment Area—an area that has been designated by the U.S. Environmental Protection Agency or the appropriate state air quality agency as exceeding one or more of the national or state ambient air quality standards.

Non-directional Radio Beacon—a radio beacon transmitting non-directional signals whereby the pilot of an aircraft equipped with direction finding equipment can determine the aircraft's bearing to or from the radio beacon and “home” on or track to or from the station.

Non-explosive, Practice Munitions (NEPM)—used when describing most common types of practice ordnance. Non-explosive practice munitions have no explosive filler but may contain spotting charges or signal cartridges for impact locating purposes (smoke charges for daylight spotting, flash charges for night spotting); example - MK-76, BDU-45. Some non-explosive, practice munitions may also contain unburned propellant (such as rockets).

Non-ionizing Radiation—electromagnetic radiation at wavelengths whose corresponding photon energy is not high enough to ionize an absorbing molecule. All radio frequency, infrared, visible, and near ultraviolet radiation are non-ionizing.

Non-Point Source Pollution—diffuse pollution; that is, from a combination of sources; typically originates from rain and melted snow flowing over the land (runoff). As runoff contacts the land's surface, it picks up many pollutants in its path: sediment, oil and grease, road salt, fertilizers, pesticides, nutrients, toxics, and other contaminants. Runoff also originates from irrigation water used in agriculture and on landscapes. Other types of non-point pollution include changes to the natural flow of water in stream channels or wetlands.

Notice to Airmen (NOTAM)—a notice containing information, not known sufficiently in advance to publicize by other means, the establishment, condition, or change in any component (facility, service, or procedure of, or hazard in the National Airspace System), the timely knowledge of which is essential to personnel concerned with flight operations.

Notice to Mariners (NOTMAR)—a periodic notice regarding changes in aids to navigation, dangers to navigation and other information essential to mariners.

Offshore—open-ocean waters over the continental slope which are deeper than 200 meters, beyond the continental shelf break.

Operating Area (OPAREA)—ocean area not part of a range used by military personnel or equipment for training and weapons system Research, Development, Test & Evaluation (RDT&E).

Operation—A combination of activities accomplished together for a scheduled period of time for an intended military mission or task. An operation can range in size from a single unit exercise to a Joint or Combined event with many participants (*e.g.*, aircraft, ships, submarines, troops).

Operational Range—a range that is under the jurisdiction, custody, or control of the Secretary of Defense and is used for range activities; or although not currently being used for range activities, that is still considered by the Secretary to be a range and has not been put to a new use that is incompatible with range activities.

Ordnance—military supplies including weapons, ammunition, combat vehicles, and maintenance equipment.

OTTO Fuel—a torpedo fuel.

Ozone (O_3)—a highly reactive form of oxygen that is the predominant component of photochemical smog and an irritating agent to the respiratory system. Ozone is not emitted directly into the atmosphere but results from a series of chemical reactions between oxidant precursors (nitrogen oxides and volatile organic compounds) in the presence of sunlight.

Ozone Layer—a naturally occurring layer of ozone 7 to 30 miles above the earth's surface (in the stratosphere) which filters out the sun's harmful ultraviolet radiation. It is not affected by photochemical smog found in the lower atmosphere, nor is there any mixing between ground level ozone and ozone in the upper atmosphere.

Paleontological Resources—fossilized organic remains from past geological periods.

Paleontology—the study of life in the past geologic time, based on fossil plants and animals.

Participant—an individual ship, aircraft, submarine, amphibious vehicle, or ground unit.

Particulate Matter, Fine Respirable—finely divided solids or liquids less than 10 microns in diameter which, when inhaled, remain lodged in the lungs and contribute to adverse health effects.

Particulate Matter, Total Suspended—finely divided solids or liquids ranging from about 0.1 to 50 microns in diameter which comprise the bulk of the particulate matter mass in the atmosphere.

Particulate Matter—particles small enough to be airborne, such as dust or smoke (see Criteria Pollutants).

