Draft

Supplemental Environmental Impact Statement/ Overseas Environmental Impact Statement Atlantic Fleet Training and Testing

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3.6 Fishes

FISHES SYNOPSIS

The Action Proponents considered the stressors to fishes that could result from the Proposed Action within the Study Area. The following conclusions have been reached for the Preferred Alternative (Alternative 1):

- Acoustic: The use of each acoustic substressor (sonar and other transducers, air guns, pile driving, vessel noise, aircraft noise, and weapons noise) could result in impacts on fishes. Some sonars, vessel and weapons noise could result in masking, physiological responses, or behavioral reactions. Aircraft noise would not likely result in impacts other than brief, mild behavioral responses in fishes that are close to the surface. Each of these substressors would be unlikely to result in temporary threshold shift. Air guns and pile driving have the potential to result in mortality, injury, or hearing loss at very short ranges (tens of meters) in addition to the effects listed above. Most impacts are expected to be temporary and infrequent as most activities involving acoustic stressors would be temporary, localized, and infrequent resulting in short-term and mild to moderate impacts. More severe impacts (e.g., mortality) could lead to permanent effects for individuals but, overall, long-term consequences for fish populations are not expected.
- Explosives: The use of explosives could result in impacts on fishes within the Study Area. Sound and energy from explosions can cause mortality, injury, hearing loss, masking, physiological stress, or behavioral responses. The time scale of individual explosions is very limited, and military readiness activities involving explosions are dispersed in space and time, therefore, repeated exposure of individuals is unlikely. Most effects such as hearing loss or behavioral responses are expected to be short term and localized. More severe impacts (e.g., mortality) could lead to permanent effects for individuals but, overall, long-term consequences for fish populations are not expected.
- Energy: The use of electromagnetic devices may elicit brief behavioral or physiological stress responses only in those exposed fishes that are able to detect electromagnetic properties. The impacts are expected to be temporary, minor, and limited to highly localized areas. Population-level impacts are unlikely.
- Physical Disturbance and Strike: The use of vessels, in-water devices, military expended materials, and seafloor devices present a risk for collision, stress response, or impacts caused by sediment disturbance, particularly near coastal areas and bathymetric features where fish densities are higher. Most fishes are mobile and have sensory capabilities that enable them to detect and avoid vessels and other items. Behavioral and stress responses would be temporary.

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- Entanglement*:* Fishes could be exposed to multiple entanglement stressors. The potential for impacts is dependent on the physical properties of the expended materials and the likelihood that a fish would encounter a potential entanglement stressor and then become entangled in it. Physical characteristics of wires and cables, decelerators/parachutes, and biodegradable polymers, combined with the sparse distribution of these items throughout the Study Area, suggests a low potential for fishes to encounter and become entangled in them. Because of the low numbers of fish potentially impacted by entanglement stressors, population-level impacts are unlikely.
- Ingestion*:* Military expended materials from munitions and military expended materials other than munitions present an ingestion risk to fishes that forage at the surface, in the water column, and on the seafloor. The likelihood that expended items would be ingested and cause an adverse effect would depend on the size and feeding habits of a fish, the rate at which a fish would encounter items, and the composition and physical characteristics of the item. Because of the low numbers of fish potentially impacted by ingestion stressors, population-level impacts are unlikely.

3.6.1 Introduction

The following sections describe the fishes in the Study Area and the potential impacts of the proposed training and testing activities on these resources. Impacts to fishes from the Proposed Action were analyzed in the 2018 *Final Atlantic Fleet Training and Testing Environmental Impact Statement/Overseas Environmental Impact Statement* (hereinafter referred to as the "2018 Final EIS/OEIS"). The primary changes from the analysis are provided where they apply in subsequent sections.

3.6.2 Affected Environment

The affected environment provides the context for evaluating the effects of the Action Proponent's military readiness (training and testing) activities on fishes. With noted exceptions, the general background for fishes in the Study Area is not meaningfully different from what is described in the 2018 Final EIS/OEIS (Section 3.6.2, Affected Environment). See Appendix F (Biological Resources Supplemental Information) for updated details on the affected environment for fishes. The details are specified in this section when they directly affect the analysis.

The Study Area is generally consistent with that analyzed in the 2018 Final EIS/OEIS. Additions to the Study Area include pierside training and testing events and transit along established navigation channels from pierside locations to offshore range complexes in the Gulf of Mexico. United States (U.S.) Coast Guard activities are similar in nature to Navy activities and fall under the same stressor categories.

3.6.2.1 General Background

Fishes are the most numerous and diverse of the vertebrate groups in the Study Area (Fricke et al., 2023). Fishes in the affected environment comprise species from many different families, use many different habitats, and have diverse behaviors. Additional or updated information from the 2018 Final EIS/OEIS includes:

- Modeling results that indicate the biomass of mesopelagic fish (depths of 200 to 1,000 meters [m]) is likely much greater than the biomass of fish that occur in waters less than 200 m (Irigoien et al., 2014).
- Survey results showing the average daytime density of rays, sharks, and large bony fishes is low (1.66 per square kilometer) in surface waters from the Virginia Capes Range Complex to the Jacksonville Range Complex (Willmott et al., 2021).

Section F.4 (Fishes) of Appendix F (Biological Resources Supplemental Information) provides additional and updated information regarding the number of marine and estuarine fish species worldwide and species richness in different parts of the Study Area.

3.6.2.1.1 Habitat Use

Habitat use varies by fish taxonomic group and includes the shoreline, water surface, water column, and seafloor. An abbreviated description of taxonomic groups including their habitat use and location in the Study Area is provided in Section 3.6.2.3 (Species Not Listed under the Endangered Species Act). Additional or updated information in Appendix F (Biological Resources Supplemental Information) regarding bottom habitat use includes the following:

- Hard bottom habitats typically support higher fish densities and species richness than soft bottom habitat (Flávio et al., 2023), although the degree of association may vary considerably.
- Most substrate in the Study Area is soft bottom; however, benthic fishes in deep ocean areas (depths greater than about 1,500 m) are generally widely dispersed and tend to ignore differences in bottom type (Milligan et al., 2016; Ross et al., 2015).

There is also updated information regarding the fish communities associated with various types of live hard bottom, the composition of soft bottom habitats, and the presence of mesophotic reefs in the Study Area.

3.6.2.1.2 Movement and Behavior

The general movement and behavior for fishes include foraging, navigation, reproduction, and predator avoidance. Examples of common types of behavior include vertical and horizontal migration, schooling, feeding, and resting. Migratory behavior consists of mass movements from one place to another. Daily or seasonal migrations are typically for feeding and/or predator avoidance. Some common movement patterns include coastal migrations, open-ocean migrations, onshore/offshore movements, vertical water column movements, and life stage-related migrations. Fishes may at times occur in a shoal or school. A shoal is a group of fishes that remains together for social reasons, while a school is a synchronized shoal. Schooling may occur when traveling, feeding, resting, reproducing, or avoiding predators. Feeding behavior of fishes is influenced by many factors, including characteristics of the environment, the predators, and prey. Updated information in Appendix F (Biological Resources Supplemental Information) includes:

- Study results showing that although daily vertical migration in many fish species results in lower densities near the surface during the day than at night, there are exceptions to this pattern, including reverse diel migration and oscillatory movements (Andrzejaczek et al., 2019; Urmy & Benoit-Bird, 2021).
- Some fish species rely on visual cues while feeding while others, particularly benthic species, also rely on taste. Fishes that rely on visual cues are more likely to ingest non-food items that visually resemble natural food than those that primarily rely on taste (Roch et al., 2020).

There is also updated information regarding schooling behavior.

3.6.2.1.3 General Threats

General threats to fishes included human-induced threats that can be divided into four components: habitat alteration, exploitation, introduction of non-native species, and pollution. These threats often act on fish populations simultaneously. Additional threats to fish populations include development and human activities, disease and parasites, and climate change. Updated information on threats is provided in Appendix F (Biological Resources Supplemental Information) and generally includes trends and the potential effects of pollution, commercial fishing, aquaculture, and other fish stressors.

3.6.2.2 Endangered Species Act-Listed Species

Table 3.6-1 shows the fish species listed under the Endangered Species Act (ESA) and occurring in the Study Area. Designated critical habitat for ESA-listed fish species in the Study Area is shown in Figure 3.6-1 through Figure 3.6-6. Changes in the ESA listings and critical habitat designations since the 2018 Final EIS/OEIS include:

- National Marine Fisheries Service (NMFS) finalized critical habitat for the Nassau grouper (*Epimetheus striatus*) on January 2, 2024. The critical habitat is located off the coasts of southeastern Florida, Puerto Rico, Navassa, and the U.S. Virgin Islands.
- Smalltail shark (*Carcharhinus porosus*) has been added to the list of candidate species for protection under the ESA.
- Alewife (*Alosa pseudoharengus*), blueback herring (*Alosa aestivalis*), cusk (*Brosme brosme*), and dwarf seahorse (*Hippocampus zosterae*) have been removed from the list of candidate species for protection under the ESA.

Additional information on ESA-listed species is provided in Appendix F (Biological Resources Supplemental Information).

Table 3.6-1: Status and Occurrence of Endangered Species Act-Listed Fish Species in the Study Area

Species Name and Regulatory Status				***Species Occurrence in the Study Area***		
Common Name	***Scientific Name***	***Distinct Population Segment/Stock***	***ESA Status/Critical Habitat***	***Range Complex/ Testing Range***	***Range Complex Inshore Areas***	***Piers/Ports/Coast Guard Stations***
Atlantic salmon	*Salmo salar*	Gulf of Maine	Endangered/ Designated	Northeast Range Complexes	Northeast RC Inshore	Pierside NS Newport, Portsmouth Naval Shipyard, NSB New London Civilian Ports Bath, ME[1]; Boston, MA Coast Guard Stations Boston, MA; New London, CT
Atlantic sturgeon	*Acipenser oxyrinchus oxyrinchus*	Gulf of Maine	Threatened/ Designated	Northeast Range Complexes, Naval Undersea Warfare Center Division, Newport Testing Area, VACAPES RC, Navy Cherry Point RC, JAX RC, SFOMF	Northeast RC Inshore; VACAPES RC Inshore[1], JAX RC Inshore[2]	Pierside Portsmouth Naval Shipyard[2], NSB New London, NS Newport, NS Norfolk, JEB Little Creek, Norfolk Naval Shipyard, NSB Kings Bay, NS Mayport, Port Canaveral Civilian Ports Bath, ME[2]; Boston, MA; Earle, NJ; Delaware Bay, DE; Hampton Roads, VA; Morehead City, NC; Wilmington, NC[2]; Kings Bay, GA; Savannah, GA[2]; Mayport, FL; Port Canaveral, FL Coast Guard Stations Boston, MA; New London, CT; Newport, RI; Virginia Beach, VA; Portsmouth, VA; Elizabeth City, NC; Charleston, SC[2]; Mayport, FL; Cape Canaveral, FL
		New York Bight, Chesapeake Bay, Carolina, South Atlantic	Endangered/ Designated			

Table 3.6-1: Status and Occurrence of Endangered Species Act-Listed Fish Species in the Study Area (continued)

Species Name and Regulatory Status				***Species Occurrence in the Study Area***		
Common Name	***Scientific Name***	***Distinct Population Segment/Stock***	***ESA Status/Critical Habitat***	***Range Complex/ Testing Range***	***Range Complex Inshore Areas***	***Piers/Ports/Coast Guard Stations***
Shortnose sturgeon	*Acipenser brevirostrum*	Not applicable	Endangered	Northeast Range Complexes, Naval Undersea Warfare Center Division, Newport Testing Area, VACAPES RC, Navy Cherry Point RC, JAX RC	Northeast RC Inshore, VACAPES RC Inshore, JAX RC Inshore	Pierside Portsmouth Naval Shipyard, NSB New London, NS Newport, NS Norfolk, JEB Little Creek, Norfolk Naval Shipyard, NSB Kings Bay, NS Mayport Civilian Ports Bath, ME; Boston, MA; Earle, NJ; Delaware Bay, DE; Hampton Roads, VA; Morehead City, NC; Wilmington, NC; Kings Bay, GA; Savannah, GA; Mayport, FL Coast Guard Stations Boston, MA; New London, CT; Newport, RI; Virginia Beach, VA; Portsmouth, VA; Elizabeth City, NC; Charleston, SC; Mayport, FL
Gulf sturgeon	*Acipenser oxyrinchus desotoi*	Not applicable	Threatened/ Designated	Naval Surface Warfare Center, Panama City Division Testing Area[3], GOMEX RC[3]	GOMEX RC Inshore	Civilian Ports Pascagoula, MS[3] Coast Guard Stations Pensacola, FL[3]; New Orleans, LA[3]

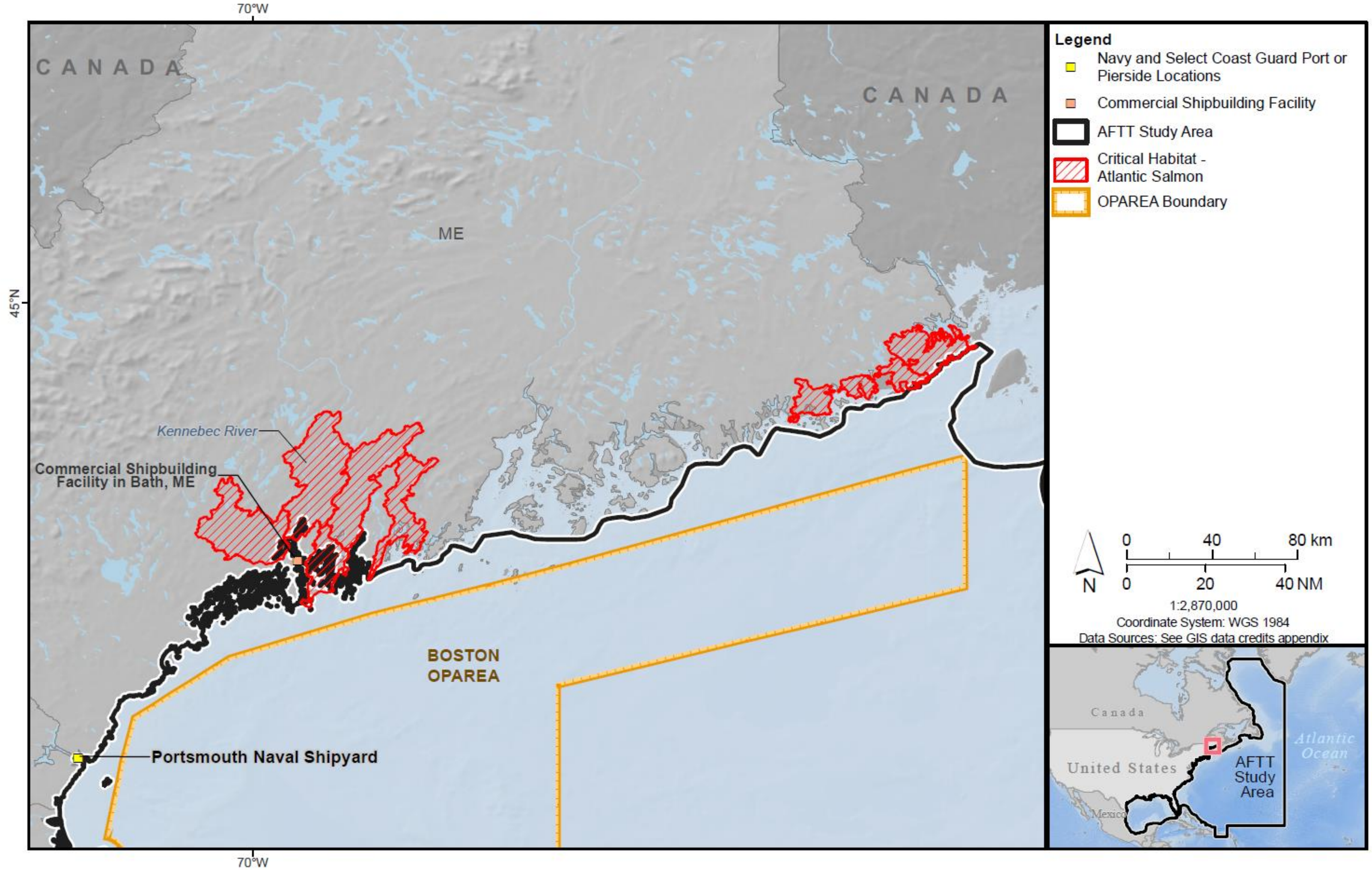
Table 3.6-1: Status and Occurrence of Endangered Species Act-Listed Fish Species in the Study Area (continued)

Species Name and Regulatory Status				*Species Occurrence in the Study Area*		
Common Name	***Scientific Name***	***Distinct Population Segment/Stock***	***ESA Status/Critical Habitat***	***Range Complex/ Testing Range***	***Range Complex Inshore Areas***	***Piers/Ports/Coast Guard Stations***
Smalltooth sawfish	*Pristis pectinata*	United States	Endangered/ Designated	JAX RC, SFOMF, Key West RC, Naval Surface Warfare Center, Panama City Division Testing Area	JAX RC Inshore, Key West RC Inshore, GOMEX RC Inshore	Pierside NS Mayport; Port Canaveral, FL Civilian Ports Tampa, FL; Mobile, AL; Pascagoula, MS; Gulfport, MS Coast Guard Stations Mayport, FL; Cape Canaveral, FL; Fort Pierce, FL; Dania, FL; Miami, FL; Key West, FL; St. Petersburg, FL; Pensacola, FL
Giant manta ray	*Mobula birostris*	Not applicable	Threatened/ None	Northeast Range Complexes, VACAPES RC, Navy Cherry Point RC, JAX RC, SFOMF, Key West RC[1], Naval Surface Warfare Center Panama City Division Testing Area, GOMEX RC	JAX RC Inshore, Key West RC Inshore, Gulf of Mexico Inshore	Pierside NS Mayport, Port Canaveral Civilian Ports Mayport, FL; Port Canaveral, FL; Tampa, FL; Gulfport, MS; Beaumont, TX; Corpus Christi, TX; Pascagoula, MS Coast Guard Stations Charleston, SC; Mayport, FL; Cape Canaveral, FL; Fort Pierce, FL; Dania, FL; Miami, FL; Key West, FL; St. Petersburg, FL; Pensacola, FL; New Orleans, LA; Corpus Christi, TX
Nassau grouper	*Epinephelus striatus*	Not applicable	Threatened/ Designated	SFOMF, Key West RC[4]	Key West RC Inshore	Coast Guard Stations Miami, FL

Table 3.6-1: Status and Occurrence of Endangered Species Act-Listed Fish Species in the Study Area (continued)

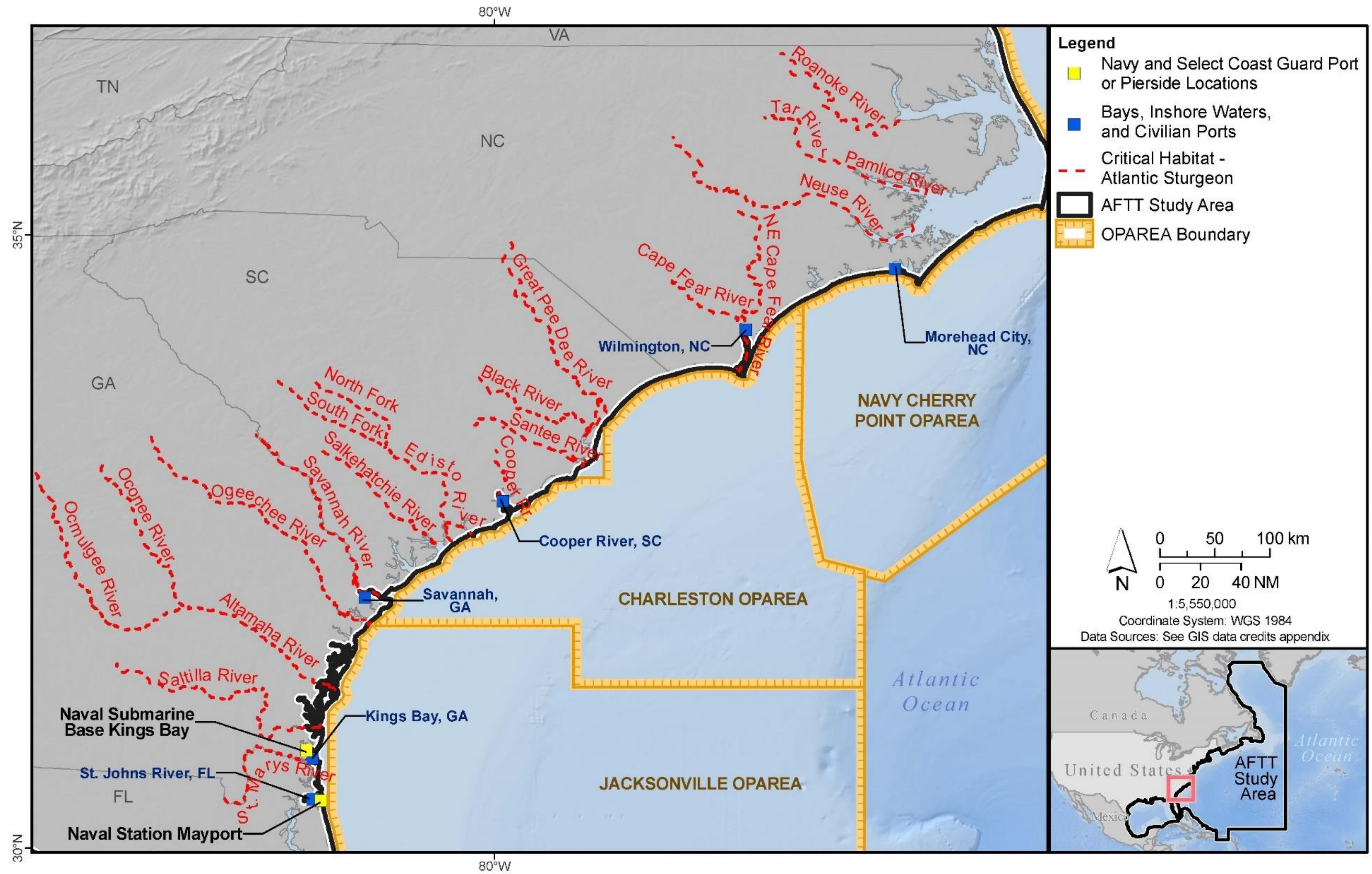
Species Name and Regulatory Status				*Species Occurrence in the Study Area*		
Common Name	***Scientific Name***	***Distinct Population Segment/Stock***	***ESA Status/Critical Habitat***	***Range Complex/ Testing Range***	***Range Complex Inshore Areas***	***Piers/Ports/Coast Guard Stations***
Oceanic whitetip shark	*Carcharhinus longimanus*	Not applicable	Threatened/ None	Northeast Range Complexes, VACAPES RC, Navy Cherry Point RC, JAX RC, SFOMF, Key West RC, Naval Surface Warfare Center Panama City Division Testing Area, GOMEX RC	Not present	Not present
Scalloped hammerhead shark	*Sphyrna lewini*	Central and Southwest Atlantic	Threatened/ None	SFOMF, Key West RC	Not present	Not present
Smalltail shark	*Carcharhinus porosus*	Not applicable	Candidate[5]/ None	Naval Surface Warfare Center, Panama City Division Testing Area, GOMEX RC	GOMEX RC Inshore	Civilian Ports Tampa, FL; Beaumont, TX; Corpus Christi, TX; Pascagoula, MS Coast Guard Stations Pensacola, FL; New Orleans, LA; New Orleans, LA; Corpus Christi, TX

