Appendix E Explosive and Acoustic Analysis Report

Acoustic and Explosive Effects Analysis for Marine Mammals, Reptiles, and Fishes in the Hawaii - California Training and Testing Study Area

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Acronyms and Abbreviations

Acronym	Definition
μPa	microPascal
AINJ	Auditory Injury
BEH	Behavioral Response
BIA	Biologically Important Area
dB	decibel
EIS	Environmental Impact Statement
EXWC	Naval Facilities Engineering & Expeditionary Warfare Center
HCTT	Hawaii-California Training and Testing
HF	High Frequency (hearing group)
HSTT	Hawaii-Southern California Training and Testing
Hz	hertz
INJ	Non-Auditory Injury
kHz	kilohertz
LF	Low Frequency (hearing group)
LOA	Letter of Authorization
MMPA	Marine Mammal Protection Act
MORT	Mortality
NAEMO	Navy Acoustic Effects Model
NAVAIR	Naval Air Systems Command
NAVSEA	Naval Sea Systems Command
NAVWAR	Naval Information Warfare Systems Command
Navy	U.S. Department of the Navy
NBVC	Naval Base Ventura County
NEPA	National Environmental Policy Act
NM	Nautical Mile
NM^2	Square Nautical Miles
NMFS	National Marine Fisheries Service
NMSDD	Navy Marine Species Density Database

Acronym	Definition
NOCAL	Northern California
OCA	Otariids and Other Marine Carnivores In Air (hearing group)
OCW	Otariids and Other Marine Carnivores in Water (hearing group)
OEIS	Overseas Environmental Impact Statement
ONR	Office of Naval Research
OPAREA	Operating Area
PCA	Phocid In Air (hearing group)
PCW	Phocid In Water (hearing group)
PMRF	Pacific Missile Range Facility
PMSR	Point Mugu Sea Range
PTS	Permanent Threshold Shift
rms	Root-mean-square
SCI	San Clemente Island
SEL	Sound Exposure Level
SINKEX	Sinking Exercise
SNI	San Nicolas Island
SOAR	Southern California Anti-Submarine Warfare Range
SOCAL	Southern California
SPL	Sound Pressure Level
SWTR	Shallow Water Training Range
TR	Technical Report
TTS	Temporary Threshold Shift
UAV	Unmanned Aerial Vehicle
U.S.	United States
UUV	Unmanned Underwater Vehicle
VHF	Very High Frequency (hearing group)
VLF	Very Low Frequency (hearing group)
W-	Warning Area

Acronym	Definition
USCG	U.S. Coast Guard
USAF	U.S. Air Force
USMC	U.S Marine Corps

1 INTRODUCTION

This analysis presents impacts on marine species due to acoustic and explosive stressors under a maximum year of military readiness activities conducted at sea under the Hawaii-California Training and Testing (HCTT) Proposed Action. There are two Action Alternatives in HCTT: Alternative 1 and Alternative 2. Alternative 1 is the Preferred Alternative and reflects a representative year of training and testing to account for the natural fluctuations of training cycles, testing programs, and deployment schedules that generally limit the maximum level of training and testing from occurring for the reasonably foreseeable future. Alternative 2 reflects the maximum number of training activities that could occur within a given year and assumes that the maximum level of activity would occur every year over a seven-year period. However, both action alternatives assume the same level of activity in a maximum year.

1.1 INFORMATION REFERENCED IN THIS ANALYSIS

The acoustic and explosive impact analysis provided here relies on information presented in other sections and appendices of this EIS, and relevant technical reports. The following lists contain abbreviated names for each of these supporting sections and briefly describes the content therein. The impact analysis refers to these supporting sections using the italicized names noted here.

Sections that provide details and descriptions of the Proposed Action include the following:

- The *Proposed Activities* section in Section 2.3 (Proposed Activities) of this Draft EIS/OEIS provides the number of activities and the locations they would occur.
- The *Activity Descriptions* section in Appendix A (Activity Descriptions) of this Draft EIS/OEIS describes for each activity the following information: the primary mission area, details of the activity, typical components, acoustic/explosive bin categories, where they would occur, and any applicable mitigation measures.
- The *Acoustic Stressors* section in Sections 3.0.3.3.1 (Acoustic Stressors) and 3.0.3.3.2 (Explosive Stressors) of this Draft EIS/OEIS describes the general categories and characteristics of each acoustic substressor and explosive, along with their general use and quantity (counts or hours, as applicable) of annual and seven-year total use. Information on characteristics of vessel, aircraft, and weapons noise produced during training and testing activities can be found in Section 3.0.3.3 (Identifying Stressors for Analysis) of this Draft EIS/OEIS.
- The *Vessel Movements* data in Section 3.0.3.3.4 (Physical Disturbance and Strike Stressors) of this HCTT Draft EIS/OEIS quantifies the vessel activity in each location in the Study Area, which is also relevant to where vessel noise would be generated in the Study Area.
- The *Munitions* data in Section 3.0.3.3.4 (Physical Disturbance and Strike Stressors) of this Draft EIS/OEIS quantifies the number of non-explosive practice munitions and the number of explosives that may result in fragments at each location in the Study Area, which are also relevant to where weapon noise (other than noise due to in-water explosives) would be generated in the Study Area.

Sections that provide general background information are listed below:

- The *Marine Mammal Background* sections in Section 3.7.2 (Affected Environment) and Appendix C (Biological Resources Supplemental Information) of this Draft EIS/OEIS describe species present in the Study Area; general biology, ecology, and status of each species; and descriptions of critical habitat, and Biologically Important Areas where applicable.

- The *Reptile Background* sections in Section 3.8.2 (Affected Environment) and Appendix C (Biological Resources Supplemental Information) of this Draft EIS/OEIS describe the species present in the Study Area; general biology, ecology, and status of each species; and descriptions of critical habitat, where applicable.
- The *Fishes Background* sections in Section 3.6.2 (Affected Environment) and Appendix C (Biological Resources Supplemental Information) of this Draft EIS/OEIS describe the species present in the Study Area; general biology, ecology, and status of each species; and descriptions of critical habitat, where applicable.
- The *Acoustic Primer* section in Appendix D (Acoustic and Explosive Effects Supporting Information; Section D.1, Acoustic and Explosive Concepts/Primer) of this Draft EIS/OEIS describes the basic concepts of sound and explosive energy transmission underwater and in air and introduces how animals perceive sound. The *Acoustic Primer* also describes acoustic metrics used in this analysis. Unless otherwise stated, sound pressure levels (SPL) in this analysis are root-mean-square (rms) values (see the *Acoustic Primer* section entitled Sound Metrics).
- The *Acoustic Habitat* section in Appendix D (Acoustic and Explosive Effects Supporting Information; Section D.2, Acoustic Habitat) of this Draft EIS/OEIS describes natural and anthropogenic sources that contribute to the ambient noise within the Study Area.
- The *Marine Mammal Acoustic Background* section in Appendix D (Acoustic and Explosive Effects Supporting Information; Section D.8, Marine Mammals) of this Draft EIS/OEIS summarizes the best available science on impacts on marine mammals from exposure to acoustic and explosive stressors.
- The *Reptile Acoustic Background* section in Appendix D (Acoustic and Explosive Effects Supporting Information; Section D.9, Reptiles) of this Draft EIS/OEIS summarizes the best available science on impacts on reptiles from exposure to acoustic and explosive stressors.
- The *Fishes Acoustic Background* section in Appendix D (Acoustic and Explosive Effects Supporting Information; Section D.7, Fishes) of this Draft EIS/OEIS summarizes the best available science on impacts on fishes from exposure to acoustic and explosive stressors.

Technical reports (TR) and analyses that provide details on the quantitative process and show specific data inputs to the models (all are available for download at https://www.nepa.navy.mil/HCTTeis/) are listed below:

- The *Quantitative Analysis TR* refers to the technical report titled *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, 2024b), which describes the modeling methods used to quantify impacts on marine mammals and sea turtles from exposure to sonar, air guns, and explosives. Impacts due to pile driving were modeled outside of the Navy Acoustic Effects Model (NAEMO) using a static area-density model and are also described in this technical report.
- The *Criteria and Thresholds TR* refers to the technical report titled *Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase IV) (U.S. Department of the Navy, 2024a)*, which describes the development of criteria and thresholds used to predict impacts on marine mammals and sea turtles.

- The *Density TR* refers to the technical report titled *U.S. Navy Marine Species Density Database Phase IV for the Hawaii-California Training and Testing Study Area* (U.S. Department of the Navy, 2024c), which describes the spatial density distributions for each species or stock in the Study Area. The density models have been updated with new data since the prior analysis. The appendix to the density technical report includes figures showing the change in spatial density for each species since the prior analysis.
- The *Dive Profile and Group Size TR* refers to the technical report titled *Dive Distribution and Group Size Parameters for Marine Species Occurring in the U.S. Navy's Atlantic and Hawaii-California Training and Testing Study Areas* (Oliveira et al., 2024), which describes the dive profile and group size for each species. There are no substantive changes from the prior analysis.
- The *Pile Driving Analysis* shows the quantitative analysis for predicting impacts on marine mammals from pile driving. This is included in Appendix E of this Draft EIS/OEIS.