Payload—any non-nuclear and possibly propulsive object or objects, weighing up to 272.2 kilograms (600 lbs), which are carried above the Strategic Target System third stage.

Pelagic Zone—commonly referred to as the open ocean.

Pelagic—of the ocean waters.

Peninsula—a portion of land nearly surrounded by water and generally connected with a larger body by an isthmus, although the isthmus is not always well defined.

Per Capita—per unit of population; by or for each person.

Permeability—a quality that enables water to penetrate.

Pesticide—any substance, organic, or inorganic, used to destroy or inhibit the action of plant or animal pests; the term thus includes insecticides, herbicides, fungicides, rodenticides, miticides, fumigants, and repellents. All pesticides are toxic to humans to a greater or lesser degree. Pesticides vary in biodegradability.

pH—a measure of the acidity or alkalinity of a solution, numerically equal to 7 for neutral solutions, increasing with increasing alkalinity and decreasing with increasing acidity.

Photosynthesis—the plant process by which water and carbon dioxide are used to manufacture energy-rich organic compounds in the presence of chlorophyll and energy from sunlight.

Physiography—geography dealing with the exterior physical features and changes of the earth (also known as physical geography).

Phytoplankton—plant-like organisms that drift with the ocean currents, with little ability to move through the water on their own. Predominately one-celled, phytoplankton float in the photic zone (sunlit surface waters of the ocean, which extends to only about 100 meters (330 feet) below the surface), where they obtain sunlight and nutrients, and serve as food for zooplankton and certain larger marine animals.

Pinniped—having finlike feet or flippers, such as a seal or walrus.

Plankton—free-floating, usually minute, organisms of the sea; includes larvae of benthic species.

Pliocene—of, relating to, or being the latest epoch of the Tertiary Period or the corresponding system of rocks; following the Pleistocene and prior to the Miocene.

PM-2.5 and PM-10—standards for measuring the amount of solid or liquid matter suspended in the atmosphere; refers to the amount of particulate matter less than or equal to 2.5 and 10 micrometers in diameter, respectively. The PM-2.5 and PM-10 particles penetrate to the deeper portions of the lungs, affecting sensitive population groups such as children and people with respiratory or cardiac diseases.

Point Source—a distinct and identifiable source, such as a sewer or industrial outfall pipe, from which a pollutant is discharged.

Population Density—the average number of individuals or organisms per unit of space or area.

Potable Water—water that is safe to drink.

Potentially Hazardous Debris—inert debris impacting the earth with a kinetic energy equal to or greater than 11 foot-pounds.

Prehistoric—literally, "before history," or before the advent of written records. In the old world writing first occurred about 5400 years ago (the Sumerians). Generally, in North America and the Pacific region, the prehistoric era ended when European explorers and mariners made written accounts of what they encountered. This time will vary from place to place.

Prohibited Area—designated airspace where aircraft are prohibited, except by special permission. Can also apply to surface craft.

Radar—a radio device or system for locating an object by means of radio waves reflected from the object and received, observed, and analyzed by the receiving part of the device in such a way that characteristics (such as distance and direction) of the object may be determined.

Range—a land or sea area designated and equipped for any or all of the following reasons:

Range Activity—an individual training or test function performed on a range or in an Operating Area. Examples include missile launching, bombardment, and vehicle driving. Individual RDT&E functions are also included in this category.

Range Complex—a geographically integrated set of ranges, operational areas, and associated special use airspace, designated and equipped with a command and control system and supporting infrastructure for freedom of maneuver and practice in munitions firing and live ordnance use against scored and/or tactical targets and/or Electronic Warfare tactical combat training environment.

Range Operation—a live training exercise, RDT&E test, or field maneuver conducted for a specific strategic, operational or tactical military mission, or task. A military action. Operations may occur independently, or multiple operations may be accomplished as part of a larger event. One operation consists of a combination of activities accomplished together. The type of operation can include air, land, sea, and undersea warfare training or testing. Participants can include a specific number and type of aircraft, ships, submarines, amphibious or other vehicles and personnel. Ordnance broadly encompasses all weapons, missiles, shells, and expendables (chaff and flares). An individual operation occurs over a given geographic footprint for a scheduled period of time. An example is a Mining Operation. Each Mining Operation is discrete and relatively short in duration, but it may be combined with other operations in a single, larger exercise, like a JTFEX, which lasts for several days or weeks.