[1] Intersects with species critical habitat as shown in Figure 3.6-1
[2] Intersects with species critical habitat as shown in Figure 3.6-2 and Figure 3.6-3
[3] Intersects with species critical habitat as shown in Figure 3.6-4
[4] Intersects with species critical habitat as shown in Figure 3.6-6
[5] Candidate species are any species that are undergoing a status review to determine whether they warrant listing under the ESA. Candidate status does not carry any procedural or substantive protections under the ESA but is provided for informational purposes.
Notes: DE = Delaware; ESA = Endangered Species Act; FL = Florida; GA = Georgia; GOMEX = Gulf of Mexico; JAX = Jacksonville; JEB = Joint Expeditionary Base; MA = Massachusetts; ME = Maine; MS = Mississippi; NA = not applicable; NC = North Carolina; NJ = New Jersey; NS = Naval Station; NSB = Naval Submarine Base; OPAREA = operating area; RC = Range Complex; RI = Rhode Island; SFOMF = South Florida Ocean Measurement Facility Testing Range; TX = Texas; VA = Virginia; VACAPES = Virginia Capes



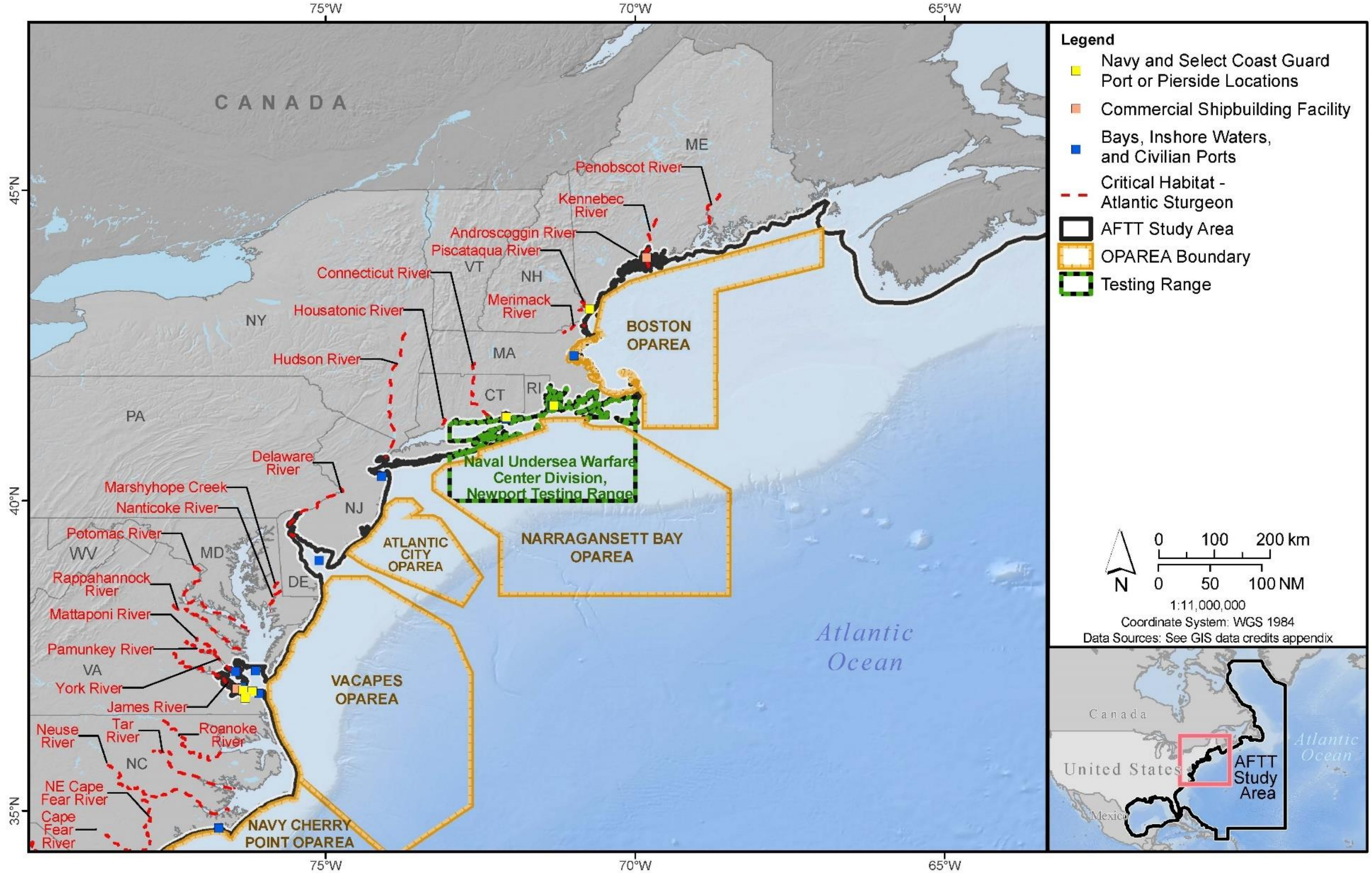
Notes: AFTT = Atlantic Fleet Training and Testing; OPAREA = operating area

Figure 3.6-1: Critical Habitat for ESA-Listed Atlantic Salmon Designated in the Study Area



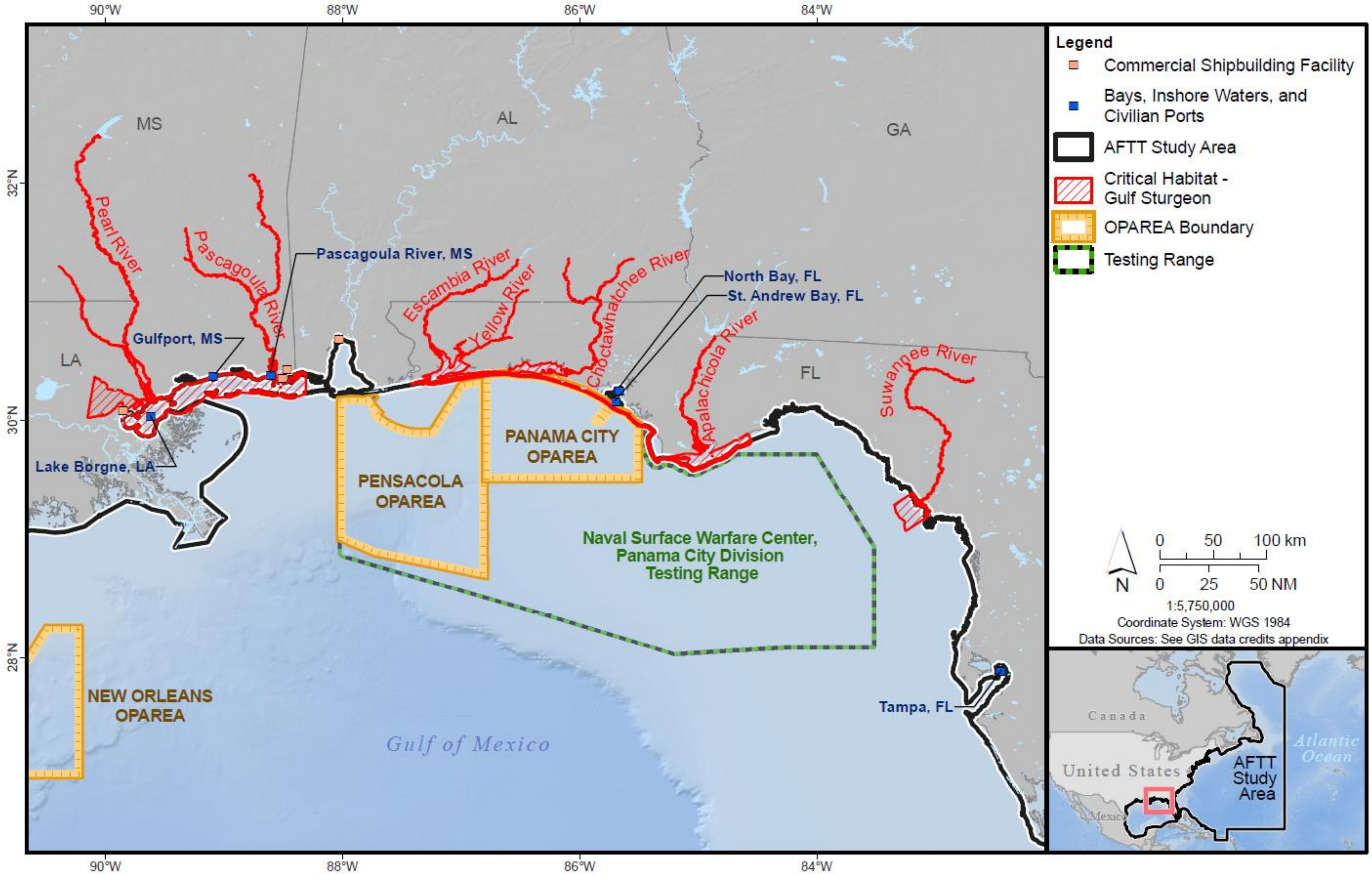
Notes: AFTT = Atlantic Fleet Training and Testing; OPAREA = operating area

Figure 3.6-2: Critical Habitat for ESA-Listed Atlantic Sturgeon Designated in the Southern Portion of the Study Area



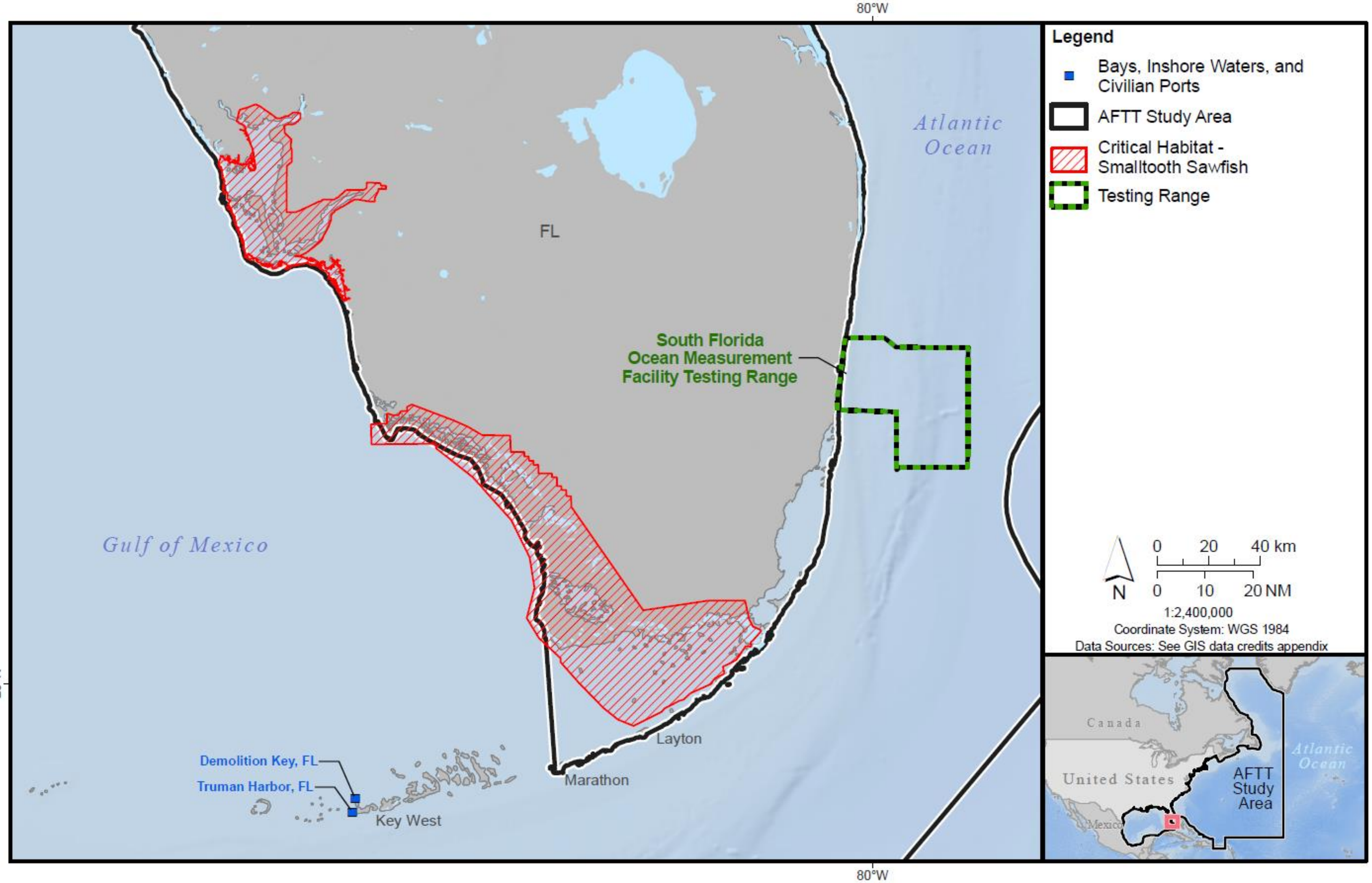
Notes: AFTT = Atlantic Fleet Training and Testing; OPAREA = operating area; VACAPES = Virginia Capes

Figure 3.6-3: Critical Habitat for ESA-Listed Atlantic Sturgeon Designated in the Northern Portion of the Study Area



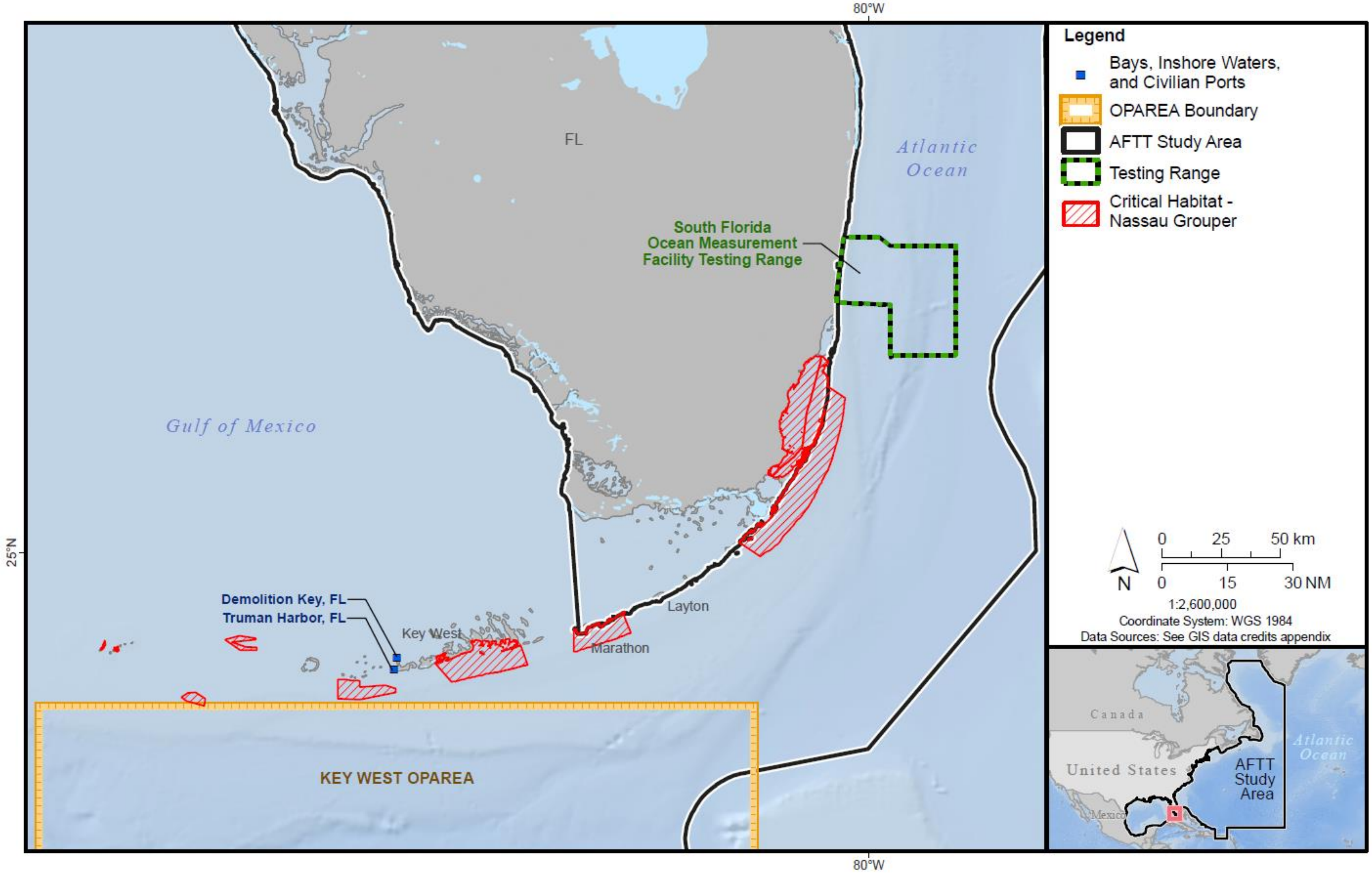
Notes: AFTT = Atlantic Fleet Training and Testing; OPAREA = operating area

Figure 3.6-4: Critical Habitat for ESA-Listed Gulf Sturgeon Designated in the Study Area



Notes: AFTT = Atlantic Fleet Training and Testing

Figure 3.6-5: Critical Habitat for ESA-Listed Smalltooth Sawfish Designated in the Study Area



Notes: AFTT = Atlantic Fleet Training and Testing; OPAREA = operating area

Figure 3.6-6: Critical Habitat for ESA-Listed Nassau Grouper Designated in the Study Area

3.6.2.3 Species Not Listed under the Endangered Species Act

Table 3.6-2 provides general descriptions of fishes and their location/habitat use in the Study Area. The general background information for each taxonomic group described in the 2018 Final EIS/OEIS has not appreciably changed. As such, the information presented in the 2018 Final EIS/OEIS Section 3.6.2.3 (Species Not Listed under the Endangered Species Act) remains valid.