Mitigation information includes the following:

- The *Mitigation* section refers to Sections 5.6.1 (Mitigation Specific to Acoustic Stressors, Explosives, and Non-Explosive Ordnance), Section 5.6.2 (Mitigation Specific to Vessels, Vehicles, Deployment of Nets, and Towed In-Water Devices), and Section 5.7 (Geographic Mitigation) of this Draft EIS/OEIS, which describes the actions taken to avoid, reduce, or minimize potential impacts from acoustic and explosive stressors.

1.2 Changes from Prior Analyses

Changes in the predicted acoustic impacts on protected species since the Navy's 2018 Hawaii-Southern California Training and Testing (HSTT) and 2022 Point Mugu Sea Range (PMSR) analyses are primarily due to the following:

- Updates to data on marine mammal and reptile presence, including estimated density of each species or stock (number of animals per unit area), group size, and depth distribution. Any substantial changes that are affecting the quantified impacts in this analysis are discussed for each species or stock below. For additional details, including maps showing the relative density changes between this analysis and the prior analysis for this Study Area, see the *Density TR* and *Dive Profile TR*.
- Updates to criteria used to determine if an exposure to sound or explosive energy may cause auditory effects, non-auditory injuries, and behavioral responses. The changes in impact thresholds between this analysis and the prior analysis in the Study Area are shown in the applicable sections below. For additional details, see the technical report *Criteria and Thresholds TR*.
- Revisions to the modeling of acoustic effects due to proposed sound-producing activities in NAEMO. An overview of notable changes is provided in relevant sections below. For additional details, see the technical report *Quantitative Analysis TR*.
- Changes in the Study Area. In addition to areas previously included in the HSTT and PMSR analyses, the HCTT Study Area includes other areas off California including an expanded Southern California (SOCAL) Range Complex; new testing sea space between; the Northern California [NOCAL] Range Complex; areas along the Southern California coastline from approximately Dana Point to Port Hueneme; and four amphibious approach lanes providing California land access from NOCAL and

PMSR. Additional information on the expanded Study Area is in Chapter 2 (Description of Proposed Action and Alternatives) of the HCTT EIS/OEIS.

- Change in the proposed action. This report does not rely on the prior analyses of impacts for HSTT and PMSR. However, significant changes in the acoustic and explosive substressors used in training and testing activities that are relevant to understanding the predicted impacts on species under this proposed action compared to prior actions are noted in the analysis of each substressor.

2 IMPACTS ON MARINE MAMMALS FROM ACOUSTIC AND EXPLOSIVE STRESSORS

This analysis is presented as follows:

- The impacts that would be expected due to each type of acoustic stressor and explosives used in the Proposed Action are described in Section 2.1 (Impacts due to each Acoustic Substressor and Explosives).
    - Incidental take as defined under the Marine Mammal Protection Act (MMPA) is anticipated due to the following substressors: sonars and other transducers, air guns, pile driving, and explosives. Incidental take of ESA-listed marine mammals is anticipated due to sonars and other transducers, air guns, and explosives.
    - The following substressors are not anticipated to result in incidental take: vessel noise, aircraft noise, and weapons noise.
    - Impacts on hauled-out pinnipeds due to land-based launches at PMSR and the Pacific Missile Range Facility (PMRF) are assessed separately.
- The approach to modeling and quantifying impacts for stressors that may cause injury, auditory effects, or significant behavioral responses is summarized in Section 2.2 (Quantifying Impacts on Marine Mammals from Acoustic and Explosive Stressors).
- The approach to assessing the significance of responses for both individuals and populations is described in Section 2.3 (Assessing Impacts on Individuals and Populations).
- Impacts on individual species (stocks) in the Study Area, including predicted instances of harm or harassment, are presented in Section 2.4 (Species Impact Assessments). Tables summarizing quantified impacts due to each substressor that correspond to each request for a Letter of Authorization under the MMPA are presented at the end of Section 2.4 (Species Impact Assessments).
- Ranges to effects for each modeled sub-stressor are shown in Section 2.5 (Ranges to Effects).