Range Safety Zone—area around air-to-ground ranges designed to provide safety of flight and personnel safety relative to dropped ordnance and crash sites. Land use restrictions can vary depending on the degree of safety hazard, usually decreasing in magnitude from the weapons impact area (including potential ricochet) to the area of armed over flight and aircraft maneuvering.

Readiness—the ability of forces, units, weapon systems, or equipment to deliver the outputs for which they were designed (includes the ability to deploy and employ without unacceptable delays).

Region of Influence—the geographical region that would be expected to be affected in some way by the Proposed Action and alternatives.

Relative Humidity—the ratio of the amount of water vapor actually present in the air to the greatest amount possible at the same temperature.

Relief—the difference in elevation between the tops of hills and the bottoms of valleys.

Remediation—all necessary actions to investigate and clean up any known or suspected discharge or threatened discharge of contaminants, including without limitation: preliminary assessment, site investigations, remedial investigations, remedial alternative analyses and remedial actions.

Restricted Area—a designated airspace in which flights are prohibited during published periods of use unless permission is obtained from the controlling authority.

Runoff—the portion of precipitation on land that ultimately reaches streams, often with dissolved or suspended material.

Safety Zone—administratively designated/implied areas designated to limit hazards to personnel and the public, and resolve conflicts between operations. Can include range safety zones, ESQDS, surface danger zones, special use airspace, HERO/HERP areas, *etc*.

Saline—consisting of or containing salt.

Sampling—the selection of a portion of a study area or population, the analysis of which is intended to permit generalization of the entire population. In archaeology, samples are often used to reduce the amount of land area covered in a survey or the number of artifacts analyzed from a site. Statistical sampling is generally preferred since it is possible to specify the bias or probability of error in the results, but judgmental or intuitive samples are sometimes used.

Scoping—a process initiated early during preparation of an Environmental Impact Statement to identify the scope of issues to be addressed, including the significant issues related to the Proposed Action. During scoping, input is solicited from affected agencies as well as the interested public.

Seamount—a peaked, underwater mountain that rises at least 3,281 feet above the ocean floor.

Seawall—a wall or embankment to protect the shore from erosion or to act as a breakwater.

Security Zone—area where public or non-operational support access is prohibited due to training operations of a classified or hazardous nature.

Seduction Chaff—radar confusion reflectors, consisting of thin metallic strips, which are used to reflect electronic signals for confusion purposes. A defensive electronic countermeasures system designed/intended to hide or obscure the launch platform from air-to-surface or surface-to-surface attack.

Sensitive Habitats—areas of special importance to regional wildlife populations or protected species that have other important biological characteristics (for example, wintering habitats, nesting areas, and wetlands).

Sensitive Receptor—an organism or population of organisms sensitive to alterations of some environmental factor (such as air quality or sound waves) that undergo specific effects when exposed to such alteration.

Short-Term Public Exposure Guidance Level—an acceptable concentration for unpredicted, single, short-term, emergency exposure of the general public, as published by the National Research Council.

Site—in archaeology, any location where human beings have altered the terrain or have discarded artifacts.

Solid Waste—municipal waste products and construction and demolition material; includes non-recyclable material with the exception of yard waste.

Sonobuoy— A floating sensor (sonar) device fitted with sensitive microphones and a radio used for searching, localization, tracking, and communication. Sonobuoys can be active or passive. Active sonobuoys can provide either a deployable acoustical signal source (DICASS) or an explosive signal source (IEER/AEER/EER). All sonobuoys receive underwater signals of interest and relay the signals..

Sortie—a single operational training or RDT&E event conducted by one aircraft tin a range or operating area. A single aircraft sortie is one complete flight (*i.e.*, one take-off and one final landing).