Table 3.6-2: Description and Occurrence of Major Taxonomic Groups of Fishes in the Study Area

Resource Groups		*Occurrence in Study Area*[1]		
Common Name (Classification)	***Description***	***Range Complex/ Testing Range***	***Range Complex Inshore***	***Piers/Ports/Coast Guard Stations***
Jawless fishes (Orders Myxiniformes and Petromyzontiformes)	Primitive, cartilaginous, eel-like vertebrates, parasitic or feed on dead fish	Seafloor	Water column, seafloor	Water column, seafloor
Ground Sharks, Mackerel Sharks, Carpet Sharks, and Bullhead Sharks (Orders Carcharhiniformes, Lamniformes, Orectolobiformes, and Heterodontiformes)[2]	Cartilaginous, two dorsal fins or first large, an anal fin, and five gill slits	Water column, seafloor	Water column, seafloor	Water column
Frilled and Cow Sharks, Sawsharks, Dogfish, and Angel Sharks (Orders Hexanchiformes, Pristiophoriformes, Squaliformes, and Squatiniformes)	Cartilaginous, anal fin and nictitating membrane absent, 6-7 gill slits	Water column, seafloor	Water column, seafloor	Water column, seafloor
Stingrays, Sawfishes, Skates, Guitarfishes, and Electric Rays (Orders Myliobatiformes, Pristiformes, Rajiformes, and Torpediniformes)[2]	Cartilaginous, flat-bodied, usually five gill slits	Water column, seafloor	Water column, seafloor	Water column, seafloor
Ratfishes (Order Chimaeriformes).	Cartilaginous, placoid scales	Water column, seafloor	Not present	Not present
Sturgeons (Order Acipenseriformes)[2]	Primitive, ray-finned, cartilaginous, bony plates, heterocercal tail	Surface, water column, seafloor	Surface, water column, seafloor	Surface, water column, seafloor, all locations except: <u>Civilian Ports</u> Tampa, FL; Beaumont, TX; Corpus Christi, TX <u>Coast Guard Stations</u> Fort Pierce, FL; Dania, FL; Miami, FL; Key West, FL; Petersburg, FL; Corpus Christi, TX

Table 3.6-2: Description and Occurrence of Major Taxonomic Groups of Fishes in the Study Area (continued)

Resource Groups		*Occurrence in Study Area*[1]		
Common Name (Classification)	***Description***	***Range Complex/ Testing Range***	***Range Complex Inshore***	***Piers/Ports/Coast Guard Stations***
Gars (Order Lepisosteiformes)	Primitive, slender body. ganoid scales, heterocercal tail; needle-like teeth	Not present	Surface, water column, all locations except Northeast Range Complex Inshore	Surface, water column, all locations except: <u>Pierside</u> Portsmouth Naval Shipyard, Naval Submarine Base New London, Naval Station Newport <u>Civilian Ports</u> Bath, ME; Boston, MA; Earle, NJ; New London, CT; Newport, RI <u>Coast Guard Stations</u> Boston, MA; New London, CT; Newport, RI
Herrings and allies (Order Clupeiformes)	Silvery, Lateral line on body and fin spines absent, usually scutes along ventral profile	Surface, water column	Surface, water column	Surface, water column
Tarpons and allies (Orders Elopiformes, and Albuliformes)	Body encased in silvery scales, mouth large, mostly a single dorsal fin, some with tapered tail fin, spines absent	Water column, seafloor	Surface, water column, seafloor	Surface, water column, seafloor
Eels and allies (Orders Anguilliforms, Notacanthiformes, and Saccopharyngiformes)	Body very elongate, usually scaleless with pelvic fins and fin spines absent	Water column, seafloor	Water column, seafloor	Water column, seafloor
Salmonids (Order Salmoniformes)[2]	Silvery body, adipose fin present	Surface, water column, Northeast Range Complexes	Surface, water column, Northeast Range Complex Inshore	Surface, water column, <u>Pierside</u> NS Newport, Portsmouth Naval Shipyard, NSB New London <u>Civilian Ports</u> Bath, ME; Boston, MA <u>Coast Guard Stations</u> Boston, MA; New London, CT
Argentines and allies (Order Argentiniformes)	Body silvery, and elongate; fin spines absent, adipose fin sometimes present, pelvic fins and ribs sometimes absent	Water column, seafloor	Not present	Not present

Table 3.6-2: Description and Occurrence of Major Taxonomic Groups of Fishes in the Study Area (continued)

Resource Groups		*Occurrence in Study Area*[1]		
Common Name (Classification)	***Description***	***Range Complex/ Testing Range***	***Range Complex Inshore***	***Piers/Ports/Coast Guard Stations***
Catfishes (Order Siluriformes)	Barbels on head, spines on dorsal and pectoral fins, scaleless, adipose fin present	Seafloor, all locations except Northeast Range Complexes	Seafloor, all locations except Northeast Range Complex Inshore	Seafloor, all locations except: Pierside Portsmouth Naval Shipyard, Naval Submarine Base New London, Naval Station Newport Civilian Ports Bath, ME; Boston, MA; Earle, NJ; New London, CT; Newport, RI Coast Guard Stations Boston, MA; New London, CT; Newport, RI
Bristlemouths and allies (Orders Stomiiformes)	Photophores present, adipose and chin barbels fin sometimes present	Water column, seafloor	Not present	Not present
Greeneyes and allies (Order Aluopiformes)	Upper jaw protrusible adipose fin present, forked tail usually present	Water column, seafloor	Not present	Not present
Lanternfishes and allies (Order Myctophiformes)	Small-sized, adipose fin, forked tail and photophores usually present	Water column, seafloor	Not present	Not present
Hakes and allies (Order Gadiformes)	Long dorsal and anal fins; no true spines, spinous rays present in dorsal fin, barbels present	Water column, seafloor	Surface, water column, seafloor	Surface, water column, seafloor
Brotulas and allies (Order Ophidiiformes)	Pelvic absent or far forward and filamentous, no sharp spines, Dorsal and anal fins joined to caudal fins	Water column, seafloor	Not present	Not present
Toadfishes and allies (Order Batrachoidiformes)	Body compressed; head large, mouth large with tentacles; two dorsal fins, the first with spines	Seafloor	Seafloor	Seafloor
Anglerfishes and allies (Order Lophiiformes)	Body globulose, first spine on dorsal fin usually modified, pelvic fins usually absent	Water column, seafloor	Not present	Not present
Flying Fishes (Order Beloniformes)	Jaws extended into a beak; pelvic fins very large wing-like; spines absent	Surface, water column	Surface, water column	Surface, water column

Table 3.6-2: Description and Occurrence of Major Taxonomic Groups of Fishes in the Study Area (continued)

Resource Groups		*Occurrence in Study Area*[1]		
Common Name (Classification)	***Description***	***Range Complex/ Testing Range***	***Range Complex Inshore***	***Piers/Ports/Coast Guard Stations***
Killifishes (Order Cyprinodontiformes)	Protrusible upper jaw; fin spines rarely present; single dorsal fin	Not present	Surface, water column	Surface, water column
Silversides (Order Atheriniformes)	Small-sized, silvery stripe on sides, pectoral fins high, first dorsal fin with flexible spine, pelvic fin with one spine	Surface, water column	Surface, water column	Surface, water column
Opahs and allies (Order Lampriformes)	Upper jaw protrusible; pelvic fins forward on body, below or just behind insertion of pectoral fins	Water column	Not present	Not present
Squirrelfishes and allies (Order Beryciformes)	Body usually round, one dorsal fin often set far back, pelvic fins absent, fin spines often present	Water column, seafloor	Not present	Not present
Dories and allies (Order Zeiformes)	Body deeply compressed, protrusible jaws, spines in dorsal fin, pelvic fin spines sometimes present	Water column, seafloor	Not present	Not present
Pipefishes (Order Syngnathiformes)	Snout tube-like, mouth small, scales often modified bony plates	Water column, seafloor	Water column, seafloor	Water column, seafloor
Sticklebacks (Order Gasterosteiformes)	Mouth small, scales often modified bony plates	Water column, seafloor	Water column, seafloor	Water column, seafloor
Scorpionfishes (Order Scorpaeniformes)	Usually strong spines on head and dorsal fin; cheeks with bony struts, pectoral fins usually rounded	Water column, seafloor	Water column, seafloor	Water column, seafloor
Mullets (Order Mugiliformes)	Streamline body, forked tail, hard angled mouth, large scales	Surface, water column, seafloor	Surface, water column, seafloor	Surface, water column, seafloor
Perch-like Fishes and Allies (Order Perciformes)[2]	Deep bodied, to moderately elongate, 1-2 dorsal fins, large mouth and eyes, and thoracic pelvic fins	Surface, water column, seafloor	Surface, water column, seafloor	Water column, seafloor
Wrasses and Allies (Order Perciformes)	Compressed body, scales large, well- developed teeth, usually colorful	Water column, seafloor	Water column, seafloor	Water column, seafloor
Eelpouts and Allies (Order Perciformes)	Eel-like body, long dorsal and anal fins, pelvic fins usually absent	Seafloor	Seafloor	Seafloor

Table 3.6-2: Description and Occurrence of Major Taxonomic Groups of Fishes in the Study Area (continued)

Resource Groups		*Occurrence in Study Area*[1]		
Common Name (Classification)	***Description***	***Range Complex/ Testing Range***	***Range Complex Inshore***	***Piers/Ports/Coast Guard Stations***
Stargazers (Order Perciformes)	Body elongated, lower jaw usually projecting beyond upper jaw, pelvic and anal fins with spines	Seafloor	Seafloor	Seafloor
Blennies, Gobies, and Allies (Order Perciformes)	Body eel-like to sculpin-like, pelvic fins reduced or fused	Seafloor	Seafloor	Seafloor
Surgeonfishes (Order Perciformes)	Body deeply compressed laterally, mouth small, scales usually small, pelvic fins with spines	Water column, seafloor	Not present	Not present
Tunas and Allies (Order Perciformes)	Large mouth, inlets and keels usually present, pelvic fins often absent or reduced, fast swimmers	Surface, water column	Juvenile barracudas only	Juvenile barracudas only, all locations except: Pierside Portsmouth Naval Shipyard Civilian Ports Bath, ME
Butterfishes (Order Perciformes)	Snout blunt and thick, teeth small, maxilla mostly covered by bone	Surface, water column, seafloor	Not present	Not present
Flatfishes (Order Pleuronectiformes)	Body flattened; eyes on one side of body	Seafloor	Seafloor	Seafloor
Pufferfishes (Order Tetraodontiformes)	Skin thick or rough sometimes with spines or scaly plates, pelvic fins absent or reduced, small mouth with strong teeth coalesced into biting plate	Surface, water column, seafloor	Surface, water column, seafloor	Surface, water column, seafloor

[1] Fishes in each group can occur in all locations, unless specifically indicated.

[2] Taxonomic group contains ESA-listed (or proposed for listing) species (refer to Section 3.6.2.2, Endangered Species Act-Listed Species, for more information).

3.6.3 Environmental Consequences

Under the No Action Alternative, none of the proposed military readiness activities would be conducted. Therefore, baseline conditions of the existing environment for fishes would either remain unchanged or would improve after cessation of ongoing military readiness activities. As a result, the No Action Alternative is not analyzed further within this section.

This section describes and evaluates how and to what degree the activities described in Chapter 2 (Description of Proposed Action and Alternatives) and stressors described in Section 3.0.3.3 (Identifying Stressors for Analysis) could potentially impact fishes known to occur within the Study Area.

The stressors vary in intensity, frequency, duration, and location within the Study Area. The activities that involve each of the following stressors are identified in Appendix A (Activity Descriptions) and Appendix B (Activity Stressor Matrices). The stressors and substressors analyzed for fishes include the following:

- **acoustics** (sonar and other transducers; air guns; pile driving; vessel noise; aircraft noise; and weapons noise)
- **explosives** (explosions in water; explosions in air)
- **energy** (in-water electromagnetic devices)
- **physical disturbance and strikes** (vessels and in-water devices; military expended materials; seafloor devices; pile driving)
- **entanglement** (wires and cables; decelerators/parachutes; biodegradable polymers)
- **ingestion** (military expended materials – munitions; military expended materials other than munitions)

A discussion of secondary stressors, to include the potential impacts to habitat or prey availability, and the potential impacts of all the stressors combined are provided at the end of the section.

The analysis of potential impacts to fishes considers standard operating procedures and mitigation measures that would potentially provide protection to fishes. Standard operating procedures are detailed in Section A.1.7 (Standard Operating Procedures) of Appendix A (Activity Descriptions). Mitigation measures relevant to fishes are referenced in Table 3.6-3 and in Section 3.3 (Habitats). Details on all mitigation measures are provided in Chapter 5 (Mitigation). Mitigation areas within the Study Area for fishes are shown in Figure 3.6-7 and Figure 3.6-8. The Panama City Gulf Sturgeon and Sea Turtle Mitigation Area overlaps a portion of Gulf sturgeon nearshore marine critical habitat.

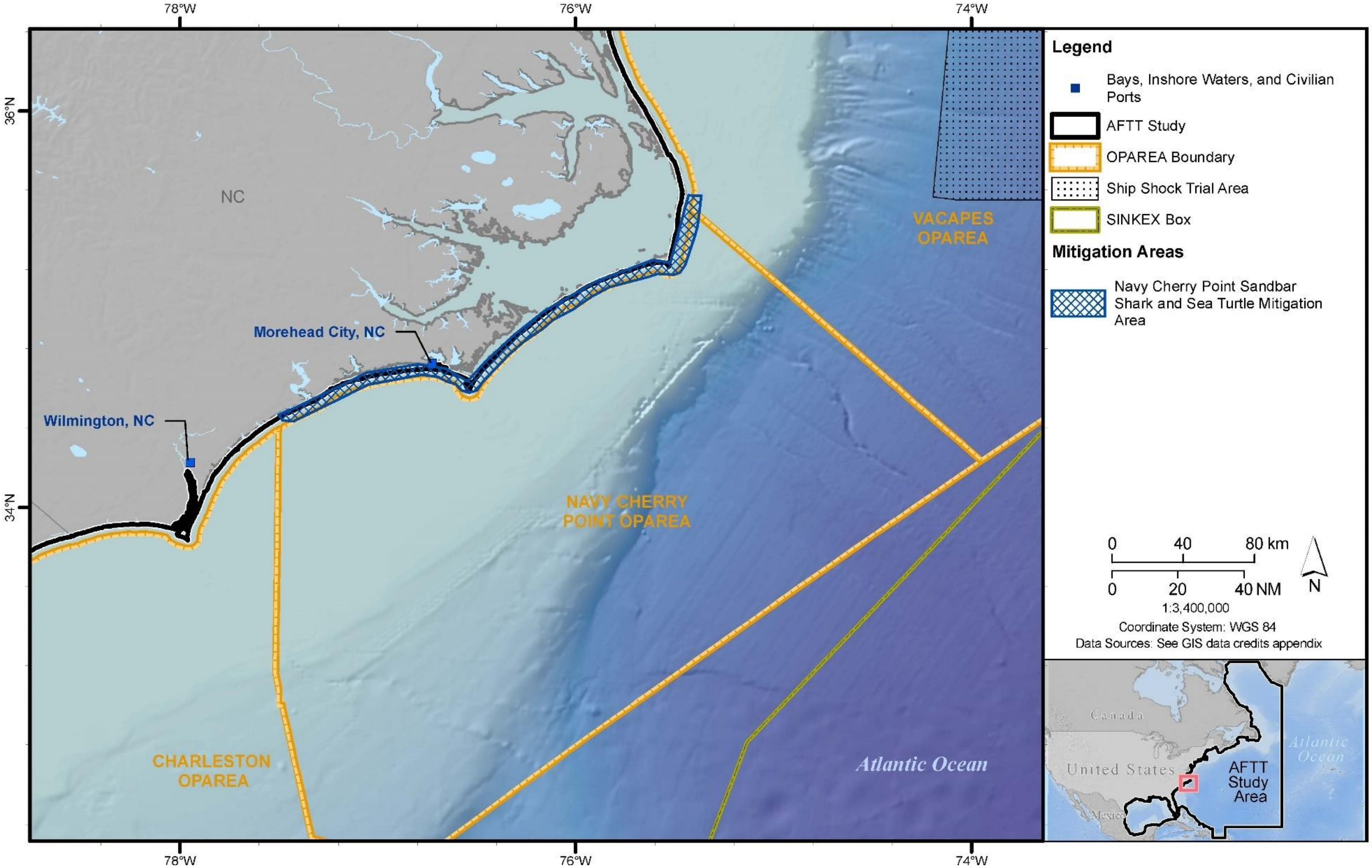
Table 3.6-3: Mitigation Requirements Summary by Stressor for Fishes

Applicable Stressor	*Requirements Summary and Protection Focus*	*Section Reference*
Explosives	Restrictions on the use of explosives within a horizontal distance from shallow-water coral reefs.	Section 5.7.1 (Shallow-Water Coral Reef Mitigation Areas)[1]
	Restrictions on the use of explosives within a horizontal distance from artificial reefs, live hard bottom, submerged aquatic vegetation, and shipwrecks, except in designated locations where these resources will be avoided to the maximum extent practicable.	Section 5.7.2 (Artificial Reef, Live Hard Bottom, Submerged Aquatic Vegetation, and Shipwreck Mitigation Areas)[1]
	Restrictions on the use of explosives from March 1 to September 30 during mine neutralization events, and on all other explosives to the maximum extent practicable.	Section 5.7.5 (Nearshore North Carolina Sandbar Shark and Sea Turtle Mitigation Area))
	Restrictions on line charge testing at night from March 1 to September 30, and from October 1 to March 31 (except within a designated location on Santa Rosa Island).	Section 5.7.6 (Panama City Gulf Sturgeon and Sea Turtle Mitigation Area)
	Conduct visual observations for floating vegetation (detached kelp paddies and *Sargassum*). During events with the largest net explosive weights involving ship shock trials, conduct observations for jellyfish aggregations, large schools of fish, or flocks of seabirds.	Section 5.6 (Visual Observations)[2]

Table 3.6-3: Mitigation Requirements Summary by Stressor for Fishes (continued)

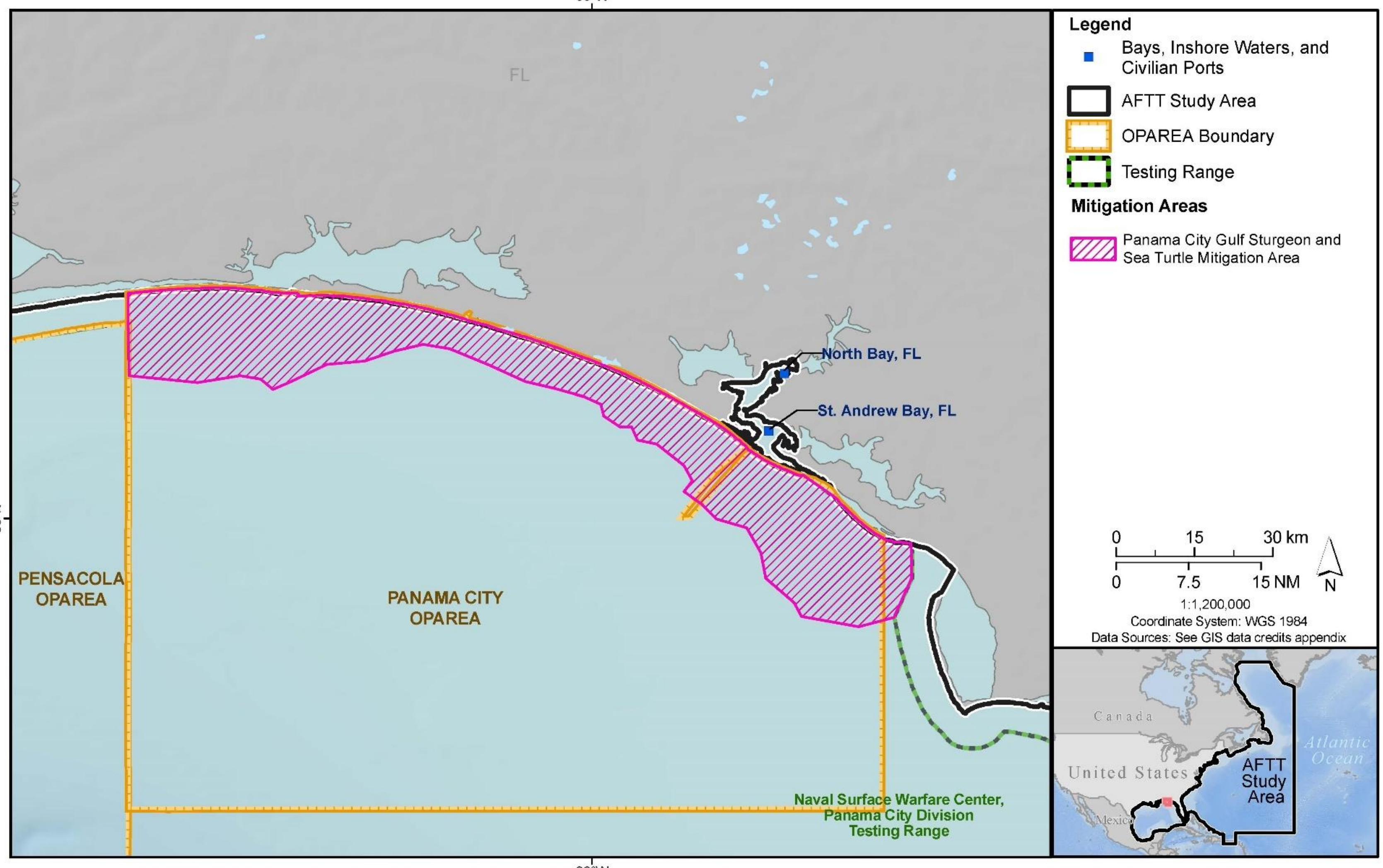
Applicable Stressor	*Requirements Summary and Protection Focus*	*Section Reference*
Physical disturbance and strike	Avoid shallow-water coral reefs during training and testing activities.	Section 5.7.1 (Shallow-Water Coral Reef Mitigation Areas)[1]
	Avoid Artificial Reef, Live Hard Bottom, Submerged Aquatic Vegetation, and Shipwreck Mitigation Areas during training and testing activities.	Section 5.7.2 (Artificial Reef, Live Hard Bottom, Submerged Aquatic Vegetation, and Shipwreck Mitigation Areas)[1]
	Mitigation for vessel disturbance and strike is summarized in Section 3.3 (Habitats)[1] including shallow-water coral reefs.	Section 5.7.3 (Key West Range Complex Seafloor Mitigation Area)[1] and Section 5.7.4 (South Florida Ocean Measurement Facility Seafloor Mitigation Area)[1]

[1] The mitigation was developed to protect specific habitats, which also protects fish that are associated with those habitats.
[2] The mitigation was developed to protect possible indicators of marine mammal presence, which includes large schools of fish.



Notes: AFTT = Atlantic Fleet Training and Testing; HAPC = habitat area of particular concern; OPAREA = operating area

Figure 3.6-7: Mitigation Areas for Fishes in the Study Area (Nearshore North Carolina Sandbar Shark and Sea Turtle Mitigation Area)



Notes: AFTT = Atlantic Fleet Training and Testing; OPAREA = operating area

Figure 3.6-8: Mitigation Areas for Fishes in the Study Area (Panama City Gulf Sturgeon and Sea Turtle Mitigation Area)

The criteria for determining the significance of Proposed Action stressors on fishes are described in Table 3.6-4. The abbreviated analysis under each substressor and alternative provides the technical support for these determinations, with reference to the 2018 Final EIS/OEIS or supporting appendices for details.

Table 3.6-4: Criteria for Determining the Significance of Proposed Action Stressors on Fishes

Impact Descriptor	*Context and Intensity*	*Significance Conclusions*
Negligible	Impacts to fishes would be limited to temporary (lasting up to several hours) behavioral and stress-startle responses to individual fish or schools of fish found within the Study Area. Impacts on habitat would be temporary (e.g., temporary placement of object on the sea floor or increased turbidity) with no lasting damage or alteration.	Less than significant
Minor	Impacts to fishes would generally be temporary or short term (lasting several days to several weeks), but would not be outside the natural range of variability of species' populations, their habitats, or the natural processes sustaining them. This could include temporary threshold shift of hearing or repeated, short-term stress responses without permanent physiological damage, but could also include physiological injury or mortality to a relatively small number of individuals of common species. Behavioral responses to disturbance by some individuals or a school of fish could be expected, but only temporary disturbance of breeding, feeding, or other activities would occur, without any impacts on population levels. Displacement would be short term and limited to the Study Area or its immediate surroundings. Impacts on habitat (e.g., short-term placement of objects on the sea floor which increases turbidity or causes loss of a small area of vegetation) would be easily recoverable, with no long-term or permanent damage or alteration.	Less than significant
Moderate	Impacts to fishes would be short term or long term (lasting several months or longer) and outside the natural range of variability of species' populations, their habitats, or the natural processes sustaining them. This could include physiological injury to individuals in the form of temporary or permanent hearing threshold shift, repeated stress responses, or mortality. Behavioral responses to disturbance by numerous individuals could be expected in the Study Area, its immediate surroundings, or beyond. These could include negative impacts to breeding, feeding, growth, or other factors affecting population levels, including population-level mortality to, or extended displacement (up to a year) of, large numbers (i.e., population level) of fish. However, they would not threaten the continued existence of a stock, population, or species. Habitat would be potentially damaged or altered over the long term but would continue to support the species reliant on it.	Less than significant
Major	Impacts to fishes would be short or long term and well outside the natural range of variability of species' populations, their habitats, or the natural processes sustaining them. Behavioral and stress responses would be repeated, and hearing threshold shifts would be permanent. Actions would affect any stage of a species' life cycle (i.e., breeding, feeding, growth, and maturity), alter population structure, genetic diversity, or other demographic factors, and/or cause mortality beyond a small number of individuals, resulting in a decrease in population levels. Displacement and stress responses would be short or long term within and well beyond the Study Area. Habitat would be degraded long term or permanently so that it would no longer support a sustainable fishery and would cause the population of a managed species to become stressed, less productive, or unstable.	Significant

With noted exceptions, the stressor background information and environmental consequences are not meaningfully different from what is described in the 2018 Final EIS/OEIS Section 3.6.3 (Environmental Consequences).