2.1 IMPACTS DUE TO EACH ACOUSTIC SUBSTRESSOR AND EXPLOSIVES

Assessing whether a sound may disturb or injure a marine mammal involves understanding the characteristics of the acoustic sources, the marine mammals that may be present in the vicinity of the sources, and the effects that sound may have on the physiology and behavior of those marine mammals. Although it is known that sound is important for marine mammal communication, navigation, and foraging (National Research Council, 2003, 2005), there are many unknowns in assessing impacts, such as the potential interaction of different effects and the significance of responses by marine mammals to sound exposures (Nowacek et al., 2007; Southall et al., 2007; Southall et al., 2021b). Many other factors besides just the received level of sound may affect an animal’s reaction, such as the duration of the sound-producing activity, the animal’s physical condition, prior experience with the sound, activity at the time of exposure (e.g., feeding, traveling, resting), the context of the exposure (e.g., in a semi-enclosed bay vs. open ocean), and proximity of the animal to the source of the sound. The *Marine Mammal Acoustic Background* section summarizes what is currently known about effects to marine mammals from all acoustic substressors and explosives. That section cites the best available science that is relied on for this impact assessment.

In this analysis, impacts are categorized as mortality, non-auditory injury, auditory injury (AINJ, including permanent threshold shift [PTS] and auditory neural injury), temporary hearing loss (temporary threshold shift [TTS]), other physiological response (including stress), masking (occurs when a noise interferes with the detection, discrimination, or recognition of other sounds), and behavioral responses. These effects are defined and explained in the *Acoustic Primer* and the *Marine Mammal Acoustic Background* section. An "exposure" occurs when the received sound level is above the background ambient noise level within a similar frequency band; not all exposures are perceivable or result in impacts.

2.1.1 Impacts from Sonars and Other Transducers

Sonars and other transducers (collectively referred to as sonars in this analysis) emit sound waves into the water to detect objects, safely navigate, and communicate. Sonars are considered non-impulsive and vary in source level, frequency, duration (the total time that a source emits sound including any silent periods between pings), duty cycle (the portion of time a sonar emits sound when active, from infrequent to continuous), beam characteristics (narrow to wide, directional to omnidirectional, downward or forward facing), and movement (stationary or on a moving platform). Additional characteristics and occurrence of sonars used under the Proposed Action are described in the *Acoustic Stressors* and *Activity Descriptions* sections.

Although sonar use could occur throughout the Study Area, sonar use would typically occur within Navy training ranges, Navy testing ranges, associated inshore range locations, and specified ports and piers identified in the *Proposed Activities* section. Activities using sonar range from single source, limited duration events to multi-day events with multiple sound sources on different platforms. The types of sonars and the way they are used differ between primary mission areas. This in turn influences the potential for impacts on exposed marine mammals.

- Anti-submarine warfare typically relies on relatively high source level, mid-frequency sources including MF1 hull-mounted sonar, which is used on Navy combatant vessels such as destroyers. Most anti-submarine warfare sonars use mid-frequency ranges (1–10 kilohertz [kHz]), and some use low-frequency ranges (< 1 kHz). Most of these sonar signals are limited in the temporal, frequency, and spatial domains. The duration of most individual sounds is short, lasting up to a few seconds each. Systems typically operate with low-duty cycles for most tactical sources, but some systems may operate nearly continuously or with higher duty cycles. The MF1 hull-mounted sonar is the predominant vessel-based anti-submarine warfare sonar. It nominally operates at 3 kHz with a source level of 235 decibels (dB) re 1 microPascal (μPa) at 1 meter (m), pinging every 50 seconds. Due to their high source levels and low transmission loss (compared to higher frequency sources), anti-submarine warfare sonar sources have the largest zones of effects. The duration and duty cycle of different sources can vary greatly, from very low duty cycle submarine sonars that infrequently emit single pings, to helicopter dipping sonars that are active for minutes, to continuously active sources on some vessels. Sonar on torpedoes would be higher frequency and used for shorter periods of time. Most anti-submarine warfare activities would occur in the SOCAL Range Complex and the Hawaii Range Complex. Compared to the prior analysis, the Action Proponents propose to use more hours of hull-mounted surface ship sonar, and these activities are newly analyzed in the NOCAL range complex and in PMSR. Compared to the prior analysis, this analysis considers increased use of MF1 (regular duty cycle) and MF1C (continuous duty cycle) associated with Navy training activities and decreased use of MF1 and MF1C associated with Navy testing activities. This analysis also considers the training and testing usage of these sonars across an expanded study area.