Special Use Airspace—consists of several types of airspace used by the military to meet its particular needs. Special use airspace consists of that airspace wherein activities must be confined because of their nature, or wherein limitations are imposed upon aircraft operations that are not a part of these activities, or both. Special use airspace, except for Control Firing Areas, are chartered on instrument flight rules or visual flight rules charts and include hours of operation, altitudes, and the controlling agency.

Species—a taxonomic category ranking immediately below a genus and including closely related, morphologically similar individuals which actually or potentially interbreed.

Specific Absorption Rate—the time rate at which radio frequency energy is absorbed per unit mass of material, usually measured in watts per kilogram (W/kg).

Stakeholder—those people or organizations that are affected by or have the ability to influence the outcome of an issue. In general this includes regulators, the regulated entity, and the public. It also includes those individuals who meet the above criteria and do not have a formal or statutorily defined decision-making role.

State Historic Preservation Officer (SHPO)—the official within each state, authorized by the state at the request of the Secretary of the Interior, to act as liaison for purposes of implementing the National Historic Preservation Act.

State Jurisdictional Waters—sea areas within 3 nm of a state's continental and island shoreline.

Stationary Source—any building, structure, facility, installation, or other fixed source that emits any regulated air pollutant.

Stormwater—runoff produced during storms, generally diverted by rain spouts and stormwater sewerage systems. Stormwater has the potential to be polluted by such sources as yard trimmings and pesticides. A stormwater outfall refers to the mouth of a drain or sewer that channels this runoff.

Subsistence Economy—a community, usually based on farming and/or fishing, that provides all or most of the basic goods required by its members for survival, usually without any significant surplus for sale.

Subsistence—the traditional harvesting of natural resources for food, clothing, fuel, transportation, construction, art, crafts, sharing, and customary trade.

Subspecies—a geographically defined grouping of local populations which differs taxonomically from similar subdivisions of species.

Substrate—the layer of soil beneath the surface soil; the base upon which an organism lives.

Sulfur Dioxide—a toxic gas that is produced when fossil fuels, such as coal and oil, are burned.

Sustainable Range Management—management of an operational range in a manner that supports national security objectives, maintains the operational readiness of the Armed Forces, and ensures the long-term viability of operational ranges while protecting human health and the environment.

Sustaining the Capability—maintaining necessary skills, readiness and abilities.

Symbiotic—living in or on the host.

System of Systems—all communications, electronic warfare, instrumentation, and systems linkage supporting the range/range complex.

Taking—to harass, harm, pursue, hunt, shout, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct. Taking can involve harming the habitat of an endangered species.

Targets—earthwork, material, actual or simulated weapons platforms (tanks, aircraft, EW systems, vehicles, ships, *etc.*) comprising tactical target scenarios within the range/range complex impact areas. Could also include SEPTAR, AQM, BQM, MQM, *etc*.

Tenant—a unit that has an Inter-Service Support Agreement with the host for use of the training areas and that maintains a permanent presence.

Thermocline—a thin, narrow region in a thermally stratified body of water which separates warmer, oxygen-rich surface water from cold, oxygen-poor deep water and in which temperature decreases rapidly with depth. In tropical latitudes, the thermocline is present as a permanent feature and is located 200 to 1,000 feet below the surface.

Threatened Species—a plant or animal species likely to become endangered in the foreseeable future.

Topography—the configuration of a surface including its relief and the position of its natural and man-made features.

Traditional Resources—prehistoric sites and artifacts, historic areas of occupation and events, historic and contemporary sacred areas, material used to produce implements and sacred objects, hunting and gathering areas, and other botanical, biological, and geographical resources of importance to contemporary groups.

Transient—remaining a short time in a particular area.

Troposphere—the atmosphere from ground level to an altitude of 6.2 to 9.3 miles (see stratosphere).

Turbid—the condition of being thick, cloudy, or opaque as if with roiled sediment; muddy.

Uncontrolled Airspace—airspace of defined dimensions in which no air traffic control services to either instrument flight rules or visual flight rules aircraft will be provided, other than possible traffic advisories when the air traffic control workload permits and radio communications can be established.