3.6.3.1 Acoustic Stressors

This section summarizes the potential impacts of acoustic stressors used during military readiness activities within the Study Area. The acoustic substressors included for analysis are (1) sonar and other transducers, (2) air guns, (3) pile driving, (4) vessel noise, (5) aircraft noise, and (6) weapons noise. Table 3.6-5 contains brief summaries of background information that is relevant to the analyses of impacts for each acoustic substressor (sonar and other transducers, etc.) on fishes. Detailed information on acoustic impact categories in general, as well as effects specific to each substressor, are provided in Appendix D (Acoustic and Explosive Impacts Supporting Information). For a listing of the types of activities that use or produce acoustic stressors, refer to Appendix A (Activity Descriptions) and Appendix B (Activity Stressor Matrices). The types and quantities of sonar sources, air guns, and pile driving, the number of events using vessels and aircrafts, and the locations of those events under each alternative are shown in Section 3.0.3.3.1 (Acoustic Stressors).

Due to updated criteria and thresholds used to assess impacts, and acoustic effects modeling, the quantitative analysis of impacts due to sonars and other transducers, air guns, and pile driving (i.e., ranges to effects) provided in this section supplant the analyses in the 2018 Final EIS/OEIS. The detailed assessment of these acoustic stressors under this Proposed Action is in Appendix E (Acoustic and Explosives Impact Analysis). Potential changes in the predicted acoustic impacts are due to the following:

- Updates to criteria used to determine if acoustic stressors may cause impacts.
- Revisions to the modeling of explosive effects in the Navy Acoustic Effects Model. See the technical report Quantifying Acoustic Impacts on Marine Mammals and Sea Turtles: Methods and Analytical Approach for Phase IV Training and Testing (U.S. Department of the Navy, 2024).
- Changes in the locations, numbers, and types of modeled military readiness activities as described in Chapter 2 (Description of Proposed Action and Alternatives), and associated quantities (hours and counts) of acoustic stressors shown in Section 3.0.3.3.1 (Acoustic Stressors).

Table 3.6-5: Acoustic Stressors Background Information Summary

Substressor	*Background Information Summary*
All acoustic substressors	Fishes are not equally sensitive to sound at all frequencies. • Most fishes are hearing generalists and primarily detect particle motion at frequencies below 2 kilohertz (kHz). • Hearing specialists can detect low frequencies but also possess anatomical specializations to enhance hearing and are capable of sound pressure detection up to 10 kHz, or over 100 kHz in some species. • Fishes with a swim bladder are generally more susceptible to temporary threshold shift (TTS) than those without a swim bladder, regardless of the sound source.
Sonar and other transducers	Sonar and other transducers may result in hearing loss, masking, physiological stress, or behavioral reactions. • Most low-frequency sonars have relatively low source levels (see Table 3.0-2, Sonar and Transducer Sources Quantitatively Analyzed, in Section 3.0.3.3.1, Acoustic Stressors, for the quantities of low-frequency sonars with source

Table 3.6-5: Acoustic Stressors Background Information Summary (continued)

Substressor	*Background Information Summary*
	levels < 205 dB) and would not result in TTS. If TTS did occur, it would occur within near to intermediate distances from a sound source (a few to tens of meters) from systems with the highest possible source levels, or those that are operated at high duty cycles or continuously. • Although masking is possible for sources that fish can hear, the narrow bandwidth and intermittent nature of most sonar signals would result in only a limited probability of impacts. • Available research showed very little response of both captive and wild Atlantic herring (hearing specialists) to sonar (e.g., no avoidance). Such data suggests sonar poses little risk to populations of herring and that there is a low probability of behavioral reactions to sonar for most fishes. • Direct injury from sonar and other transducers is highly unlikely and is not considered further in this analysis.
Air guns	Exposure to air guns could result in hearing loss, masking, physiological stress, or behavioral reactions, and in some cases, injury. • Hair cell loss and TTS have been reported in fishes exposed to air guns, though fishes typically recovered from these effects in controlled laboratory settings. • Although masking could occur, air gun pulses are typically brief (fractions of a second) and biological sounds can be detected between pulses within close distances to the source. Masking could also indirectly occur because of repetitive impulsive signals where the repetitive sounds and reverberations over distance may create a more continuous noise exposure. • Fish may react behaviorally to any impulsive sound source within near and intermediate distances (tens to hundreds of meters), with decreasing probability of reaction at increasing distances. Examples of reported behavioral reactions to impulsive sources include startle response, changes in swimming speeds and movement patterns, avoidance of the sound source, and no observed response. • Exposure to air gun shots has not caused mortality, and fishes typically recovered from injuries in controlled laboratory settings.
Pile driving	Pile driving and removal involves both impact and vibratory methods. Exposure to pile driving could result in hearing loss, masking, physiological stress, or behavioral reactions, and in some cases, injury. • Hair cell loss and TTS have been reported in fishes exposed to impact pile driving, though fishes typically recovered from these effects in controlled laboratory settings. • Although masking could occur, impact pile driving pulses are typically brief (fractions of a second) and biological sounds can be detected between pulses within close distances to the source. Masking could also indirectly occur because of repetitive impulsive signals where the repetitive sounds and reverberations over distance may create a more continuous noise exposure. • Vibratory pile driving could result in reductions in auditory sensitivity and masked biological signals. The relative risk of masking due to vibratory pile driving is highest in the near and moderate distances from the source (up to hundreds of meters) but decreases with increasing distance. • Fish may react behaviorally to any impulsive sound source within near and intermediate distances (tens to hundreds of meters), with decreasing probability of reaction at increasing distances. Examples of reported behavioral reactions to impulsive sources include startle response, changes in swimming

Table 3.6-5: Acoustic Stressors Background Information Summary (continued)

Substressor	*Background Information Summary*
	speeds and movement patterns, avoidance of the sound source, and no observed response. • Exposure to impact pile driving has not caused mortality, and fishes typically recovered from injuries in controlled laboratory settings. • Direct injury from vibratory pile driving, like other continuous sources, is highly unlikely and is not considered further in this analysis.
Vessel disturbance (including vessel noise)	Vessel disturbance (including the production of noise) may result in hearing loss, masking, physiological stress, or behavioral reactions. In some more industrialized or populated areas, vessel noise is a chronic and frequent stressor. • Behavioral responses to vessels can be caused by multiple factors (e.g., visual cues) as vessel sound exposure is rarely decoupled from the physical presence of a vessel. • Fishes with hearing specializations are more susceptible to TTS from long duration continuous noise (e.g., 12 hours). However, it is less likely that TTS would occur in fishes that are hearing generalists. • The probability of masking, physiological responses, and behavioral reactions from vessel noise is higher at near to moderate distances from the source (up to hundreds of meters) but decreases with increasing distance. • Direct injury from vessel noise is highly unlikely and is not considered further in this analysis.
Aircraft disturbance (including aircraft noise)	Aircraft noise may result in masking, physiological stress, or behavioral reactions in fishes near the surface as aircrafts pass overhead. • Aircraft sound exposure is rarely decoupled from the physical presence of an aircraft therefore responses may be due to multiple factors (e.g., visual cues). • Most aircraft activities are transient resulting in brief periods of exposure (seconds to minutes), with fewer instances where aircraft noise would persist for longer periods (e.g., hovering helicopters, which are accompanied by other disturbance factors such as shadows and water displacement). • Sound from an overhead aircraft would only be transmitted into the water in a narrow beam directly below the source, minimizing the total energy that enters the water and limiting the total ensonified area. • Documented reactions by fishes to aircraft noise is limited, however fishes would be expected to react to aircraft noise as they would react to other transient sounds (e.g., vessel noise).
Weapons noise	Weapons noise may result in hearing loss, masking, physiological stress, or behavioral reactions. • Weapons noise is rarely decoupled from the physical presence of a vessel or object (e.g., projectiles) therefore responses may be due to multiple factors (e.g., visual cues). • Sound from weapons firing would only be transmitted into the water directly below the firing source, transiting projectile, or at the area of impact, minimizing the total energy that enters the water and limiting the total ensonified area. • Reactions by fishes to weapons noise is limited; however, fishes would be expected to react to weapons noise as they would react to other transient sounds (e.g., vessel noise). • Documented reactions by fishes to aircraft noise is limited, however fishes would be expected to react to weapons noise as they would react to other impulsive sounds (e.g., impact pile driving or air guns).

Notes: < = less than; dB = decibels; kHz = kilohertz; TTS = temporary threshold shift

3.6.3.1.1 Impacts from Sonar and Other Transducers

Table 3.6-5 contains a summary of the background information used to analyze the potential impacts of sonar and other transducers on fishes. For information on sonar and other transducers hours or counts proposed for each alternative, see Table 3.0-2 (Sonar and Transducer Sources Quantitatively Analyzed).

3.6.3.1.1.1 Impacts from Sonar and Other Transducers under Alternative 1

As discussed in Section 3.0.3.3.1 (Acoustic Stressors), a detailed comparison of sonar quantities analyzed in the 2018 Final EIS/OEIS with sonar quantities under this Proposed Action is not feasible due to changes in the source binning process. However, the overall use of sonar and other transducers would decrease from the 2018 Final EIS/OEIS for both training and testing activities.

Under Alternative 1, changes from the 2018 Final EIS/OEIS for training activities using low-frequency sonar (in addition to other types of sonar) would include the following:

- There would be a small increase in unit-level anti-submarine warfare activities in the Gulf of Mexico Range Complex and pierside location Naval Station Mayport.

For all other locations, there would be a decrease or a similar number of activities that involve the use of low-frequency sonar to the 2018 Final EIS/OEIS.

Under Alternative 1, changes from the 2018 Final EIS/OEIS for testing activities using low-frequency sonars would include the following:

- Under anti-submarine warfare testing activities, there would be new events in the high seas, Gulf of Mexico Range Complex Inshore, Joint Expeditionary Base Little Creek, Naval Station Mayport, Naval Station Norfolk, Naval Submarine Base King Bay, and Naval Submarine Base New London.
- There would also be a notable increase in Anti-Submarine Warfare activities in Bath, Maine, and Pascagoula, Mississippi.

Although some marine fishes are considered hearing specialists (e.g., shad) and could be impacted by mid- or high-frequency sources, sound from these systems do not propagate as far as other sonars limiting the range these sources would be detectable, and therefore minimizing potential risk of impacts. Most marine fishes (hearing generalists) would not detect most mid- or high-frequency sonars and therefore would not experience impacts from these systems.

All fishes can detect low frequencies, therefore, most impacts would be limited to a subset of activities that utilize low-frequency sonars in the offshore portions of the Study Area. Some impacts may also occur during a small number of equipment testing activities conducted at pierside locations (e.g., Naval Submarine Base New London and Naval Station Norfolk). Range complexes with the highest quantities of low-frequency sonar, listed in descending order, include the Jacksonville, Virginia Capes, Northeast, Gulf of Mexico, and Navy Cherry Point Range Complexes, though these sources could also be used in other portions of the Study Area (e.g., in the Naval Surface Warfare Center Panama City, Naval Underwater Warfare Center Newport, and South Florida Ocean Measurement Facility Testing Range). Generally, low-frequency sonars are operated less often than mid- or high-frequency sources throughout the Study Area. Sonar is used more often during testing than training activities, resulting in slightly more potential impacts from testing activities.

Fishes may only detect the most powerful systems within a few kilometers; and most other, less powerful systems, at shorter ranges. Overall, temporary threshold shift (TTS) is not anticipated to occur in fishes exposed to low-frequency sonars as these systems generally lack the power necessary to generate hearing loss. Although unlikely, hearing specialists in proximity (tens of meters) to some mid-frequency systems may experience TTS. These individuals may experience a reduced ability to detect biologically relevant sounds until their hearing recovers (likely within a few minutes to hours depending on the amount of threshold shift).

Most sonars do not have the potential to substantially mask key environmental sounds due to the limited time of exposure resulting from the moving sound sources and variable duty cycles. Although available research has shown a lack of behavioral reactions to military sonar by hearing specialists (herring) (e.g., Sivle et al., 2012), it is possible that fish exposed to sonar could show some physiological or behavioral responses, especially in fish or schools of fish located close to the source (hundreds of meters). However, these impacts, if any, would be localized and infrequent, only lasting a few seconds or minutes due to the transient nature of most sonar operations.

Based on the updated background and analysis for training and testing under Alternative 1, sonar impacts on fishes would be limited to brief (seconds to minutes) periods of physiological or behavioral reactions to individual fish found within localized areas. This is consistent with a negligible impact on fish populations as defined in Table 3.6-4.

The use of sonar and other transducers during training and testing activities as described under Alternative 1 may affect ESA-listed Atlantic salmon, Atlantic sturgeon, shortnose sturgeon, Gulf sturgeon, smalltooth sawfish, giant manta rays, Nassau grouper, oceanic whitetip sharks, and scalloped hammerhead sharks due to overlap of the substressor with the species distributions throughout the Study Area. Sonar use is not applicable to smalltooth sawfish critical habitat due to lack of overlap with the stressor. Designated Atlantic salmon, Atlantic sturgeon, Gulf sturgeon, or Nassau grouper critical habitat will not be affected by sonar because sound would not affect the physical and biological features associated with the habitat. The Action Proponents are consulting with NMFS as required by section 7(a)(2) of the ESA.

3.6.3.1.1.2 Impacts from Sonar and Other Transducers under Alternative 2

Under Alternative 2, sonar use during training activities would increase compared to Alternative 1:

- The maximum number of composite training exercises would occur each year, and an additional composite training exercise would occur in the Gulf of Mexico Range Complex.

Impacts from sonar and other transducers under Alternative 2 are not meaningfully different from Alternative 1 and therefore the conclusions for significance, ESA-listed species, and critical habitat are the same for both training and testing. The quantities of sonar and other transducer activity (e.g., hours, counts) under Alternative 2 would increase only slightly over Alternative 1.

3.6.3.1.2 Impacts from Air Guns

Table 3.6-5 contains a summary of the background information used to analyze the potential impacts of air guns on fishes. For information on air gun counts proposed for each alternative, see Table 3.0-3 (Training and Testing Air Gun and Non-Explosive Impulsive Sources Quantitatively Analyzed in the Study Area).

3.6.3.1.2.1 Impacts from Air Guns under Alternative 1

Air guns would not be used under training activities. The proposed use of air guns decreased overall for testing from the 2018 Final EIS/OEIS. Small air guns would be fired over a limited period within a single day. Air gun use would only occur in two testing activities: semi-stationary equipment testing and acoustic and oceanographic research. While air gun use during semi-stationary equipment testing may occur nearshore at Newport, Rhode Island, air gun use during acoustic and oceanographic research may occur in the Northeast, Virginia Capes, Jacksonville, and Gulf of Mexico Range Complexes.

A quantitative analysis was performed to estimate range to effects for fishes exposed to air guns. However, calculated ranges to effects indicate injury and hearing loss would only occur within a short distance (less than 20 m). Exposure to air guns could also result in masking, physiological response, or behavioral reactions. These impacts are expected to be brief (seconds to minutes) due to the short pulse length (approximately 0.1 second) and intermittent use of air guns throughout the Study Area.

Based on the updated background and analysis for training and testing under Alternative 1, air gun impacts on fishes would be limited to temporary (minutes to hours) physiological and behavioral responses, and some instances of TTS or direct injury (though this would be rare) in individual fishes found within localized areas. This is consistent with a minor impact on fish populations.

The use of air guns during testing activities as described under Alternative 1 may affect ESA-listed Atlantic salmon, Atlantic sturgeon, shortnose sturgeon, Gulf sturgeon, smalltooth sawfish, Giant manta ray, and oceanic whitetip shark due to the overlap of the substressor with the species distribution throughout the Study Area. The use of air guns is not applicable regarding ESA-listed Nassau grouper or scalloped hammerhead shark as well as designated critical habitat for Atlantic salmon, Atlantic sturgeon, Gulf sturgeon, smalltooth sawfish, and Nassau grouper due to lack of overlap with the stressor. The Action Proponents are consulting with NMFS as required by section 7(a)(2) of the ESA.

3.6.3.1.2.2 Impacts from Air Guns under Alternative 2

Air guns would not be used during training activities. Impacts from air guns under Alternative 2 are not meaningfully different from Alternative 1 and therefore the conclusions for significance, ESA-listed species, and critical habitat are the same for testing activities. Alternative 2 is the maximum number of air gun blasts that is included in the range of blasts for Alternative 1.

3.6.3.1.3 Impacts from Pile Driving

Table 3.6-5 contains a summary of the background information used to analyze the potential impacts of pile driving noise on fishes. Only Port Damage Repair training includes pile driving. For information on pile driving quantities proposed for each alternative, see Table 3.0-4 (Number of Piles/Sheets Quantitatively Analyzed under Pile Driving and Removal Training Activities). The impact and vibratory pile driving hammers would expose fishes to impulsive and continuous non-impulsive broadband sounds, respectively.

3.6.3.1.3.1 Impacts from Pile Driving under Alternative 1

Pile driving or removal would not occur under testing activities. The activity type and location for pile driving activities for training have changed from the 2018 Final EIS/OEIS.

Under Alternative 1 for training:

- Pile driving would occur as part of Port Damage Repair activities in Gulfport, Mississippi.

- Pile driving would no longer occur as part of the Elevated Causeway System at Joint Expeditionary Base Little Creek in the Virginia Capes Range Complex or Marine Corps Base Camp Lejeune in the Navy Cherry Point Range Complex.

Impact and vibratory pile driving during Port Damage Repair training activities can occur throughout the year over five days, and up to four times per year (20 days total) in Gulfport, Mississippi. Pile driving activities would occur intermittently in very limited areas and would be of temporary duration. The activity is also occurring in a highly disturbed estuarine habitat that is different than the natural beach environments covered in the 2018 Final EIS/OEIS.

A quantitative analysis was performed to estimate range to effects for fishes exposed to pile driving. Calculations resulted in ranges of zero or one for injury or mortality and very short, estimated ranges to TTS (15 m or less for a single day exposure). Considering these extremely small footprints and standard operating procedure for soft starts, mortality or injury in fishes exposed to impact pile driving is so unlikely as to be discountable. Although TTS could occur at farther ranges (tens of meters) for the longer of the exposure periods, available research suggest fishes are more likely to startle or avoid the immediate area surrounding a pile driving activity or, in some cases, would habituate and return to normal behaviors after initial exposure. In the rare event some individuals remain in the area for a full day and receive TTS, these fish may experience a reduced ability to detect biologically relevant sounds until their hearing recovers (likely within a few minutes to days depending on the amount of threshold shift).

Fishes exposed to vibratory extraction would not experience mortality, injury, or TTS based on the low source level and limited duration of these activities. Based on the predicted noise levels, fishes may exhibit other responses such as temporary masking, physiological response, or behavioral reactions such as increasing their swimming speed, moving away from the source, or not responding at all. Individual fish that avoid the pile driving location would likely find similar suitable habitat in adjacent areas or would return to the location after cessation of the noise, reducing the potential for long-term effects.

Based on the updated background and analysis for training under Alternative 1, pile driving impacts on fishes would be limited to temporary (minutes to hours) physiological and behavioral responses, and some instances of TTS (though this would be rare) in individual fishes found within localized areas. This is consistent with a minor impact on fish populations.

The use of pile driving during training activities as described under Alternative 1 may affect ESA-listed Gulf sturgeon, smalltooth sawfish, and giant manta rays due to overlap of the substressor with the species distribution in the Gulf of Mexico. The use of pile driving is not applicable regarding Atlantic salmon, Atlantic sturgeon, shortnose sturgeon, Nassau grouper, oceanic whitetip sharks, and scalloped hammerhead sharks as well as designated critical habitat for Atlantic salmon, Atlantic sturgeon, smalltooth sawfish, and Nassau grouper due to the lack of overlap with the substressor. Designated Gulf sturgeon critical habitat may be affected by pile driving due to potential impacts to prey items within the habitat. The use of pile driving is not applicable to designated Atlantic salmon, Atlantic sturgeon, smalltooth sawfish, and Nassau grouper critical habitat due to lack of overlap with the stressor. The Action Proponents are consulting with NMFS as required by section 7(a)(2) of the ESA.

3.6.3.1.3.2 Impacts from Pile Driving under Alternative 2

There would be no pile driving or removal associated with testing activities. Impacts from pile driving during training under Alternative 2 are no different from Alternative 1 and therefore the conclusions for significance, ESA-listed species, and critical habitat are the same.

3.6.3.1.4 Impacts from Vessel Noise

Table 3.6-5 contains a summary of the background information used to analyze the potential impacts of vessel noise on fishes. For information on the number of activities including vessel noise, see Table 3.0-9 (Number and Location of Activities Including Vessels) and Table 3.0-10 (Number and Location of Activities Including In-Water Devices).

3.6.3.1.4.1 Impacts from Vessel Noise under Alternative 1

For both training and testing activities, vessel activity would decrease overall from the 2018 Final EIS/OEIS. This Supplemental EIS/OEIS will rely on the previous 2018 Final EIS/OEIS analysis of vessel noise, so impacts would be expected to be similar or lesser than previously concluded.

Under Alternative 1 for training:

- Vessel noise would occur in two locations that are new or not previously analyzed (Gulfport and Pascagoula, Mississippi, respectively). For all other locations, there would either be a decrease or similar events including vessel activity.