Understory—a vegetal layer growing near the ground and beneath the canopy of a taller layer.

Unique and Sensitive Habitats—areas of special importance to regional wildlife populations or protected species that have other important biological characteristics (for example, wintering habitats, nesting areas, and wetlands).

Unsymmetrical Dimethyl Hydrazine (UDMH)—a liquid hypergolic propellant utilized as a missile fuel (as in the Lance); clear and colorless, UDMH has a sharp ammonia-like or fishy odor, is toxic when inhaled, absorbed through the skin, or taken internally. It is dissolvable in water, but not sensitive to shock or friction; however, when in contact with IRFNA, or any other oxidizing material, spontaneous ignition occurs. In addition, UDMH vapors greater than 2 percent in air can be detonated by electric spark or open flame.

Upland—an area of land of higher elevation.

Upwelling—the replenishing process of upward movement to the surface of marine often nutrient-rich lower waters (a boon to plankton growth), especially along some shores due to the offshore drift of surface water as from the action of winds and the Coriolis force.

U.S. Territorial Waters—sea areas within 12 nm of the U.S. continental and island shoreline.

Viewshed—total area seen within the cone of vision from a single observer position, or vantage point; a collection of viewpoints with optimal linear paths of visibility.

Vista—a distant view through or along an avenue or opening.

Visual Flight Rules (VFR)—rules that govern the procedures for conducting flight under visual conditions; used by pilots and controllers to indicate type of flight plan.

Volatile Organic Compound (VOC)—one of a group of chemicals that react in the atmosphere with nitrogen oxides in the presence of heat and sunlight to form ozone; it does not include methane and other compounds determined by the Environmental Protection Agency to have negligible photochemical reactivity. Examples of volatile organic compounds include gasoline fumes and oil-based paints.

Warfare Mission—referring to one of the eight Primary Mission Areas (MIW, AMW, SUW, AW, STW, EC, NSW) as further broken down into sub-events (MCM, amphibious assault, GUNEX(S-S), TRACKEX(Sub), MISSILEX(A-A), BOMBEX(A-G), CHAFFEX, CSAR).

Warning Area—a designated airspace in which flights are not restricted but avoidance is advised during published times of use.

Wastewater—water that has been previously utilized; sewage.

Wetlands—lands or areas that either contain much soil moisture or are inundated by surface or groundwater with a frequency sufficient to support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include such areas as bogs, marshes, mud and tidal flats, sloughs, river overflows, seeps, springs, or swamps.

Wholly Inert—ordnance with no explosive, propellant, or pyrotechnic component (non-reactive); example: BDU-50, BDU-56 (both are non-reactive heavy-weights with no explosive charges).

Yearly Average Day-Night Sound Level (DNL or L_{dn})—utilized in evaluating long-term environmental impacts from noise, this is an annual mean of the day-night sound level.

Zoning—the division of a municipality (or county) into districts for the purpose of regulating land use, types of buildings, required yards, necessary off-street parking, and other prerequisites to development. Zones are generally shown on a map, and the text of the zoning ordinance specifies requirements for each zoning category.

Zooplankton—animals that drift with the ocean currents, with little ability to move through the water on their own, ranging from one-celled organisms to jellyfish up to 1.8 meters (6 feet) wide. Zooplankton live in both surface and deep waters of the ocean; crustaceans make up about 70 percent. While some float about freely throughout their lives, many spend only the early part of their lives as plankton.

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CHAPTER 10 DISTRIBUTION LIST

The individuals, agencies, and organizations listed below received a copy of the Jacksonville Draft Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS). Please note that not all states have a clearinghouse. For states not having a clearinghouse, a copy of the Jacksonville Draft EIS/OEIS was sent to the most relevant state agency. Following this list is a list of stakeholders: individuals, agencies, and organizations which received notification of the availability of the Jacksonville Draft EIS/OEIS.

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Representative William Herbkersman SC House – 118th District 308B Blatt Building Columbia, SC 29201	Representative Leonidas E. Stavrinakis SC House – 119th District 420D Blatt Building Columbia, SC 29201
The Honorable Dick Elliott State Senator (D) District 28 601 Gressette Building Columbia, SC 29201	Represenative C. David Umphlett, Jr. SC House Representative, District 100 310D Blatt Building Columbia, SC 29201
Represenative Tracy R. Edge SC House Representative, District 104 503B Blatt Building Columbia, SC 29201	Represenative Nelson L. Hardwick SC House Representative, District 106 320C Blatt Building Columbia, SC 29201

STATE ELECTED OFFICIALS Cont'd	
Representative Kenneth Hodges SC House – 121st District 434B Blatt Building Columbia, SC 29201	Represenative Shannon Erickson SC House Representative,District 124 306A Blatt Building Columbia, SC 29201
Represenative F. Gregory Delleney SC House Representative,District 43 532C Blatt Bldg. Columbia, SC 29201	Represenative Jenny Anderson SC House Representative, District 94 308A Blatt Building Columbia, SC 29201
Representative Curtis Brantley SC House – 122nd District 314D Blatt Building Columbia, SC 29201	
Georgia	
Representative Cecily Hill GA House – 180th District Coverdell Legislative Office Building, Suite 501 Atlanta, GA 30334	The Honorable Eric Johnson GA Senate – 1st District 321 State Capitol Atlanta, GA 30334
The Honorable Jeff Chapman GA Senate – 3rd District 110 D State Capitol Atlanta, GA 30334	The Honorable Jack Hill GA Senate – 4th District 234 State Capitol Atlanta, GA 30334
The Honorable Tommie Williams GA Senate – 19th District 236 State Capitol Atlanta, GA 30334	Representative Buddy Carter GA House – 159th District Coverdell Legislative Office Building, Suite 508 Atlanta, GA 30334
Representative Bob Bryant GA House – 160th District Coverdell Legislative Office Building, Suite 608 Atlanta, GA 30334	Representative Lester Jackson GA House – 161st District Coverdell Legislative Office Building, Suite 511 Atlanta, GA 30334
Representative Tom Bordeaux GA House – 162nd District Coverdell Legislative Office Building, Suite 511 Atlanta, GA 30334	Representative Burke Day GA House – 163rd District State Capitol, Room 218 Atlanta, GA 30334
Representative Ron Stephens GA House – 164th District State Capitol, Room 228 Atlanta, GA 30334	Representative Al Williams GA House – 165th District Coverdell Legislative Office Building, Suite 511 Atlanta, GA 30334
Representative Terry Barnard GA House – 166th District State Capitol, Room 401 Atlanta, GA 30334	Representative Roger Bert Lane GA House – 167th District Coverdell Legislative Office Building, Suite 404 Atlanta, GA 30334
Representative Tommy Smith GA House – 168th District State Capitol, Room 131 Atlanta, GA 30334	Representative George "Hinson" Mosley GA House – 178th District Coverdell Legislative Office Building, Suite 501 Atlanta, GA 30334
Representative Jerry Keen GA House – 179th District State Capitol, Room 338 Atlanta, GA 30334	The Honorable Lester Jackson GA State Senator, District 2 313A Coverdell Legislative Office Building Atlanta, GA 30334