Under Alternative 1 for testing:

- Vessel noise would occur in five locations not previous analyzed (inshore locations of the Northeast, Virginia Capes, and Gulf of Mexico Range Complexes; Other AFTT Areas; Hampton Roads, Virginia). There would also be notable increases in vessel activity at the Naval Surface Warfare Center Panama City Division Testing Range, Naval Station Norfolk, and Pascagoula, Mississippi. For all other locations, there would either be a decrease or similar amount of vessel activity.

Based on the updated background and previous analysis for training and testing under Alternative 1, vessel noise impacts on fishes would be limited to temporary (hours) behavioral and stress-startle responses to individual fish found within localized areas. This is consistent with a negligible impact on fish populations.

The production of vessel noise during training and testing activities as described under Alternative 1 may affect ESA-listed Atlantic salmon, Atlantic sturgeon, shortnose sturgeon, Gulf sturgeon, smalltooth sawfish, giant manta rays, Nassau grouper, oceanic whitetip sharks, and scalloped hammerhead sharks due to the overlap of the substressor with the species distribution throughout the Study Area. Designated Atlantic salmon, Atlantic sturgeon, Gulf sturgeon, smalltooth sawfish, and Nassau grouper critical habitat will not be affected by vessel noise because sound would not affect the physical and biological features associated with the habitat. The Action Proponents are consulting with NMFS as required by section 7(a)(2) of the ESA.

3.6.3.1.4.2 Impacts from Vessel Noise under Alternative 2

Impacts from vessel noise under Alternative 2 are not meaningfully different from Alternative 1 and therefore the conclusions for significance, ESA-listed species, and critical habitat are the same for both training and testing. The number of activities including vessels or in-water devices increases only slightly over that of Alternative 1.

3.6.3.1.5 Impacts from Aircraft Noise

Table 3.6-5 contains a summary of the background information used to analyze the potential impacts of aircraft noise on fishes. For information on the number of activities including aircraft noise, see Table 3.0-16, Number and Location of Activities with Aircraft).

3.6.3.1.5.1 Impacts from Aircraft Noise under Alternative 1

For both training and testing activities, aircraft activity would decrease overall from the 2018 Final EIS/OEIS. This Supplemental EIS/OEIS will rely on the previous 2018 Final EIS/OEIS analysis of aircraft noise, so impacts would be expected to be similar or lesser than previously concluded.

Under Alternative 1, the following changes exist from the 2018 Final EIS/OEIS for training activities:

- A notable increase in the Navy Cherry Point Range Complex.

Under Alternative 1, the following changes exist from the 2018 Final EIS/OEIS for testing activities:

- Aircraft use in the following area that was not previously analyzed: Other AFTT Areas.

Based on the updated background and previous analysis for training and testing under Alternative 1, aircraft noise impacts on fishes would be limited to brief (seconds to minutes) behavioral and stress-startle responses to individual fish found within localized areas. This is consistent with a negligible impact on fish populations.

The production of aircraft noise during training and testing activities as described under Alternative 1 may affect ESA-listed Atlantic salmon, Atlantic sturgeon, shortnose sturgeon, Gulf sturgeon, smalltooth sawfish, giant manta rays, Nassau grouper, oceanic whitetip sharks, and scalloped hammerhead sharks due to the overlap of the substressor with the species distribution throughout the Study Area. Designated Atlantic sturgeon, Gulf sturgeon, smalltooth sawfish, and Nassau grouper critical habitat will not be affected by aircraft noise because sound would not affect the physical and biological features associated with the habitat. Aircraft noise is not applicable to designated Atlantic salmon and Atlantic sturgeon critical habitat due to lack of geographic overlap. The Action Proponents are consulting with NMFS as required by section 7(a)(2) of the ESA.

3.6.3.1.5.2 Impacts from Aircraft Noise under Alternative 2

Impacts from aircraft noise under Alternative 2 are not meaningfully different from Alternative 1 and therefore the conclusions for significance, ESA-listed species, and critical habitat are the same for both training and testing. The number of activities including aircraft under Alternative 2 would increase only slightly over Alternative 1.

3.6.3.1.6 Impacts from Weapons Noise

Table 3.6-5 contains a summary of the background information used to analyze the potential impacts of weapons noise on fishes. For information on the number of activities including weapons noise, see Table 3.0-11 (Number and Location of Non-explosive Practice Munitions Expended during Military Readiness Activities).

3.6.3.1.6.1 Impacts from Weapons Noise under Alternative 1

For both training and testing activities, weapons activity would decrease overall from the 2018 Final EIS/OEIS. This Supplemental EIS/OEIS will rely on the previous 2018 Final EIS/OEIS analysis of aircraft noise, so impacts would be expected to be similar or lesser than previously concluded.

Based on the updated background and previous analysis for training and testing under Alternative 1, weapons noise impacts on fishes would be limited to brief (seconds to minutes) behavioral and stress-startle responses to individual fish found within localized areas. This is consistent with a negligible impact on fish populations.

The production of weapons noise during training and testing activities as described under Alternative 1 may affect ESA-listed Atlantic salmon, Atlantic sturgeon, shortnose sturgeon, Gulf sturgeon, smalltooth sawfish, giant manta rays, Nassau grouper, oceanic whitetip sharks, and scalloped hammerhead sharks due to the overlap of the substressor with the species distribution throughout the Study Area. Designated Atlantic salmon, Atlantic sturgeon, Gulf sturgeon, smalltooth sawfish, and Nassau grouper critical habitat will not be affected by weapons noise because sound would not affect the physical and biological features associated with the habitat. The Action Proponents are consulting with NMFS as required by section 7(a)(2) of the ESA.

3.6.3.1.6.2 Impacts from Weapons Noise under Alternative 2

Impacts from weapons noise under Alternative 2 are not meaningfully different from Alternative 1 and therefore the conclusions for significance, ESA-listed species, and critical habitat are the same for both training and testing. The number of items generating weapons firing noise (e.g., non-explosive and explosive practice munitions) under Alternative 2 is the same as Alternative 1.

3.6.3.2 Explosive Stressors

This section summarizes the potential impacts of explosives used during military readiness activities within the Study Area. Table 3.6-6 summarizes background information that is relevant to the analyses of impacts for explosives. New applicable and emergent best available science regarding explosive impacts is presented in Appendix D (Acoustic and Explosive Impacts Supporting Information).

Due to updates to acoustic effects modeling, criteria and thresholds used to assess impacts, and changes to proposed use of explosives, the analysis of impacts due to explosives provided in this section supplant the analyses in the 2018 Final EIS/OEIS. The detailed assessment of explosive stressors under this Proposed Action is in Appendix E (Acoustic and Explosives Impact Analysis). Changes in the predicted explosive impacts are due to the following:

- Updates to criteria used to determine if an exposure to explosive energy may cause impacts.
- Revisions to the modeling of explosive effects in the Navy Acoustic Effects Model. See the technical report *Quantifying Acoustic Impacts on Marine Mammals and Sea Turtles: Methods and Analytical Approach for Phase IV Training and Testing* (U.S. Department of the Navy, 2024).
- Changes in the locations, numbers, and types of modeled military readiness activities as described in Chapter 2 (Description of Proposed Action and Alternatives), and associated quantities of explosives (counts) shown in Section 3.0.3.3.2 (Explosive Stressors).

As discussed in Section 3.6.3 (Environmental Consequences), the Action Proponents will implement mitigation under Alternative 1 and Alternative 2 to reduce potential impacts from explosives on fish. Mitigation will include visual observations for large schools of fish during ship shock trials, and restrictions on the use of certain explosives within important Gulf sturgeon and sandbar shark habitats as well as within certain seafloor habitats used by fish for important life processes (e.g., in proximity to shallow-water coral reefs).

Table 3.6-6: Explosive Stressors Background Information Summary

Substressor	*Background Information Summary*
Explosives in water	Sound and energy from explosives in water pose the greatest potential threats for injury and mortality in marine fishes and may also cause hearing loss, masking, physiological stress, or behavioral responses. • Fishes without a swim bladder, adult fishes, and larger species would generally be less susceptible to injury and mortality from sound and energy associated with explosive activities than fishes with a swim bladder, small, juvenile, or larval fishes. • Sound and energy from explosions could result in mortality, injury, and temporary threshold shift, on average, for hundreds or even thousands of meters from some of the largest explosions. • Generally, the size of the explosive correlates to the ranges to effects (i.e., larger charges produce longer ranges). Observed effects also depend on the geometry of the exposure (e.g., distance and depth relationship to the receiver). • Though hearing loss has never been measured in fishes exposed to explosives, fish may respond to explosives similarly to other impulsive sources. • Masking would be unlikely due to the intermittent nature of explosions. If masking were to occur, it would only occur during the duration of the signal. • Without specific data, it is assumed that fishes with similar hearing capabilities show similar behavioral reactions to all impulsive sounds (e.g., air guns and impact pile driving) outside the zone for hearing loss and injury.
Explosives in air	In-air detonations at or near the water surface could transmit sound and energy into the water and impact fishes. However, detonations within a few tens of meters of the surface are analyzed as if detonating completely underwater and the background information described above would also apply. Detonations that occur at higher altitudes would not propagate enough sound and energy into the water to result in impacts to fishes and therefore are not analyzed in this section.

3.6.3.2.1 Impacts from Explosives

Table 3.6-6 contains a summary of the background information used to analyze the potential impacts of explosives on fishes. Potential impacts from explosive energy and sound include non-auditory injury (including mortality), auditory effects (auditory injuries and TTS), behavioral reactions, physiological response, and masking. Ranges to effects for mortality, non-auditory injury, and auditory effects are shown in Appendix E (Acoustic and Explosives Impact Analysis). For information on explosive sizes and quantities for each alternative, see Table 3.0-5 (Explosive Sources Quantitatively Analyzed that Could Be Used Underwater or at the Water Surface).

3.6.3.2.1.1 Impacts from Explosives under Alternative 1

The use of explosives would generally decrease from the 2018 Final EIS/OEIS for both training and testing activities. Notably, for testing there would be no use of bin E17 (greater than 14,500 – 58,000 pounds [lb.] net explosive weight [NEW]) and reduced use of bin E16 (greater than 7,250 to 14,500 lb. NEW) for ship shock trials. There is also a reduction in use of most of the largest explosive bins for both training and testing, and an extremely large decrease in explosives associated with medium-caliber gunnery (bin E1 [0.1 to 0.25 lb. NEW]).

Most activities involving large-caliber naval gunfire, or the launching of targets, missiles, bombs, or other munitions are conducted more than three nautical miles from shore. Very few detonations would occur at inshore locations and would involve the use of smaller charge sizes (E5 or below). Additionally, small ship shock trials could occur in Virginia Capes, Jacksonville, or the Gulf of Mexico Range Complexes.

The death of an animal would eliminate them from the population and impact future reproductive potential. Exposures that result in non-auditory injuries may limit an animal's ability to find food, communicate with other animals, interpret the surrounding environment, or detect and avoid predators. Impairment of these abilities can decrease an individual's chance of survival or affect its ability to reproduce depending on the severity of the impact. Though TTS can impair an animal's abilities, individuals may recover quickly with little lasting effect depending on the amount of threshold shift.

Fishes may also experience brief periods of masking, physiological response, or behavioral reactions, depending on the level and duration of exposure. However, due to the short duration of single explosive detonations, these effects are expected to be brief (seconds to minutes). Although multiple shots conducted during large events could lead to prolonged or repeated exposures within a short period of time (hours), military readiness activities involving explosions are generally dispersed in space and time. Consequently, repeated exposures over the course of a day or multiple days are unlikely and most behavioral effects are expected to be brief (seconds or minutes) and localized, regardless of the size of the explosion, and fish would likely return to their natural behavior shortly after exposure.

Based on the updated background and analysis for training and testing under Alternative 1, explosive impacts on fishes could result in the death or injury of a small number of individual fish, as well as brief (seconds to minutes) periods of physiological or behavioral reactions of fish found within localized areas. This is consistent with a moderate (due to limited potential injury/mortality to some individuals) impact on fish populations.

The use of explosives during training and testing activities as described under Alternative 1 may affect ESA-listed Atlantic salmon, Atlantic sturgeon, shortnose sturgeon, Gulf sturgeon, smalltooth sawfish, giant manta rays, Nassau grouper, oceanic whitetip sharks, and scalloped hammerhead sharks due to overlap of the substressor with the species distributions throughout the Study Area. Designated sturgeon, Gulf sturgeon and Nassau grouper critical habitat may be affected by explosives due to potential impacts to prey items within the habitat for Gulf sturgeon and due to alteration of some physical features for Atlantic sturgeon and Nassau grouper. Explosives effects to designated Atlantic salmon and smalltooth sawfish critical habitat are not applicable due to lack of overlap with the stressor. The Action Proponents are consulting with NMFS as required by section 7(a)(2) of the ESA.

3.6.3.2.1.2 Impacts from Explosives under Alternative 2

Impacts from explosives in water under Alternative 2 are not meaningfully different from Alternative 1 and therefore the conclusions for significance, ESA-listed species, and critical habitat are the same for both training and testing. The explosive sizes and numbers under Alternative 2 are the same as Alternative 1.

3.6.3.3 Energy Stressors

Table 3.6-7 contains brief summaries of the background information that is relevant to analyses of impacts for each energy substressor (in-water electromagnetic devices) on fishes. The background information for energy stressor effects on fishes in the Study Area as described in the 2018 Final EIS/OEIS Section 3.6.3.3 (Energy Stressors) has not appreciably changed. As such, the information presented in the 2018 Final EIS/OEIS remains valid.

3.6.3.3.1 Impacts from In-Water Electromagnetic Devices

Table 3.6-7 contains a summary of the background information used to analyze the potential impacts of in-water electromagnetic devices on fishes. The in-water devices producing an electromagnetic field are towed or unmanned mine countermeasure systems. The electromagnetic field is produced to simulate a vessel's magnetic field. In an actual mine-clearing operation, the intent is that the electromagnetic field would trigger an enemy mine designed to sense a vessel's magnetic field. In-water electromagnetic energy associated with the Proposed Action alternatives produce a strong enough field for effects on fishes within a few feet of their source. For information on the number of location of activities including in-water electromagnetic devices, see Table 3.0-6 (Number and Location of Activities Using In-Water Electromagnetic Devices).

Table 3.6-7: Energy Stressors Background Information Summary

Substressor	*Background Information Summary*
In-water electromagnetic devices	Although many fish groups (particularly sharks and rays as well as salmonids) are sensitive to electric and magnetic fields, the range to effects would be small (likely overlapped with/by physical disturbance effects) and adverse physiological and behavioral impacts would be unlikely at field strengths encountered by most individuals during proposed military readiness activities: • The potential response of various species to electric fields and electrical pulses may include no reaction, avoidance, habituation, changes in activity level, or attraction, but effects would only occur near the source. • Some shark and ray species have demonstrated behavioral reactions to magnetic fields (including avoidance), and some freshwater species have shown developmental and physiological effects, but the experimental field intensities were much greater than those associated with proposed activities. • Salmon navigate using Earth's magnetic field (Scanlan et al., 2018), and electromagnetic fields can alter their magnetic orientation (Naisbett-Jones et al., 2020). • A recent review of the effects of power cables and other energized devices found an overall relatively low risk of physiological and behavioral effects on fish (Copping et al., 2021). • Due to the relatively low field intensity, highly localized impact area, and limited duration of the activities (hours), exposure is not likely to impact the health of resident or migratory populations or have lasting effects on survival, growth, recruitment, or reproduction at the population level.
In-air electromagnetic devices	In-air electromagnetic devices are not applicable to fishes because of the lack of transmission of electromagnetic radiation across the air/water interface and distant proximity to in-air sources. In-air electromagnetic energy effects are not analyzed further in this section.
High-energy lasers	While analyzed in the 2018 Final EIS/OEIS, the Action Proponents determined that there is no potential for fishes to be affected by high-energy lasers. This conclusion was based on additional information on the employment and function of high-energy lasers. High-energy lasers directed at surface targets cease projecting laser light when no longer on target, precluding any effects from energy from striking the water or a fish near the water surface. High-energy laser effects are not analyzed further in this section. • High-energy laser weapons training and testing involves the use of up to 30 kilowatts of directed energy as a weapon against small surface vessels and airborne targets which are deployed from surface ships and helicopters and directed at targets in open-ocean areas where fish may be present.

Table 3.6-7: Energy Stressors Background Information Summary (continued)

Substressor	*Background Information Summary*
	• The primary concern for high-energy weapons training and testing is the potential for a fish to be struck by a high-energy laser beam at or near the water's surface, which could result in injury or death from traumatic burns from the beam. • The potential for exposure to a high energy laser beam decreases as the water depth increases. Because laser platforms are typically helicopters and ships, fish at sea would likely move away in response to other stressors, such as ship or aircraft noise, although some fish would not exhibit a response to an oncoming vessel or aircraft, increasing the risk of contact with the laser beam. • High-energy laser weapons are designed to disable surface targets and turn off when they lose track of the target. Therefore, the likelihood of a fish being exposed to the laser would be minimal.

Notes: EIS = Environmental Impact Statement; OEIS = Overseas Environmental Impact Statement

3.6.3.3.1.1 Impacts from In-Water Electromagnetic Devices under Alternative 1

For both training and testing activities, in-water electromagnetic device activity decreased overall from the 2018 Final EIS/OEIS (Table 3.0-6, Number and Location of Activities Using In-Water Electromagnetic Devices).

Under Alternative 1 for training:

- In-water electromagnetic devices would occur in two locations not previously analyzed (Key West Range Complex and Virginia Capes Complex Inshore) in the 2018 Final EIS/OEIS. There would also be notable increases in in-water electromagnetic devices in the Virginia Capes and Gulf of Mexico Range Complexes. For all other locations, there would either be a decrease or similar amount of in-water electromagnetic devices.

Under Alternative 1 for testing:

- In-water electromagnetic devices would occur in two locations (Northeast Range Complexes and Hampton Roads, Virginia) not previously analyzed in the 2018 Final EIS/OEIS. There would also be a notable increase in in-water electromagnetic devices in the Naval Surface Warfare Center Panama City Testing Range. For all other locations, there would either be a decrease or cessation of in-water electromagnetic devices.

For locations without notable increases in activity, the impact analysis that was conducted in the 2018 Final EIS/OEIS remains valid; the updates to the affected environment noted in Section 3.6.2 (Affected Environment) do not alter the analysis because the general distribution and sensitivity of fishes among training and testing locations has not changed.

For locations with notable increase in activity, the impact analysis that was conducted in the 2018 Final EIS/OEIS would not change because the infrequent and localized nature of in-water electromagnetic device activity remains an accurate characterization of the Proposed Action in those locations.

For the locations not previously analyzed, standard operating procedures (e.g., in-water device safety) will help reduce potential impacts to fishes. Potential impacts would be limited to temporary behavioral and stress-startle responses to individual sensitive fishes within localized areas. The ESA-listed Atlantic salmon's range includes the Northeast Range Complexes, a testing location not previously analyzed for in-water electromagnetic devices.

Based on the relative amount and location of in-water electromagnetic device use, and the general description of impacts, the potential exposure is not expected to result in detectable changes in the survival, growth, recruitment, or reproduction of fish species at the population level.

The analysis conclusions for in-water electromagnetic device use with training and testing activities under Alternative 1 are consistent with a negligible impact on fish populations.

The use of in-water electromagnetic devices during training and testing activities as described under Alternative 1 may affect the ESA-listed Atlantic salmon, Atlantic sturgeon, shortnose sturgeon, Gulf sturgeon, smalltooth sawfish, giant manta ray, oceanic whitetip shark, and scalloped hammerhead shark (training only) due to temporary behavioral and stress-startle responses to individual fishes found within localized areas. Because Nassau grouper are not sensitive to electromagnetic energy, Alternative 1 would have no effect on this species. The Action Proponents are consulting with NMFS as required by section 7(a)(2) of the ESA.

Critical habitat for ESA-listed Atlantic sturgeon, Gulf sturgeon, and Nassau grouper would not be affected by in-water electromagnetic devices because the substressors would have no effect on the biological and physical features associated with critical habitat. The use of in-water electromagnetic devices during training and testing activities is not applicable to designated critical habitat for Atlantic salmon, Nassau grouper, and smalltooth sawfish.

3.6.3.3.1.2 Impacts from In-Water Electromagnetic Devices under Alternative 2

Impacts from in-water electromagnetic devices under Alternative 2 are not meaningfully different from Alternative 1 and therefore the conclusions for significance, ESA-listed species, and critical habitat are the same for both training and testing. The number of activities including use of in-water electromagnetic devices under Alternative 2 is the same as Alternative 1.

3.6.3.4 Physical Disturbance and Strike Stressors

Table 3.6-8 contains brief summaries of background information that is relevant to analyses of impacts for each physical disturbance and strike substressor (vessels and in-water devices, military expended materials, seafloor devices, and pile driving). Details on updated information relevant to physical disturbance and strike potential are provided in Appendix G (Non-Acoustic Impacts Supporting Information). Details on physical disturbance and strike stressors in general, as well as effects specific to each substressor, are provided in the 2018 Final EIS/OEIS Section 3.6.3.4 (Physical Disturbance and Strike Stressors).

The Action Proponents will implement mitigation tailored to reducing the impact of physical disturbance and strike on sensitive habitats that feature fishes, including the ESA-listed smalltooth sawfish, giant manta ray, and Nassau grouper, within the mitigation areas identified in Table 3.6-3. The mitigation area restrictions are mapped and described in Section 3.3 (Habitats) because they primarily address impacts on the seafloor habitat of fishes and other biological resources. The critical habitat for ESA-listed fish species depicted in Figure 3.6-1 to Figure 3.6-6 encompasses the sensitive habitats shown in Section 3.3.