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The Honorable J.B. Powell GA State Senator, District 23 320A Coverdell Legislative Office Building Atlanta, GA 30334	The Honorable Ed Traver GA State Senator, District 22 313B Cordvell Office Building Atlanta, GA 30334
The Honorable Nancy Schaefer GA State Senator, District 50 323A Coverdell Legislative Office Building Atlanta, GA 30334	
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The Honorable Stephen R. Wise Florida Senate – District 5 Room 220, Senate Office Building 404 South Monroe Street Tallahassee, FL 32399	The Honorable Mike Haridopolos Florida Senate – District 26 Room 318, Senate Office Building 404 South Monroe Street Tallahassee, FL 32399
The Honorable Alfred Lawson, Jr. Florida Senate – District 6 Senate Office Building, Room 210 404 South Monroe Street Tallahassee, FL 32399	The Honorable Evelyn J. Lynn Florida Senate – District 7 536 North Halifax, Avenue, Suite 101 Daytona Beach, FL 32118
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The Honorable Ken Pruitt FL Senate – 28th District 1850 SW Fountainview Blvd., Suite 200 Port St. Lucie, FL 34986	The Honorable Eleanor Sobel FL Senate – 31st District 400 South Federal Highway, Suite 204 Hallandale Beach, FL 33009
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Representative Clay Ford FL House – 3rd District 1804 W. Garden Street Pensacola, FL 32501	Representative Ray Sansom FL House – 4th District 99 Eglin Parkway NE, Suite 18 Fort Walton Beach, FL 32548
Representative Brad Drake FL House – 5th District NFWL State-Chautauqua Campus, #205 908 Highway 90 West DeFuniak Springs, FL 32433-1436	Representative Jimmy T. Patronis FL House – 6th District 455 Harrison Avenue, Suite A Panama City, FL 32401
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Representative Mia Jones FL House – 14th District 3890 Dunn Avenue, Suite 901 Jacksonville, FL 32218-6431	Representative Audrey Gibson FL House – 15th District 101 East Union Street, Suite 402 Jacksonville, FL 32202
Representative Charles McBurney FL House – 16th District 76 S. Laura Street Jacksonville, FL 32202-3411	Representative Ray Lake FL House – 17th District 9485 Regency Square Blvd., Suite 109 Jacksonville, FL 32225-8111
Representative Ronald Renuart FL House – 18th District 50 a1a North, Suite 105 Ponte Verda Beach, FL 32082	Representative Michael Weinstein FL House – 19th District 155 Blanding Blvd., Suite 10 Orange Park, FL 32073
Representative William L. Proctor FL House – 20th District 900 SR 16, Suite 2 St. Augustine, FL 32084	Representative Charles Van Zant FL House – 21st District 3841 Reid Street, Suite 5 Palatka, FL 32177
Representative Pat Patterson FL House – 26th District 230 North Woodland Blvd., Room 222 DeLand, FL 32720	Representative Dorothy Hukill FL House – 28th District 1398 Dunlawton Avenue Suite 1-A Port Orange, FL 32127-8915
Representative Steve Crisafulli FL House – 32nd District 2460 N. Courteany Parkway Suite 108 Merritt Island, FL 32953-4193	Representative Ritch Workman FL House – 30th District 33 Suntree Place Suite D Melbourne, FL 32940-7602

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Representative John Wood FL House – 65th District 702 Jones Avenue Haines City, FL 33844-4342	Representative Bill Galvano FL House – 68th District 1023 Manatee Avenue West, Suite 715 Bradenton, FL 34205-7829
STATE ELECTED OFFICIALS Cont'd	
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Mayor W. Burford Clark, Jr. Mayor of Woodbine City of Woodbine Office of the Mayor 310 Bedell Avenue Woodbine, GA 31569	
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Mr. Wes Seegars Chairman NC Wildlife Resources Commission PO Box 1756 Goldsboro, NC 27533	Mr. Richard Rogers North Carolina Department of Environment and Natural Resources Office of Conservation and Community Affairs 1601 Mail Service Center Raleigh, NC 27699
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South Carolina	
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Mr. Chad Prosser Director SC Department of Parks, Recreation, & Tourism 1205 Pendleton Street Columbia, SC 29201	Mr. Robert C. Schowalter State Forester South Carolina Forestry Commission 5500 Broad River Road Columbia, SC 29201
Mr. Henry Kodama State Forester South Carolina Forestry Commission 5500 Broad River Road Columbia, SC 29212	Ms. Shelly Sherritt Federal Facilities Liaison South Carolina Dept of Health and Environmental Control 2600 Bull Street Columbia, SC 29201
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Mr. M. Beach Charleston, SC	Mr. Geoff White Washington, DC
Mr. Will Sloger North Charleston, SC	Mr. Tom Currin North Charleston, SC
Mr. Tom Davis Mt. Pleasant, SC	Mr. Billy Drawdy Beaufort, SC
LT Col. James O'Brien Townsend, GA	Mr. Isaac Gaymon
Ms. Angela Patterson	Ms. Alice Howard Beaufort, SC
Mr. Anthony Diaz Beaufort, SC	Mr. Billy Hendricks Atlanta, GA
Ms. Margaret Manuel Savannah, GA	Ms. Kelly Pigge Savannah, GA
Ms. Rose Marie Durig New Martinsville, WV	Mr. Jerry Durig New Martinsville, WV
Ms. Becky Shortland Savannah, GA	Mr. C. Lagman Atlantic Beach, FL
Mr. F. Winkler Valparaiso, FL	Mr. Kevin Gartland Jacksonville, FL
Mr. Roy Stafford Jacksonville, FL	Mr. R. Pratt Jacksonville, FL
Ms. Dorothy Dougherty Ponte Vedra Beach, FL	RC Snyder Jacksonville, FL
Ms.Jeanne Kennedy Ponte Vedra Beach, FL	Ms. Jennifer Auger Jacksonville, FL
Mr. James Fletcher Jacksonville Beach, FL	
Individuals (Public Hearing Meeting Attendees)	
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Melissa Rada Charleston, SC	Jim Flatley Mt. Pleasant, SC
Curtis S. Davis Charleston, SC	David Curfman Chesapeake, VA
Betty S. Jernigan Jacksonville, FL	Wanda Todd Surfside Beach, SC
Lanny Gelmer York Haven, PA	D. A. Beer Beaufort, SC