Table 3.6-8: Physical Disturbance and Strike Stressor Background Information Summary

Substressor	*Background Information Summary*
Vessels and in-water devices	Most fishes would detect and avoid vessels and in-water devices and therefore, with the exception of certain slow-moving species located near the surface, strikes would be unlikely: • Fishes generally respond to an approaching vessel or in-water device with lateral or downward avoidance, although some fishes are attracted to them. • Most in-water devices move slowly or are closely monitored by observers. • Early life stages of most fishes could be displaced by a moving vessel and then entrained by the vessel's propeller movement or propeller wash rather than struck. • Large slow-moving fishes such as whale sharks, manta rays, and sturgeon may occur near the surface, making them susceptible to strikes.
Aircraft and aerial targets	Impacts from aircraft and aerial targets are not applicable and will not be analyzed further in this section.
Military expended materials	Fishes could be struck by military expended materials at the surface and on the seafloor as items settle on the bottom and could also be disturbed by materials sinking through the water column. • Direct strike potential is greatest at or near the surface, but the number of fishes at the surface is typically low, particularly during the day when most activities would occur. • Most missiles and projectiles are fired at and hit their targets, so only a very small portion hit the water with maximum velocity and force. • Expended aerial targets and aerial target fragments hit the water surface with relatively high velocity and force, although they fall rather than being fired or propelled. • Disturbance or strike as expended materials sink through the water column is possible but not likely because most objects sink slowly and can be avoided. • Fishes on the seafloor where an item settles could be struck or displaced, but small numbers of individuals would likely be affected. • Propelled fragments produced by an exploding bomb are large and decelerate rapidly, posing little risk to fishes. • Sediment disturbance and turbidity caused by materials settling on the seafloor would be temporary and affect a small area.
Seafloor devices	Seafloor devices are either stationary (e.g., mine shapes, anchors, bottom-placed instruments) or move very slowly along the bottom (e.g., bottom-crawling unmanned underwater vehicles) where they may temporarily disturb the bottom before being recovered. • Items dropped into the water could strike fishes, but the probability would be low based on the low number of fish at the surface and the ability of fish to avoid sinking objects. • Few individuals would likely be affected by items deployed on the bottom, and many fishes, even if they were attracted to the device or to invertebrate prey exposed by sediment disturbance, would be able to avoid strikes by unmanned vehicles, including vehicles in close proximity to the fishes (e.g., bottom-crawling vehicles).
Pile driving	A relatively small number of fishes could be disturbed during pile installation and removal, primarily by sediment disturbance: • Fishes would not likely be struck by a piling due to their mobility. • Sediment disturbance and turbidity could affect fishes behaviorally and physiologically, including eggs and larvae, but the effects would be minor, temporary, and localized.

3.6.3.4.1 Impacts from Vessels and In-Water Devices

Table 3.6-8 contains a summary of the background information used to analyze the potential impacts of vessels and in-water devices on fishes. For information on the number of activities including vessels and in-water devices, see Table 3.0-9 (Number and Location of Activities Including Vessels) and Table 3.0-10 (Number and Location of Activities Including In-Water Devices).

The seafloor resource mitigation measures identified in Table 3.6-3 will reduce or eliminate the potential impacts from vessel disturbance on some ESA-listed species and other shallow-water habitats in the Key West Range Complex and South Florida Ocean Measurement Facility (refer to Section 3.3, Habitats, for detailed mapping of the mitigation). In other shallow areas where vessel or in-water device use is proposed, the avoidance of features that could damage the vessel or in-water device (e.g., seafloor in general and hard substrate in particular) is part of standard operating procedures.

3.6.3.4.1.1 Impacts from Vessels and In-Water Devices under Alternative 1

For both training and testing activities, vessel and in-water device activity decreased overall from the 2018 Final EIS/OEIS (Table 3.0-9 and Table 3.0-10).

Under Alternative 1 for training:

- Vessel activity would occur in two locations that are new or not previously analyzed (Gulfport and Pascagoula, Mississippi, respectively). For all other locations, there would either be a decrease or similar amount of vessel activity.
- In-water device activity (including both expended and recovered water-based targets) would occur in one location not previously analyzed (Northeast Range Complex Inshore). For all other locations, there would either be a decrease, similar amount, or cessation of in-water device activity.

Under Alternative 1 for testing:

- Vessel activity would occur in five locations not previously analyzed (inshore locations of the Northeast, Virginia Capes, and Gulf of Mexico Range Complexes; Other AFTT Areas; Hampton Roads, Virginia). There would also be notable increases in vessel activity at the Naval Surface Warfare Center Panama City Division Testing Range, Naval Station Norfolk, and Pascagoula, Mississippi. For all other locations, there would either be a decrease or similar amount of vessel activity.
- In-water device activity (including both expended and recovered water-based targets) would occur in four locations not previously analyzed (Gulf of Mexico Range Complex Inshore; Bath, Maine; Newport, Rhode Island; and Pascagoula, Mississippi). For all other locations, there would either be a decrease or similar amount of in-water device activity.

For locations without notable increases in vessel and in-water device activity, the analysis from the 2018 Final EIS/OEIS remains valid; the updates to the affected environment noted in Section 3.6.2 (Affected Environment) do not alter the analysis because the general distribution and sensitivity of fishes among training and testing locations has not changed.

For locations with notable increase in vessel activity, the impact analysis that was conducted in the 2018 Final EIS/OEIS would not change because the risk of strike would remain low.

For the new and not previously analyzed Study Area-Inshore Locations, standard operating procedures (e.g., vessel and in-water device safety) and mitigation implemented in the seafloor resource mitigation areas help to avoid impacting shallow waters and associated fishes. The addition of Other AFTT Areas would not meaningfully change the potential for physical disturbance or strike to fishes. The other new/not previously analyzed locations are port or pierside locations featuring artificial structures in areas that are highly modified/disturbed by human activity and frequent dredging.

Based on the relative amount and location of vessels and in-water devices under Alternative 1 and the general description of impacts, the analysis that was conducted in the 2018 Final EIS/OEIS remains valid because the risk of a strike is low, effects would primarily be limited to temporary behavioral and stress-startle responses to individual fishes found within localized areas, and the number of eggs and larvae entrained by propellers would be low compared to overall numbers of eggs and larvae. It is likely that any mortality arising from this stressor is within the natural range of species' populations. This conclusion is generally applicable to ESA-listed species in new areas and areas with notable increases in activity. There would be relatively greater risk of vessel strike to ESA-listed species that may occur near the surface in applicable locations (Table 3.6-1), primarily Atlantic sturgeon. However, the effects of this substressor on fishes are not expected to result in detectable changes in the survival, growth, recruitment, or reproduction of fish species at the population level.

The analysis conclusions for vessel and in-water device use with training and testing activities under Alternative 1 are consistent with a minor to moderate (due to limited potential for injury/mortality) impact on fish populations.

The use of vessels and in-water devices during training and testing activities as described under Alternative 1 may affect the ESA-listed Atlantic salmon, Atlantic sturgeon, shortnose sturgeon, Gulf sturgeon, smalltooth sawfish, giant manta ray, Nassau grouper, oceanic whitetip shark, and scalloped hammerhead shark due to the potential for temporary behavioral and stress-startle responses and limited mortality. The Action Proponents are consulting with NMFS as required by section 7(a)(2) of the ESA.

Critical habitat for ESA-listed Atlantic salmon, Atlantic sturgeon, Gulf sturgeon, and Nassau grouper would not be affected by vessels and in-water devices because the substressors would have no effect on the biological and physical features associated with critical habitat designations. Vessel and in-water device use during training and testing activities is not applicable to critical habitat for smalltooth sawfish.

3.6.3.4.1.2 Impacts from Vessels and In-Water Devices under Alternative 2

Impacts from vessels and in-water device activities under Alternative 2 are not meaningfully different from Alternative 1 and therefore the conclusions for significance, ESA-listed species, and critical habitat are the same for both training and testing. The number of activities including vessels or in-water devices increases only slightly over that of Alternative 1.

3.6.3.4.2 Impacts from Military Expended Materials

Table 3.6-8 contains a summary of the background information used to analyze the potential impacts of military expended materials on fishes. For information on the type, number, and location of military expended materials, see Table 3.0-11 (Number and Location of Non-Explosive Practice Munitions Expended during Military Readiness Activities), Table 3.0-12 (Number and Location of Explosives that May Result in Fragments during Military Readiness Activities), Table 3.0-13 (Number of Location of Targets Expended during Military Readiness Activities), Table 3.0-14 (Number and Location of Other Military Materials Expended during Military Readiness Activities), Table 3.0-17 (Number and Location of Wires and Cables Expended during Military Readiness Activities), and Table 3.0-18 (Number and Location of Activities Including Biodegradable Polymers during Testing).

The mitigation measures identified in Table 3.6-3 will reduce or eliminate potential impacts by locating some military expended materials away from ESA-listed coral species and reef-associated fishes (refer to Section 3.3, Habitats, for detailed mapping of the mitigation). Mapped sensitive habitat features (e.g., shallow-water coral reefs) within the Study Area only occur within mitigation areas. In other areas where military expended materials are proposed, the impact is limited by the distance from shore (e.g., most heavy munitions limited to areas outside of state coastal waters).

The combination of mitigation areas for shallow-water coral reefs and Action Proponents abiding by national marine sanctuary regulations (with agreed-upon exceptions) protects nearly all seafloor habitats and corresponding fishes less than 30 m deep in the Key West Range Complex (offshore and inshore locations) from direct strike from the direct strike of most military expended materials.

3.6.3.4.2.1 Impacts from Military Expended Materials under Alternative 1

For both training and testing activities, the number of military expended materials would decrease overall from the 2018 Final EIS/OEIS (Table 3.0-11 through Table 3.0-14).

Under Alternative 1 for training:

- Military expended materials would occur in one location not previously analyzed (Gulf of Mexico Range Complex Inshore), and there would be a notable increase in the Key West Range Complex Inshore from the 2018 Final EIS/OEIS. For all other locations, there would either be a decrease, similar amount, or cessation of military expended materials.

Under Alternative 1 for testing:

- Military expended materials would occur in three locations not previously analyzed (Other AFTT Areas; Naval Submarine Base Kings Bay, and Port Canaveral, Florida) in the 2018 Final EIS/OEIS. For all other locations, there would either be a decrease or similar amount of military expended materials.

For locations without a notable increase in military expended materials, the analysis from the 2018 Final EIS/OEIS remains valid; the updates to the affected environment noted in Section 3.6.2 (Affected Environment) do not alter the analysis because the general distribution and sensitivity of fishes among training and testing locations has not changed.

For locations not previously analyzed, and notable increases in activity, the impact analysis that was conducted in the 2018 Final EIS/OEIS has changed because the analysis is mostly quantitative. Qualitative aspects of the analysis include the potential for lighter expended materials (e.g., decelerators/parachutes) to drift into shallow, inshore habitats.

Based on the quantitative analysis in Section 3.3 (Habitats), the total shallow-water coral reef area, along with associated fishes, impacted by military expended materials in the Key West Range Complex and South Florida Ocean Measurement Facility would be less than 0.13 acres annually. However, the area of impacted shallow-water coral reefs is overestimated due to mitigation measures that apply to a subset of military expended materials. For location-specific details, refer to Appendix I (Military Expended Materials and Direct Strike Impact Analysis) Table I-1 (Potential Impact from Explosive Charges on or near the Bottom for Military Readiness Activities under Alternative 1 in a Single Year). This area represents less than one thousandth of 1 percent of available shallow-water coral reef habitat in Study Area locations (refer to figures in Section 3.3 for mapping). Most military expended material footprints would impact soft bottom habitat or the bathyal/abyssal zone where fishes are relatively dispersed. Expended material footprints associated with port and pierside locations impact mostly shallow soft bottom habitat where fish abundance is typically less relative to hard substrate.

Whereas it is possible for a portion of expended items to impact hard substrate and associated fish communities, the number of exposed individuals would not likely affect the overall viability of populations or species. While the potential for overlap between proposed activities and fish is reduced for those species living in relatively rare habitats, if overlap does occur, any potential impacts would be amplified. Within the far greater area of soft bottom habitat, the impact of military expended materials is likely to cause injury or mortality to individual fish. However, the number of individuals affected would be small relative to total population, the area exposed to the stressor is extremely small relative to the area of available habitat, the activities are dispersed such that few individuals would likely be exposed to more than one event, and exposures would be localized and would cease when the military expended material becomes part of the bottom (e.g., buried or encrusted with sessile organisms).

Based on the relative amount, impact footprint, and location of material expended and the general description of impacts, impacts on fishes from activities involving military expended materials would consist of temporary behavioral and stress-startle responses and limited injury/mortality to individuals found within localized areas. The effects of this substressor on fishes are not expected to result in detectable changes in the survival, growth, recruitment, or reproduction of fish species at the population level.

The analysis conclusions for military expended materials associated with training and testing activities under Alternative 1 are consistent with a minor to moderate (due to limited potential for injury or mortality) impact on fish populations.

The military expended materials associated with training and testing activities as described under Alternative 1 may affect the ESA-listed Atlantic salmon, Atlantic sturgeon, shortnose sturgeon, Gulf sturgeon, smalltooth sawfish, giant manta ray, Nassau grouper, oceanic whitetip shark, and scalloped hammerhead shark because there is a risk of strike to these species. The Action Proponents are consulting with NMFS as required by section 7(a)(2) of the ESA.

Critical habitat for ESA-listed Atlantic sturgeon may be affected by military expended materials because they may temporarily cover suitable substrate (e.g., sand, mud) habitat between river mouths and spawning sites that is used for juvenile foraging and physiological development. Critical habitat for ESA-listed Nassau grouper may be affected by military expended materials because lighter materials could drift into critical habitat (e.g., sonobuoy decelerators/parachutes, flares) depending on the oceanic currents. Military expended materials from training and testing activities may affect designated critical habitat for Gulf sturgeon because they may affect the abundance of prey items, an identified biological feature of the designated critical habitat for subadult and adult life stages. Critical habitat is not applicable for ESA-listed Atlantic salmon and smalltooth sawfish because the military expended material stressor would not occur within their critical habitat.

3.6.3.4.2.2 Impacts from Military Expended Materials under Alternative 2

Impacts from military expended materials under Alternative 2 are not meaningfully different from Alternative 1 and therefore the conclusions for significance, ESA-listed species, and critical habitat are the same for both training and testing. The increase in footprint from Alternative 1 to 2 is only 0.026 acres and located mostly in the Gulf of Mexico Range Complex, with relatively small footprints in the other range complexes.

3.6.3.4.3 Impacts from Seafloor Devices

Table 3.6-8 contains a summary of the background information used to analyze the potential impacts of seafloor devices on fishes. For information on the type, number, and location of military expended materials, see Table 3.0-15 (Number and Location of Activities that Use Seafloor Devices).

Proposed mitigation identified in Table 3.6-3 will reduce or eliminate the potential impacts on some fishes by locating most seafloor devices away from shallow-water coral reefs and other sensitive bottom habitats (refer to Section 3.3, Habitats, for detailed mapping and description of the mitigation). Due to the prevalence of shallow-water hard corals in the South Florida Ocean Measurement Facility, there is additional mitigation that ensures placement of seafloor devices outside of sensitive habitats. This mitigation will reduce or eliminate impacts on associated fishes.

3.6.3.4.3.1 Impacts from Seafloor Devices under Alternative 1

For both training and testing activities, the proposed use of seafloor devices increased overall from the 2018 Final EIS/OEIS devices (Table 3.0-15, Number and Location of Activities that Use Seafloor Devices).

Under Alternative 1 for training:

- Seafloor device use would occur in five locations that are new or not previously analyzed (Northeast Range Complexes; Other AFTT Areas; Jacksonville Range Complex Inshore, Naval Station Mayport, and Gulfport, Mississippi). There would also be notable increases in seafloor devices at the Virginia Capes Range Complex (offshore and inshore locations) and Key West Range Complex Inshore. For all other locations, there would either be a decrease, similar amount, or cessation of seafloor devices.

Under Alternative 1 for testing:

- Seafloor device use would occur in five locations not previously analyzed (Virginia Cape Range Complex Inshore, Key West Range Complex Inshore, Naval Submarine Base New London, Naval Station Mayport, and Port Canaveral, Florida). There would also be notable increases in seafloor devices in the Northeast and Jacksonville Range Complexes, and in the Naval Surface Warfare Center Panama City Division Testing Range. For all other locations, there would either be a decrease or similar amount of seafloor device use.

For locations without a notable increase in seafloor devices, the analysis from the 2018 Final EIS/OEIS remains valid; the updates to the affected environment noted in Section 3.6.2 (Affected Environment) do not alter the analysis because the general distribution and sensitivity of fishes among training and testing locations has not changed.

For locations with notable increases in activity, the impact analysis that was conducted in the 2018 Final EIS/OEIS would not change because the infrequent and localized nature of seafloor device activity remains an accurate characterization of the Proposed Action in those locations. Few fish would potentially be struck by deployed devices and most fish would be able to avoid unmanned vehicles (e.g., bottom-crawling vehicles).

For new locations and locations not previously analyzed, standard operating procedures and seafloor resource mitigation measures that apply to mine shapes and other devices moored to the bottom help to avoid impacting sensitive habitats that support fishes (e.g., oyster bed/reefs, shallow-water coral reefs, live hard bottoms). The new pierside location features artificial structures in soft bottom habitat that is highly modified/disturbed due to human activity and frequent dredging. Fish abundance in such shallow, soft bottom habitats is typically less relative to areas of hard substrate.

Based on the relative amount and location of seafloor device use and the general description of impacts, impacts from seafloor devices would be limited to infrequent and temporary behavioral and stress-startle responses to individual fishes found within localized areas. The effects of this substressor on fishes are not expected to result in detectable changes in the survival, growth, recruitment, or reproduction of fish species at the population level.

The analysis conclusions for seafloor device use with training and testing activities under Alternative 1 are consistent with a minor to moderate impact on fish populations.

The use of seafloor devices during training and testing activities as described under Alternative 1 may affect the ESA-listed Atlantic salmon, Atlantic sturgeon, shortnose sturgeon, Gulf sturgeon, smalltooth sawfish, giant manta ray, Nassau grouper, oceanic whitetip shark, and scalloped hammerhead shark because of temporary effects such as stress or behavioral disruptions. The Action Proponents are consulting with NMFS as required by section 7(a)(2) of the ESA.

Critical habitat for ESA-listed Atlantic sturgeon may be affected by seafloor devices because they may temporarily cover soft substrate (e.g., sand, mud) critical habitat between river mouths and spawning sites that is used for juvenile foraging and physiological development. Critical habitat for ESA-listed Gulf sturgeon may be affected by seafloor devices because they may affect the abundance of prey items. Critical habitat for ESA-listed Nassau grouper may be affected by seafloor devices due to the prevalence of shallow-water hard corals in the South Florida Ocean Measurement Facility which overlaps Nassau grouper critical habitat. The use of seafloor devices during training and testing activities is not applicable to designated critical habitat for Atlantic salmon and smalltooth sawfish.

3.6.3.4.3.2 Impacts from Seafloor Devices under Alternative 2

Impacts from seafloor device activities under Alternative 2 are not meaningfully different from Alternative 1 and therefore the conclusions for significance, ESA-listed species, and critical habitat are the same for both training and testing. The number of activities including seafloor devices under Alternative 2 would increase only slightly over Alternative 1.

3.6.3.4.4 Impacts from Pile Driving

Table 3.6-8 contains a summary of the background information used to analyze the potential impacts of pile driving on fishes. Only Port Damage Repair training includes pile driving (Table 3.0-4, Number of Piles/Sheets Quantitatively Analyzed under Pile Driving and Removal Training Activities).

3.6.3.4.4.1 Impacts from Pile Driving under Alternative 1

Under Alternative 1 for training:

- Pile driving would occur in one new location (Gulfport, Mississippi) where it did not occur in for the 2018 Final EIS/OEIS.
- Pile driving would no longer occur as part of the Elevated Causeway System at Joint Expeditionary Base Little Creek Fort Story in the Virginia Capes Range Complex or Marine Corps Base Camp Lejeune in the Navy Cherry Point Range Complex.

There would be no pile driving or removal associated with testing activities.

Most fish are mobile enough to avoid piling strikes. Impacts on fishes would be limited to infrequent, temporary (lasting up to several hours) behavioral and stress-startle responses to individual fish or schools of fish in localized areas. Associated sediment disturbance could cause physiological effects (e.g., gill clogging) and behavioral effects (e.g., avoiding turbidity plumes), but the impacts would be temporary and localized and would affect a small number of fish.

The analysis conclusions for pile driving for training under Alternative 1 are consistent with a negligible impact on fish populations.

The pile driving associated with training activities as described under Alternative 1 may affect the ESA-listed Gulf sturgeon, smalltooth sawfish, and giant manta ray due to their potential presence during pile driving activities and temporary behavioral and stress-startle responses. Alternative 1 pile driving associated with training activities is not applicable to the ESA-listed Atlantic salmon, Atlantic sturgeon, shortnose sturgeon, Nassau grouper, oceanic whitetip shark, and scalloped hammerhead shark. The Action Proponents are consulting with NMFS as required by section 7(a)(2) of the ESA.

Pile driving activities may affect critical habitat for the ESA-listed Gulf sturgeon due to temporarily increased water turbidity. The effects would be infrequent, temporary, and localized with no lasting damage or alteration. The use of pile driving during training activities is not applicable to designated critical habitat for Atlantic salmon, Atlantic sturgeon, smalltooth sawfish, and Nassau grouper.

3.6.3.4.4.2 Impacts from Pile Driving under Alternative 2

Impacts from pile driving during training under Alternative 2 are no different from Alternative 1 and therefore the conclusions for significance, ESA-listed species, and critical habitat are the same.

There would be no pile driving associated with testing activities.

3.6.3.5 Entanglement Stressors

Most expended materials do not have the characteristics required to entangle marine species. Wires and cables, decelerators/parachutes, and biodegradable polymer are the expended materials most likely to entangle fish.

Table 3.6-9 contains brief summaries of background information that is relevant to analyses of impacts for each entanglement substressor (wires and cables, decelerators/parachutes, and biodegradable polymer). The background information for entanglement stressor effects on fishes in the Study Area as described in the 2018 Final EIS/OEIS Section 3.6.3.5 (Entanglement Stressors) has not changed appreciably. As such, the information presented in the 2018 Final EIS/OEIS remains valid.

Table 3.6-9: Entanglement Stressors Background Information Summary

Substressor	***Background Information Summary***
Wires and cables	Fiber-optic cables, guidance wires, bathythermograph wires, and sonobuoy components would pose a generally low potential entanglement risk to susceptible fishes, although the potential would be higher for sonobuoy components than for wires and cables: • Fiber-optic cables do not easily form loops, are not anchored, are brittle, and break easily if bent. • Guidance wires typically sink immediately after release and remain on the seafloor and would not likely form loops because of their size and rigidity. • The encounter rate for fiber-optic cables and guidance wires would be extremely low, as few would be expended. • Most sonobuoys are expended in offshore areas where large open-ocean species (e.g., manta rays) could become entangled in vertical cable. • Smaller species could become entangled in components such as plastic mesh. • Fish species with protruding physical features, such as sawfish, hammerhead sharks, manta rays, and billfishes, would be more susceptible to entanglement in wires and cables than other types of fish.

Table 3.6-9: Entanglement Stressors Background Information Summary (continued)

Substressor	***Background Information Summary***
Decelerators/ parachutes	Decelerators/parachutes pose a potential entanglement risk to fishes (the risk is higher for decelerators/parachutes on the seafloor), although the number of fish affected would likely be low: • During activities that involve recoverable targets, the target and any associated decelerators or parachutes are recovered to the maximum extent practical. • Decelerators/parachutes are relatively large and visible, reducing the chance that fish would accidentally become entangled. • Once a decelerator/parachute is on the bottom, a fish could become entangled in the item or its attachment lines while diving and feeding, especially at night or in deeper waters. • If a decelerator/parachute dropped in an area of strong bottom currents, it could billow open and pose a short-term entanglement threat to large fish feeding on the bottom. • Most smooth-bodied fishes would not become entangled, but fish with spines or other protrusions would be more susceptible.
Biodegradable polymers	The potential for fish to become entangled in biodegradable polymers would be low because of the materials' characteristics and level of use: • Biodegradable polymers begin to degrade and lose strength within hours and would break down to small pieces within a few days to weeks. • The materials can be easily broken within several hours of immersion. • The materials would ultimately sink. • The concentration of biodegradable polymers in the Study Area would be low, and the encounter rate and entanglement risk for fishes would be extremely low.

3.6.3.5.1 Impacts from Wires and Cables

Table 3.6-9 contains a summary of the background information used to analyze the potential impacts of wires and cables on fishes. Table 3.0-17 (Number and Location of Wires and Cables Expended During Military Readiness Activities) indicates the number and location of wires and cables expended during military readiness activities for Alternatives 1 and 2.

3.6.3.5.1.1 Impacts from Wires and Cables under Alternative 1

For training activities, the use of wires and cables would increase overall from the 2018 Final EIS/OEIS, and for testing activities, the use of wires and cables would decrease overall (Table 3.0-17, Number and Location of Wires and Cables Expended during Military Readiness Activities).

Under Alternative 1 for training:

- The use of wires and cables would occur in one location not previously analyzed (Key West Range Complex). There would also be a notable increase in the use of wires and cables in the Virginia Capes and Jacksonville Range Complexes. For all other locations, there would be a similar amount of wires and cables.

Under Alternative 1 for testing:

- The use of wires and cables would occur in one location not previously analyzed (Other AFTT Areas) for the 2018 Final EIS/OEIS. There would also be a notable increase in wires and cables in the Virginia Capes and Key West Range Complexes. For all other locations, there would either be a decrease or similar amount of wires and cables.

For locations without a notable increase in wires and cables, the analysis from the 2018 Final EIS/OEIS remains valid; the updates to the affected environment noted in Section 3.6.2 (Affected Environment) do not alter the analysis because the general distribution and sensitivity of fishes among training and testing locations has not changed.

For locations with notable increases in activity, the impact analysis that was conducted in the 2018 Final EIS/OEIS would not change because the infrequent and localized nature of wire and cable releases remains an accurate characterization of the Proposed Action in those locations.

Although activities will occur in locations not previously analyzed, there would be no change in the impact analysis conducted in the 2018 Final EIS/OEIS because the likelihood of fish encountering a wire or cable and becoming entangled would be low. Impacts from wires and cables on more abundant fish species would potentially be higher, though still considered low for the reasons listed in Table 3.6-9. If a fish were to become entangled, the impacts could be short term or long term, potentially including physiological injury or mortality. Behavioral responses would be uncommon and would consist only of temporary disturbance. Expended wires and cables are not expected to substantially change habitat characteristics.

Based on the relative amount and location of wires and cables and the general description of effects, the impact on individuals and populations would be low because the area exposed to the stressor is small relative to the distribution ranges of most fishes, the activities are dispersed such that few individuals would likely be exposed to more than one event, and exposures would be localized. Activities involving wires and cables are not expected to result in detectable changes in the survival, growth, recruitment, or reproduction of fish species at the population level.

The analysis conclusions for wires and cables as an entanglement stressor associated with training and testing activities under Alternative 1 are consistent with a minor to moderate (due to limited potential for entanglement and injury) impact on fish populations.

In regard to the potential for entanglement, the entangling aspect of wires and cables during training and testing activities as described under Alternative 1 may affect the ESA-listed Atlantic salmon, Atlantic sturgeon, shortnose sturgeon, Gulf sturgeon, smalltooth sawfish, giant manta ray, Nassau grouper, oceanic whitetip shark, and scalloped hammerhead shark due to the potential for these species to become entangled and suffer physiological injury or mortality. The Action Proponents are consulting with NMFS as required by section 7(a)(2) of the ESA.

The entanglement stressor is not applicable to critical habitat for ESA-listed Atlantic salmon, Atlantic sturgeon, Gulf sturgeon, smalltooth sawfish, and Nassau grouper.

3.6.3.5.1.2 Impacts from Wires and Cables under Alternative 2

Impacts from wires and cables under Alternative 2 are not meaningfully different from Alternative 1 and therefore the conclusions for significance, ESA-listed species, and critical habitat are the same for both training and testing. The number of wires and cables used under Alternative 2 would increase only slightly over Alternative 1.

3.6.3.5.2 Impacts from Decelerators/Parachutes

Table 3.6-9 contains a summary of the background information used to analyze the potential impacts of decelerators/parachutes on fishes. Table 3.0-14 (Number and Location of Other Military Materials

Expended during Military Readiness Activities) indicates the number and location of decelerators/parachutes expended during military readiness activities for Alternatives 1 and 2.

3.6.3.5.2.1 Impacts from Decelerators/Parachutes under Alternative 1

For both training and testing activities, decelerator/parachute use would increase overall from the 2018 Final EIS/OEIS (see Table 3.0-14, Number and Location of Other Military Materials Expended during Military Readiness Activities).

Under Alternative 1 for training:

- Decelerators/parachutes would be used in the same locations as for the 2018 Final EIS/OEIS. However, there would be notable increases in the Virginia Capes and Jacksonville Range Complexes. For all other locations, there would be a similar amount of decelerators/parachutes.

Under Alternative 1 for testing:

- Decelerators/parachutes would be used in one area (Other AFTT Areas) that was not previously analyzed, and there would be notable increases in the Northeast, Virginia Capes, and Key West Range Complexes. For all other locations, there would either be a decrease or similar amount of decelerators/parachutes.

For locations without a notable increase in decelerators/parachutes, the analysis from the 2018 Final EIS/OEIS remains valid; the updates to the affected environment noted in Section 3.6.2 (Affected Environment) do not alter the analysis because the general distribution and sensitivity of fishes among training and testing locations has not changed.

Although activities will occur in locations not previously analyzed, there would be no change in the impact analysis conducted in the 2018 Final EIS/OEIS because, although the increased number of decelerators/parachutes expended would cause a corresponding increase in the potential for entanglement, the probability would remain low relative to population numbers. Impacts from decelerators/parachutes on fishes would be short-term or long-term entanglement effects, potentially including physiological injury or mortality, although a low number of individuals would likely be affected. Behavioral responses would consist only of temporary disturbance. Expended decelerators/parachutes would not significantly change habitat characteristics.

Based on the relative amount and location of decelerators/parachutes and the general description of effects, most fish would not encounter a decelerator/parachute. In the event of a coincidence of decelerators/parachutes and susceptible fish (e.g., species with rigid protruding features), the impact on populations would be low because the area exposed to the stressor is small relative to the distribution ranges of most fishes, the activities are dispersed such that few individuals would likely be exposed to more than one event, and exposures would be localized. Activities involving decelerators/parachutes are not expected to result in detectable changes in the survival, growth, recruitment, or reproduction of fish species at the population level.

The analysis conclusions for decelerators/parachutes as an entanglement stressor associated with training and testing activities under Alternative 1 are consistent with a minor to moderate (due to limited potential for entanglement, injury, and mortality) impact on fish populations.

The entangling aspect of decelerators/parachutes during military readiness activities as described under Alternative 1 may affect the ESA-listed Atlantic salmon, Atlantic sturgeon, shortnose sturgeon, Gulf sturgeon, smalltooth sawfish, giant manta ray, Nassau grouper, oceanic whitetip shark, and scalloped hammerhead shark due to the potential for these species to become entangled and suffer physiological injury or mortality. The Action Proponents are consulting with NMFS as required by section 7(a)(2) of the ESA.

The entanglement stressor is not applicable to critical habitat for ESA-listed Atlantic salmon, Atlantic sturgeon, Gulf sturgeon, smalltooth sawfish, and Nassau grouper.

3.6.3.5.2.2 Impacts from Decelerators/Parachutes under Alternative 2

Impacts from decelerators/parachutes under Alternative 2 are not meaningfully different from Alternative 1 and therefore the conclusions for significance, ESA-listed species, and critical habitat are the same for both training and testing. The number of decelerators/parachutes used under Alternative 2 would increase only slightly over Alternative 1.

3.6.3.5.3 Impacts from Biodegradable Polymers

Table 3.6-9 contains a summary of the background information used to analyze the potential impacts of biodegradable polymer on fishes. Table 3.0-18 (Number and Location of Activities Including Biodegradable Polymers during Testing) indicates the number and location of activities including biodegradable polymers for Alternatives 1 and 2. Section 3.0.3.3.5 (Entanglement Stressors) describes a new type of biodegradable polymer vessel stopping technology not analyzed in the 2018 Final EIS/OEIS.

3.6.3.5.3.1 Impacts from Biodegradable Polymers under Alternative 1

There would be no use of biodegradable polymers associated with training activities.

The proposed use of biodegradable polymer decreased overall for testing from the 2018 Final EIS/OEIS (Table 3.0-18, Number and Location of Activities Including Biodegradable Polymers during Testing).

Under Alternative 1 for testing:

- Activities using biodegradable polymer would occur in three locations not previously analyzed (Northeast Range Complexes, Navy Cherry Point Range Complex, and Joint Expeditionary Base Little Creek Fort Story). For all other locations, there would be a decrease in activities using biodegradable polymer.

For locations with a decrease in biodegradable polymer use, the analysis from the 2018 Final EIS/OEIS remains valid; the updates to the affected environment noted in Section 3.6.2 (Affected Environment) do not alter the analysis because the general distribution and sensitivity of fishes among these locations has not changed.

Although activities will occur in locations not previously analyzed, there would be no change in the impact analysis conducted in the 2018 Final EIS/OEIS because the likelihood of fishes encountering a biodegradable polymer and becoming entangled remains low.

Based on the relative amount and location of biodegradable polymer use, most fish would not encounter a biodegradable polymer. In the unlikely event of an encounter, it is conceivable that a pelagic fish could be temporarily entangled in biodegradable polymer material, although the probability is low due to the polymer designs. The most likely effect would be temporary displacement as the material floats past an animal. Impacts to benthic fish species would not be expected. Activities involving biodegradable polymer as an entanglement risk would be unlikely to yield any detectable changes in the survival, growth, recruitment, or reproduction of fish species at the population level.

The analysis conclusions for biodegradable polymer as an entanglement stressor associated with testing activities under Alternative 1 are consistent with a negligible impact on fish populations.

The entangling aspect of biodegradable polymers during testing activities as described under Alternative 1 may affect the ESA-listed Atlantic salmon, Atlantic sturgeon, shortnose sturgeon, Gulf sturgeon, smalltooth sawfish, giant manta ray, Nassau grouper, oceanic whitetip shark, and scalloped hammerhead shark due to the potential for these species to encounter the biodegradable polymer and experience behavioral responses (primarily displacement). The Action Proponents are consulting with NMFS as required by section 7(a)(2) of the ESA.

The entanglement stressor is not applicable to critical habitat for ESA-listed Atlantic salmon, Atlantic sturgeon, Gulf sturgeon, smalltooth sawfish, and Nassau grouper.

3.6.3.5.3.2 Impacts from Biodegradable Polymers under Alternative 2

There would be no use of biodegradable polymers associated with training activities.

Impacts from biodegradable polymer use during testing under Alternative 2 are the same as those under Alternative 1 and therefore the conclusions for significance, ESA-listed species, and critical habitat are the same. The number of events using biodegradable polymer under Alternative 2 is the same as Alternative 1.

3.6.3.6 Ingestion Stressors

The analysis of ingestion stressors on fishes is differentiated by munitions and expended materials other than munitions.

The difference between the military expended materials categories is related to shape and material composition; munitions are aero- and/or hydrodynamic and composed of mostly hard metal or concrete whereas other types of military expended materials can be composed of a great variety of materials (e.g., metal, concrete, plastic, rubber, silicon, fabric) and components (e.g., circuit boards, batteries, electric motors). Both material categories break down through time and use of explosives. Synthetic bio-inspired slime is a new type of biodegradable polymer that may present an ingestion risk to some fishes.

Table 3.6-10 contains brief summaries of background information that is relevant to the analyses of impacts for each ingestion substressor (military expended materials that are munitions and military expended materials other than munitions) on fishes. Details on updated information relevant to ingestion potential are provided in Appendix G (Non-Acoustic Impacts Supporting Information). Details on ingestion stressors in general, as well as effects specific to each substressor, are provided in the 2018 Final EIS/OEIS Section 3.6.3.6 (Ingestion Stressors). The potential for fish to ingest various types of military expended materials is influenced by their feeding strategy (Table 3.6-11).

Table 3.6-10: Ingestion Stressors Background Information Summary

Substressor	*Background Information Summary*
Military expended materials – munitions	Fishes may potentially ingest non-explosive practice munitions (small- or medium-caliber projectiles) and high-explosives munitions fragments, but the number of individuals adversely affected would be low in the context of population size: • Military expended materials from munitions could be ingested by fishes at the surface, in the water column, and on the seafloor. • The potential for ingestion would depend on the size and shape of the expended item and the size, feeding method, and typical food of the fish. • Ingested items might pass through the digestive tract without causing harm or might cause effects such as tissue cutting or digestive tract blockage. • Some fishes could reject potentially ingestible items because of their size, shape, color, or smell.

Table 3.6-10: Ingestion Stressors Background Information Summary (continued)

Substressor	*Background Information Summary*
Military expended materials other than munitions	Fishes in the water column and at the seafloor could purposely or inadvertently ingest many types of expended materials with potentially adverse effects, but the number of individuals affected would be low in the context of population size: • Plastic items are possibly the most commonly ingested materials and may cause digestive or toxicity issues. • Large filter-feeding fishes (e.g., whale sharks) could inadvertently ingest small or medium decelerators/parachutes. • Chaff fibers would not impact fishes because of the low concentration and their small size. • Fishes may ingest chaff cartridge and flare components; encounters would mostly occur on the seafloor except for the relatively few items that float or become entangled in floating vegetation. • Biodegradable polymers would only effect fish if the expended polymer was large enough to block the throat or impact the digestive system. • Biodegradable polymers would break down to small pieces within a few days to weeks.

Table 3.6-11: Ingestion Stressors Potential for Impact on Fishes Based on Feeding Guild

Feeding Guild	*Representative Species*	*Endangered Species Act-Protected Species*	*Overall Potential for Impact*
Open-ocean predators	Dolphinfishes, most shark species, tuna, mackerel, wahoo, jacks, billfishes, swordfishes	Atlantic salmon, Scalloped hammerhead sharks, Oceanic whitetip sharks	These fishes may eat floating or sinking expended materials, but the encounter rate would be extremely low. May result in individual injury or death but is not anticipated to have population-level effects.
Open-ocean plankton eaters (Planktivores)	Atlantic herrings, Atlantic menhaden, basking shark, whale shark	Giant manta rays	These fishes may ingest floating expended materials incidentally as they feed in the water column, but the encounter rate would be extremely low. May result in individual injury or death but is not anticipated to have population-level effects.
Coastal bottom-dwelling predators	Atlantic cod, skates, cusks, and rays	Atlantic salmon, Scalloped hammerhead sharks, Nassau grouper	These fishes may eat expended materials on the seafloor, but the encounter rate would be extremely low. May result in individual injury or death but is not anticipated to have population-level effects.
Coastal bottom-dwelling foragers and scavengers	Skates and rays, flounders	Sturgeon species, Smalltooth sawfish	These fishes could incidentally eat some expended materials while foraging, especially in muddy waters with limited visibility. May result in individual injury or death but is not anticipated to have population-level effects.

Notes: The scientific names of species not yet given are as follows: Atlantic cod (*Hippoglossus hippoglossus*), Atlantic herring (*Clupea harengus*), Atlantic menhaden (*Brevoortia tyrannus*), basking shark (*Cetorhinus maximus*), cusk (*Brosme brosme*), dolphinfish (*Coryphaena hippurus*), flounders (*Bothidae*), hammerhead sharks (*Sphyrna* spp.), rays (*Dasyatidae*), skates (*Amblyraja* spp.), wahoo (*Acanthocybium solandri*), and whale shark (*Rhincodon typus*).

3.6.3.6.1 Impacts from Military Expended Materials – Munitions

Table 3.6-10 contains a summary of the background information used to analyze the potential impacts of military expended materials that are munitions on fishes. For more information on the location and number of military expended materials that are ingestible munitions see Table 3.0-11, (Number and Location of Non-Explosive Practice Munitions Expended during Military Readiness Activities) and Table 3.0-12 (Number and Location of Explosives that May Result in Fragments Used during Military Readiness Activities).

3.6.3.6.1.1 Impacts from Military Expended Materials – Munitions under Alternative 1

For both training and testing activities, military expended materials - munitions would decrease from the 2018 Final EIS/OEIS.

Under Alternative 1 for training:

- Ingestible munitions (including fragments from explosive munitions) would occur in the same locations they did in the 2018 Final EIS/OEIS. There would be a notable increase in the Key West Range Complex Inshore, but for all other locations there would either be a decrease, similar amount, or cessation of ingestible munitions.

Under Alternative 1 for testing:

- Ingestible munitions would occur in one location not previously analyzed (Naval Undersea Warfare Center Division, Newport Testing Range). For all other locations, there would be a decrease in the amount of ingestible munitions.

For locations without a notable increase in military expended materials from munitions, the analysis from the 2018 Final EIS/OEIS remains valid; the updates to the affected environment noted in Section 3.6.2 (Affected Environment) do not alter the analysis because the general distribution and sensitivity of fishes among training and testing locations has not changed.

Although activities will occur in a location not previously analyzed, there would be no change in the impact analysis conducted in the 2018 Final EIS/OEIS because the likelihood of fishes encountering a munition or munition fragment and consuming it remains low.

The heavy materials comprising munitions would degrade into fragments that remain in the sediment posing an ingestion risk mostly to bottom-dwelling foragers and scavengers. Based on the relative amount and location of expended munitions and the general description of effects, an impact on individual fish is unlikely, and impacts on populations would probably not be detectable.

The analysis conclusions for ingestible munitions or munition fragments associated with training and testing activities under Alternative 1 are consistent with a minor to moderate (due to limited potential for ingestion and injury) impact on fish populations.

The ingestible munitions or munition fragments associated with training and testing activities as described under Alternative 1 may affect the ESA-listed Atlantic salmon, Atlantic sturgeon, shortnose sturgeon, Gulf sturgeon, smalltooth sawfish, giant manta ray, Nassau grouper, oceanic whitetip shark, and scalloped hammerhead shark due to the potential for ingestion and associated physiological injury or mortality. The Action Proponents are consulting with NMFS as required by section 7(a)(2) of the ESA.

Because ingestible munitions and fragments from training and testing activities are not anticipated to impact any of the physical and biological features associated with critical habitats, ingestion of military expended materials - munitions from training and testing activities would have no effect on critical habitat designated for Gulf sturgeon and Nassau grouper. Because ESA-listed Atlantic salmon, Atlantic sturgeon, and smalltooth sawfish designated critical habitat does not overlap stressor locations, the ingestion stressor is not applicable to critical habitat for these species.

3.6.3.6.1.2 Impacts from Military Expended Materials – Munitions under Alternative 2

Impacts from military expended materials – munitions under Alternative 2 are not meaningfully different from Alternative 1 and therefore the conclusions for significance, ESA-listed species, and critical habitat are the same for both training and testing. The number of ingestible munitions or munition fragments used under Alternative 2 would increase only slightly over Alternative 1.

3.6.3.6.2 Impacts from Military Expended Materials Other Than Munitions

Table 3.6-10 contains a summary of the background information used to analyze the potential impacts of military expended materials other than munitions on fishes. For more information on the location and number of military expended materials that are ingestible munitions see Table 3.0-14 (Number and Location of Other Military Materials Expended during Military Readiness Activities).

3.6.3.6.2.1 Impacts from Military Expended Materials Other Than Munitions under Alternative 1

For both training and testing activities, military expended materials other than munitions would decrease from the 2018 Final EIS/OEIS (Table 3.0-14, Number and Location of Other Military Materials Expended during Military Readiness Activities).

Under Alternative 1 for training:

- Ingestible military expended materials other than munitions would no longer occur at one location (Virginia Capes Range Complex Inshore) that they did in the 2018 Final EIS/OEIS. However, there would be a notable increase in military expended materials other than munitions at the Virginia Capes Range Complex and the Key West Range Complex. For all other locations, there would either be a decrease or similar amount of military expended materials other than munitions.

Under Alternative 1 for testing:

- Ingestible military expended materials other than munitions would occur in one location not previously analyzed (Other AFTT Areas). For all other locations, there would either be a decrease or similar amount of military expended materials other than munitions.
- Activities using biodegradable polymer would occur in three locations not previously analyzed Northeast Range Complexes, Navy Cherry Point Range Complex, and Joint Expeditionary Base Little Creek Fort Story). For all other locations, there would be a decrease in the activities using biodegradable polymer (Table 3.0-18, Number and Location of Activities Including Biodegradable Polymers during Testing).

For locations without a notable increase in ingestible non-munitions and target fragments, the analysis from the 2018 Final EIS/OEIS remains valid; the updates to the affected environment noted in Section 3.6.2 (Affected Environment) do not alter the analysis because the general distribution and sensitivity of fishes among training and testing locations has not changed.