David Butler II Beaufort, SC	Scott Brewer Camp Lejeune, NC
Mike Jones Beaufort, SC	David Wilson MCAS Beaufort
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Debra Birtalan Jacksonville, FL	

Jacksonville Range Complex EIS/OEIS

The U.S. Navy is announcing public hearings and a public comment period for the Jacksonville (JAX) Draft Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS). This document assesses the potential environmental consequences associated with Navy Atlantic Fleet training and research, development, testing, and evaluation (RDT&E) activities, and associated range capabilities enhancements (including infrastructure enhancements) in the JAX Range Complex (including Charleston/JAX Operating Area).

Public hearings will be held on the following dates:

July 28, 2008 Doubletree Guest Suites– Historic Charleston; 181 Church Street Charleston,; SC 29401
July 29, 2008 Holiday Inn Beaufort; 2225 Boundry St.; Beaufort, SC 29902
July 30, 2008 Hyatt Regency Savannah; 2 W. Bay Street; Savannah, GA 31401
July 31, 2008 Hyatt Regency Jacksonville – Riverfront; 225 E. Coastline Dr.; Jacksonville, FL 32202

Copies of the draft document can be found at the following locations:

Charleston County Library; 68 Calhoun Street; Charleston, SC 29401
Beaufort County Public Library; 311 Scott Street; Beaufort, SC 29902
Live Oak Public Libraries; 2002 Bull Street; Savannah, GA 31401
Three Rivers Regional Library System; 208 Gloucester Street; Brunswick, GA 31520
Jacksonville Public Library; 303 North Laura Street; Jacksonville, FL 32202
Polk County Library Cooperative; 215 South Bougainvillea Avenue; Polk City, FL 33868
Marion County Public Library; 2720 East Silver Springs Boulevard; Ocala, FL 34470
The document is also available for download at http://www.jacksonvillerangecomplexeis.com

Each hearing will begin with an open house poster session from 5-7 p.m.
A formal presentation and public comment period will be held from 7-9 p.m.

Comments on the Draft JAX EIS/OEIS can be sent via U.S. mail or fax, as well as through the JAX Range Complex EIS/OEIS website. The mailing address is: Naval Facilities Engineering Command, Atlantic Division; Attention: Code EV22CM (JAX EIS/OEIS PM);
6506 Hampton Blvd; Norfolk, VA 23508-1278. Fax: (757) 322-4894.
Website: http://www.jacksonvillerangecomplexeis.com
Please submit comments by August 11, 2008