Although activities will occur in locations not previously analyzed, there would be no change in the impact analysis conducted in the 2018 Final EIS/OEIS because the likelihood of fishes encountering an ingestible military expended material or target fragment and consuming it remains low.

In addition to metal or concrete fragments in the sediment, small plastic (or otherwise light) fragments may be consumed by fishes in the water column or on the bottom, but most likely by pelagic species that rely on vision for feeding. Adverse effects due to metal pieces on the bottom or in the water column are unlikely. Microplastic particles could affect individuals. Although the potential effects on fish populations due to microplastic ingestion are currently uncertain, Action Proponent activities would result in a small number of plastic particles introduced to the marine environment compared to other sources. It is conceivable that a fish could ingest a fragment of biodegradable polymer in the unlikely event of an encounter. Considering the biodegradable polymer is composed of synthetic proteins that mimic hagfish slime and because hagfish slime is not toxic (Fudge et al., 2005), the effect would likely be negligible. The potential for one type of biodegradable polymer (bio-inspired slime) to block a fish's throat if ingested soon after expenditure could be greater than that of other polymers because of its tacky nature. However, the material would break down within hours to days after deployment and the encounter rate would be low. Overall, impacts on fish populations due to military expended materials other than munitions and target fragments would probably not be detectable.

The analysis conclusions for ingestible non-munitions or target fragments associated with training and testing activities under Alternative 1 are consistent with a minor to moderate (due to limited potential for ingestion and injury) impact on fish populations.

The ingestible military expended materials other than munitions or target fragments associated with training and testing activities as described under Alternative 1 may affect the ESA-listed Atlantic salmon, Atlantic sturgeon, shortnose sturgeon, Gulf sturgeon, smalltooth sawfish, giant manta ray, Nassau grouper, oceanic whitetip shark, and scalloped hammerhead shark due to the potential for these species to ingest expended items and suffer physiological injury or mortality. The Action Proponents are consulting with NMFS as required by section 7(a)(2) of the ESA.

Because ingestible materials and fragments from training and testing activities are not anticipated to impact any of the physical and biological features associated with critical habitats, ingestion of military expended materials other than munitions from training and testing activities will have no effect on critical habitat designated for Gulf sturgeon and Nassau grouper. Because ESA-listed Atlantic salmon, Atlantic sturgeon, and smalltooth sawfish designated critical habitat does not overlap stressor locations, the ingestion stressor is not applicable to critical habitat for these species.

3.6.3.6.2.2 Impacts from Military Expended Materials Other Than Munitions under Alternative 2

Impacts from military expended materials other than munitions under Alternative 2 are not meaningfully different from Alternative 1 and therefore the conclusions for significance, ESA-listed species, and critical habitat are the same for both training and testing. The number of ingestible non-munitions under Alternative 2 is the same as Alternative 1.

3.6.3.7 Secondary Stressors

This section analyzes potential impacts on fishes exposed to stressors indirectly through impacts on their habitat (explosives and explosive byproducts, unexploded munitions, metals, chemicals) and/or prey availability. Table 3.6-12 contains brief summaries of background information that is relevant to the analyses of impacts for each substressor (explosives via habitat, etc.). Details on secondary stressors in general, as well as effects specific to each substressor, are provided in the 2018 Final EIS/OEIS Section 3.6.3.7 (Secondary Stressors).

Table 3.6-12: Secondary Stressor Background Information Summary

Indirect Links	*Substressors*	*Background Information Summary*
Habitat	Explosives	Explosions would temporarily affect soft bottom sediments and could potentially damage hard structures, but the effects would likely be undetectable in the context of impacts on fish populations: • Most explosions would occur in the air or at the surface. • Sediment disturbance from explosions in soft bottom habitat would be smoothed or filled over time by water movement and would affect a miniscule percentage of habitat in the Study Area. • Turbidity would be temporary and localized. • Explosions would not purposely occur near hard bottom habitat or reefs.
	Explosive byproducts and unexploded munitions	Explosive byproducts and unconsumed explosives may potentially affect habitat, but the effects would likely be undetectable in the context of impacts on fish populations because of extremely low concentrations and dilution of these materials in the Study Area: • Explosion byproducts associated with high-order detonations present no indirect stressors to fishes through sediment or water. • Fishes may be exposed to explosives and byproducts from low-order detonations and unexploded munitions through contact with contaminants in the sediment or water, and ingestion of contaminated sediments, potentially experiencing toxic effects. • Due to the low solubility of most explosives and their degradation products, concentrations in the marine environment are low and are readily diluted in the water column.
	Metals	Some metals are toxic to fishes at high concentrations, but effects would likely be undetectable in the context of impacts on fish populations because of the low concentrations of these materials in the Study Area: • Some metals bioaccumulate, and physiological impacts begin to occur only after several trophic transfers concentrate the materials. • Concentrations of metals in seawater are orders of magnitude lower than concentrations in marine sediments.
	Chemicals	Chemicals may potentially affect habitat, but the effects would likely be undetectable in the context of impacts on fish populations because of extremely low concentrations and dilution of these materials in the Study Area: • Properly functioning flares, missiles, rockets, and torpedoes combust most of their propellants, leaving benign or readily diluted soluble combustion byproducts. • Propellants released because of operational failures are generally diluted or degraded in the water column and sediments.
Prey availability	All stressors	The potential for primary stressors to impact fish prey populations is directly related to their impacts on biological resources consumed by fishes (e.g., vegetation, invertebrates, other fish, and other animal carcasses).

3.6.3.7.1 Impact of Secondary Stressors

3.6.3.7.1.1 Impacts from Secondary Stressors Under Alternative 1

The impacts of explosives and military expended materials in terms of abiotic substrate disturbance are described in Section 3.3 (Habitats). The assessment of potential sediment and water quality degradation on aquatic life is described in Section 3.2 (Sediment and Water Quality). Considering that the literature on fishes does not suggest an elevated sensitivity to pollutants from the Proposed Action, the analysis of impacts on abiotic and biotic fish habitats in the sections identified above is sufficient to cover the impact on fishes. The analysis determined that neither state nor federal standards/guidelines for sediments nor water quality would be violated by Alternative 1. Therefore, because these standards and guidelines are structured to protect human health and the environment, and the proposed activities do not violate them, no indirect impacts are anticipated on fish habitat by military readiness activities proposed by under Alternative 1. The assessments of biotic habitats that may be used by fishes are described in Section 3.4 (Vegetation) and Section 3.5 (Invertebrates).

Impacts on fish prey availability from the Proposed Action would likely be less than significant overall based on the analysis conclusions for the direct stressors on their food resources (e.g., invertebrates, vegetation, other fish, and animal carcasses). In the context of predation, disproportionate effects of the Proposed Action on marine mammals, birds, and bats could result in a marginal beneficial impact on fishes. However, as discussed in Section 3.7 (Marine Mammals) and Section 3.9 (Birds and Bats), impacts on these taxa would be less than significant and there would not likely be detectable changes to fish predation.

The impact of the Proposed Action on secondary stressors were considered negligible to moderate (depending on the primary stressor) impact on linked fish populations.

The secondary stressors associated with training and testing activities as described under Alternative 1 may affect the ESA-listed Atlantic salmon, Atlantic sturgeon, shortnose sturgeon, Gulf sturgeon, smalltooth sawfish, giant manta ray, Nassau grouper, oceanic whitetip shark, and scalloped hammerhead shark. The Action Proponents are consulting with NMFS as required by section 7(a)(2) of the ESA.

Because the physical (e.g., substrate type and composition, water quality) and biological features (e.g., prey species) that comprise critical habitat may be impacted by secondary stressors associated with training and testing activities, Alternative 1 may affect Atlantic salmon, Atlantic sturgeon, Gulf sturgeon, and Nassau grouper designated critical habitat. Secondary stressors are not applicable to smalltooth sawfish critical habitat.

3.6.3.7.1.2 Impacts from Secondary Stressors under Alternative 2

Impacts from secondary stressors under Alternative 2 are not meaningfully different from Alternative 1 and therefore the conclusions for significance, ESA-listed species, and critical habitat are the same for both training and testing.

3.6.3.8 Combined Stressors

As described in Section 3.0.3.5 (Resource-Specific Impacts Analysis for Multiple Stressors), this section evaluates the potential for combined impacts of all stressors from the Proposed Action. The analysis and conclusions for the potential impacts from each of the individual stressors are discussed in the sections above. Stressors associated with proposed military readiness activities do not typically occur in isolation but rather occur in some combination. For example, mine neutralization activities include elements of acoustic, physical disturbance and strike, entanglement, ingestion, and secondary stressors that are all coincident in space and time. An analysis of the combined impacts of all stressors considers the potential consequences of additive and synergistic stressors from the Proposed Action, as described below.

There are generally two ways that a fish could be exposed to multiple additive stressors. The first would be if a fish were exposed to multiple sources of stress from a single event or activity within a single training or testing event (e.g., a mine warfare event may include the use of a sound source and a vessel). The potential for a combination of these impacts from a single activity would depend on the range to effects of each of the stressors and the response or lack of response to that stressor. Secondly, a fish could be exposed to multiple military readiness activities over the course of its life, however, military readiness activities are generally separated in space and time in such a way that it would be unlikely that any individual fish would be exposed to stressors from multiple activities within a short timeframe. However, animals with a home range intersecting an area of concentrated activity have elevated exposure risks relative to animals that simply transit the area through a migratory corridor.

Multiple stressors may also have synergistic effects. For example, fishes that experience temporary hearing loss or injury from acoustic stressors could be more susceptible to physical strike and disturbance stressors via a decreased ability to detect and avoid threats. Fishes that experience behavioral and physiological consequences of ingestion stressors could be more susceptible to entanglement and physical strike stressors via malnourishment and disorientation. These interactions are speculative, and without data on the combination of multiple stressors, the synergistic impacts from the combination of stressors are difficult to predict in any meaningful way.

The following analysis makes the reasonable assumption that most exposures to individual stressors are non-lethal, and instead focuses on consequences potentially impacting fish fitness (e.g., physiology, behavior, reproductive potential).

3.6.3.8.1 Combined Impacts of All Stressors under Alternative 1

Most of the activities proposed under Alternative 1 generally involve the use of moving platforms (e.g., ships, torpedoes) that may produce one or more stressors; therefore, if fishes were within the effects range of those activities, they may be introduced to multiple stressors at different times. The minimal effects of far-reaching stressors (e.g., sound pressures, particle motion) may also trigger some animals to leave the area ahead of a more damaging impact (e.g., physical disturbance or strike). Individual stressors that would otherwise have minimal to no impact may combine to have a measurable effect. Due to the wide dispersion of stressor sources, speed of the platforms, and general dynamic movement of many military readiness activities, it is unlikely that a highly mobile fish would occur in the potential affects range of multiple sources or sequential exercises. Impacts would be more likely to occur to slow-moving species or species with relatively small ranges in areas where military readiness activities are concentrated and consistently located.

Although potential impacts on fishes from military readiness activities under Alternative 1 may include injury and mortality, in addition to other effects such as physiological stress, masking, and behavioral effects, the combined impacts are not expected to lead to long-term consequences for fish populations. Based on the general description of impacts, the number of fishes impacted is expected to be small relative to overall population sizes and would not be expected to yield any lasting effects on the survival, growth, recruitment, or reproduction of any fish species.

The combined impact of all stressors from Alternative 1 are considered minor to moderate (due to limited potential for injury/mortality) impacts on linked biological resources for both action alternatives.

The combined stressors associated with training and testing activities as described under Alternative 1 may affect Atlantic sturgeon and Gulf sturgeon designated critical habitat but would have no effect on designated critical habitat for Nassau grouper. The combined stressors are not applicable to Atlantic salmon and smalltooth sawfish critical habitat.

3.6.3.8.2 Combined Impacts of All Stressors under Alternative 2

The combined impacts of stressors under Alternative 2 are not meaningfully different from Alternative 1 and therefore the conclusions for significance are the same for both training and testing.

3.6.4 Endangered Species Act Determinations

Pursuant to the ESA, the Action Proponents have concluded that military readiness activities may affect the ESA-listed Atlantic salmon, Atlantic sturgeon, shortnose sturgeon, Gulf sturgeon, smalltooth sawfish, giant manta ray, Nassau grouper, oceanic whitetip shark, and scalloped hammerhead shark described in Section 3.6.2.2 (Endangered Species Act-Listed Species) for Alternative 1. The Action Proponents have also concluded that military readiness activities will not affect designated critical habitat for Atlantic salmon, and smalltooth sawfish but may affect designated critical habitat for Atlantic sturgeon, Gulf sturgeon, and Nassau grouper. The Action Proponents are consulting with NMFS as required by section 7(a)(2) of the ESA. The summary of effects determinations for each ESA-listed species are shown in Table 3.6-13 for training and testing.

Table 3.6-13: Fishes ESA Effect Determinations for Military Readiness Activities under Alternative 1 (Preferred Alternative)

Species	DPS/ Critical Habitat	*Effect Determinations by Stressor*																						
		Acoustic						*Explosives*		*Energy*			*Physical Disturbance and Strike*						*Entanglement*			*Ingestion*		
		Sonar and Other Transducers	*Air Guns*	*Pile Driving*	*Vessel Noise*	*Aircraft Noise*	*Weapons Noise*	*Explosions in Air*	*Explosions in Water*	*In-Air Electromagnetic Devices*	*In-Water Electromagnetic Devices*	*High-Energy Lasers*	*Vessels*	*In-Water Devices*	*Aircraft and Aerial Targets*	*Military Expended Materials[1]*	*Seafloor Devices*	*Pile Driving*	*Wires and Cables*	*Decelerators/Parachutes*	*Biodegradable Polymers[1]*	*Military Expended Materials-Munitions*	*Military Expended Materials- Other[1]*	*Secondary Stressors*
Training Activities																								
Atlantic salmon	Gulf of Maine DPS	MA	N/A	N/A	MA	MA	MA	NE	MA	N/A	MA	NE	MA	MA	N/A	MA	MA	N/A	MA	MA	N/A	MA	MA	MA
	Critical Habitat	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Atlantic sturgeon	Gulf of Maine DPS	MA	N/A	N/A	MA	MA	MA	NE	MA	N/A	MA	NE	MA	MA	N/A	MA	MA	N/A	MA	MA	N/A	MA	MA	MA
	New York Bight DPS	MA	N/A	N/A	MA	MA	MA	NE	MA	N/A	MA	NE	MA	MA	N/A	MA	MA	N/A	MA	MA	N/A	MA	MA	MA
	Chesapeake Bay DPS	MA	N/A	N/A	MA	MA	MA	NE	MA	N/A	MA	NE	MA	MA	N/A	MA	MA	N/A	MA	MA	N/A	MA	MA	MA
	Carolina DPS	MA	N/A	N/A	MA	MA	MA	NE	MA	N/A	MA	NE	MA	MA	N/A	MA	MA	N/A	MA	MA	N/A	MA	MA	MA
	South Atlantic DPS	MA	N/A	N/A	MA	MA	MA	NE	MA	N/A	MA	NE	MA	MA	N/A	MA	MA	N/A	MA	MA	N/A	MA	MA	MA
	Critical habitat	NE	N/A	N/A	NE	NE	NE	N/A	MA	N/A	NE	N/A	NE	NE	N/A	MA	MA	N/A	N/A	N/A	N/A	N/A	N/A	MA
Shortnose sturgeon	Throughout range	MA	N/A	N/A	MA	MA	MA	NE	MA	N/A	MA	NE	MA	MA	N/A	MA	MA	N/A	MA	MA	N/A	MA	MA	MA
Gulf sturgeon	Throughout range	MA	N/A	MA	MA	MA	MA	NE	MA	N/A	MA	N/A	MA	MA	N/A	MA	MA	MA	MA	MA	N/A	MA	MA	MA
	Critical habitat	NE	NE	MA	NE	NE	NE	NE	MA	N/A	NE	N/A	NE	NE	N/A	MA	MA	MA	NE	NE	N/A	NE	NE	MA
Smalltooth sawfish	U.S. DPS	MA	N/A	MA	MA	MA	MA	NE	MA	N/A	MA	N/A	MA	MA	N/A	MA	MA	MA	MA	MA	N/A	MA	MA	MA
	Critical habitat	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Giant manta ray	Throughout range	MA	N/A	MA	MA	MA	MA	NE	MA	N/A	MA	NE	MA	MA	N/A	MA	MA	MA	MA	MA	N/A	MA	MA	MA
Nassau grouper	Throughout range	MA	N/A	N/A	MA	MA	MA	NE	MA	N/A	NE	N/A	MA	MA	N/A	MA	MA	N/A	MA	MA	N/A	MA	MA	MA
	Critical Habitat	NE	N/A	N/A	NE	NE	NE	NE	MA	N/A	NE	N/A	NE	NE	N/A	MA	MA	N/A	NE	NE	N/A	NE	NE	MA
Oceanic whitetip shark	Throughout range	MA	N/A	N/A	MA	MA	MA	NE	MA	N/A	MA	N/A	MA	MA	N/A	MA	MA	N/A	MA	MA	MA	MA	MA	MA
Scalloped hammerhead shark	Central and Southwest Atlantic	MA	N/A	N/A	MA	MA	MA	NE	MA	N/A	MA	N/A	MA	MA	N/A	MA	MA	N/A	MA	MA	N/A	MA	MA	MA

Table 3.6-13: Fishes ESA Effect Determinations for Military Readiness Activities under Alternative 1 (Preferred Alternative) (continued)

Species	DPS/ Critical Habitat	*Effect Determinations by Stressor*																						
		Acoustic						*Explosives*		*Energy*			*Physical Disturbance and Strike*						*Entanglement*			*Ingestion*		
		Sonar and Other Transducers	*Air Guns*	*Pile Driving*	*Vessel Noise*	*Aircraft Noise*	*Weapons Noise*	*Explosions in Air*	*Explosions in Water*	*In-Air Electromagnetic Devices*	*In-Water Electromagnetic Devices*	*High-Energy Lasers*	*Vessels*	*In-Water Devices*	*Aircraft and Aerial Targets*	*Military Expended Materials[1]*	*Seafloor Devices*	*Pile Driving*	*Wires and Cables*	*Decelerators/Parachutes*	*Biodegradable Polymers[1]*	*Military Expended Materials-Munitions*	*Military Expended Materials- Other[1]*	*Secondary Stressors*
Testing Activities																								
Atlantic salmon	Gulf of Maine DPS	MA	MA	N/A	MA	MA	MA	NE	MA	N/A	MA	NE	MA	MA	N/A	MA	MA	N/A	MA	MA	MA	MA	MA	MA
	Critical Habitat	NE	N/A	N/A	NE	NA	N/A	N/A	N/A	N/A	N/A	N/A	NE	NE	N/A	MA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NE
Atlantic sturgeon	Gulf of Maine DPS	MA	MA	N/A	MA	MA	MA	NE	MA	N/A	MA	NE	MA	MA	N/A	MA	MA	N/A	MA	MA	MA	MA	MA	MA
	New York Bight DPS	MA	MA	N/A	MA	MA	MA	NE	MA	N/A	MA	NE	MA	MA	N/A	MA	MA	N/A	MA	MA	MA	MA	MA	MA
	Chesapeake Bay DPS	MA	MA	N/A	MA	MA	MA	NE	MA	N/A	MA	NE	MA	MA	N/A	MA	MA	N/A	MA	MA	MA	MA	MA	MA
	Carolina DPS	MA	MA	N/A	MA	MA	MA	NE	MA	N/A	MA	NE	MA	MA	N/A	MA	MA	N/A	MA	MA	MA	MA	MA	MA
	South Atlantic DPS	MA	MA	N/A	MA	MA	MA	NE	MA	N/A	MA	NE	MA	MA	N/A	MA	MA	N/A	MA	MA	MA	MA	MA	MA
	Critical habitat	NE	N/A	N/A	NE	N/A	N/A	N/A	MA	N/A	N/A	N/A	NE	NE	N/A	N/A	MA	N/A	N/A	N/A	N/A	N/A	N/A	MA
Shortnose sturgeon	Throughout range	MA	MA	N/A	MA	MA	MA	NE	MA	N/A	MA	NE	MA	MA	N/A	MA	MA	N/A	MA	MA	MA	MA	MA	MA
Gulf sturgeon	Throughout range	MA	MA	N/A	MA	MA	MA	NE	MA	N/A	MA	NE	MA	MA	N/A	MA	MA	N/A	MA	MA	MA	MA	MA	MA
	Critical habitat	NE	NE	N/A	NE	NE	NE	NE	MA	N/A	NE	NE	NE	NE	N/A	MA	MA	N/A	NE	NE	NE	NE	NE	MA
Smalltooth sawfish	U.S. DPS	MA	MA	N/A	MA	MA	MA	NE	MA	N/A	MA	N/A	MA	MA	N/A	MA	MA	N/A	MA	MA	MA	MA	MA	MA
	Critical habitat	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Giant manta ray	Throughout range	MA	MA	N/A	MA	MA	MA	NE	MA	N/A	MA	NE	MA	MA	N/A	MA	MA	N/A	MA	MA	MA	MA	MA	MA
Nassau grouper	Throughout range	MA	N/A	N/A	MA	MA	MA	NE	MA	N/A	N/A	N/A	MA	MA	N/A	MA	MA	N/A	MA	MA	MA	MA	MA	MA
	Critical Habitat	NE	N/A	N/A	NE	NE	NE	NE	MA	N/A	N/A	N/A	NE	NE	N/A	MA	M	N/A	NE	NE	NE	NE	NE	MA
Oceanic whitetip shark	Throughout range	MA	MA	N/A	MA	MA	MA	NE	MA	N/A	MA	N/A	MA	MA	N/A	MA	MA	N/A	MA	MA	MA	MA	MA	MA
Scalloped hammerhead shark	Central and Southwest Atlantic	MA	N/A	N/A	MA	MA	MA	N/A	MA	N/A	N/A	N/A	MA	MA	N/A	MA	MA	N/A	MA	MA	MA	MA	MA	MA

[1] Inclusion of new material (synthetic hagfish slime)
Notes: DPS = distinct population segment; ESA= Endangered Species Act; MA = may affect; N/A = not applicable; NE = no effect; U.S. = United States.
The determinations for likelihood of adverse effects are pending consultation with the National Marine Fisheries Service.

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