For the maximum analyzed year of training and testing activities under this proposed action, MF1 has increased 20 percent and MF1C has increased 50 percent in the expanded California Study Area (which now includes PMSR and NOCAL)). In the Hawaii Study Area MF1 and MF1C is proposed to increase greater than 10 percent and 60 percent respectively when compared to the prior HSTT analysis.

The largest activities in terms of number of platforms using sonar and event duration are major training exercises. These are multi-day exercises that transition across large areas and involve multiple anti-submarine warfare assets. Although major training exercises tend to move to different locations as the event unfolds, some animals could be exposed to sonars over multiple days and across a large area. Integrated and coordinated training similarly involve multiple anti-submarine warfare platforms, but these activities are of shorter duration, smaller scale, and fewer participants than major training exercises. Unit-level training typically involves a single platform conducting anti-submarine warfare. Testing activities are often on the scale of unit-level training. These events would be conducted across a smaller area and for a shorter period, usually within a few hours of a single day, although certain vessel evaluation activities using anti-submarine warfare sonars may extend over multiple days.

Individual ships and submarines would use their anti-submarine warfare sonars during maintenance of these systems. These smaller scale events are less likely to repeatedly expose any marine mammals when these events are considered individually; however, these events may be concentrated in certain locations, such as Sonar Maintenance events at piers conducted near homeports, increasing the potential to repeatedly expose local populations. Except for nearshore maintenance activities and system checks, anti-submarine warfare sonars would typically be used in water deeper than approximately 200 meters (m). Thus, in most locations near-shore populations would not be impacted by these activities.

- Mine Warfare training and testing activities typically involve a ship, helicopter, or unmanned vehicle using a mine-hunting sonar to locate mines. Most Mine Warfare sonar systems have a lower source level, higher frequency, and narrower, often downward facing beam pattern as compared to most anti-submarine warfare sonars. Because of these factors, zones of effect for these systems tend to be relatively smaller. Mine Warfare activities may extend from hours to days. Despite relatively lower source levels, long duration events may still pose a risk of auditory effects due to accumulated exposure to any animal that remains in the vicinity. These activities would typically occur offshore throughout the Study Area but would also occur closer to shore at designated training and testing areas near San Diego, San Clemente Island, Silver Stand Training Complex, Pearl Harbor, and other designated locations around Oahu (see Appendix H, Description of Systems and Ranges, of the HCTT EIS/OEIS).
- Navigation and object detection activities typically employ ship and submarine-based sonars to navigate and avoid underwater objects. Submarines will use their low duty cycle sonars to navigate near ports or train for simulated under ice conditions farther offshore. Surface ships will use hull-mounted sonar at higher frequencies (e.g., bin MF1K) to detect and avoid hazards. The activities would typically occur in Hawaii and SOCAL Range Complexes and while navigating near homeports (San Diego and Pearl Harbor).
- Unmanned underwater vehicles (UUV) typically employ sonars with higher frequencies and lower source levels. These activities therefore typically have a smaller zone of effect. Still, because some

sonars on UUVs have high duty cycles and UUVs may be active for hours at a time, there is a risk of longer exposures for nearby animals. In addition, low-frequency and mid-frequency sonars may be used during some activities.

- A variety of sound sources are used in other testing activities. Acoustic and oceanographic research activities use a variety of sonars to conduct engineering tests of acoustic sources, validate ocean acoustic models, and characterize how sound travels and interacts with the ocean bottom, fish, and ocean surface. Other Testing activities include but are not limited to testing of communication sound sources and countermeasures. Most of these systems generate low to moderate sound levels. Some sources are stationary. Certain events may use sources over long durations (days) which may result in long duration exposures to animals that remain in the vicinity.

Sonars have the potential to affect marine mammals by causing hearing loss, masking, non-injurious physiological responses (such as stress), or behavioral reactions. Low- (less than 1 kHz), mid- (1–10 kHz), and some high (10–100 kHz) frequency sonars are within the hearing range of all marine mammals, though odontocetes hear poorly at low frequencies. Additionally, very high-frequency (100–200 kHz) sonars are in the hearing range of all odontocetes. See the section titled *Hearing* in the *Marine Mammal Background* for additional information.

Hearing Loss: Hearing loss, or threshold shift, is related to the received level of sound and the duration of the exposure. Proposed activities with more sound sources, louder sound sources, or that transmit sonar for longer durations increase the likelihood of auditory effects in marine mammals. For example, high-duty cycle hull-mounted sonar is more likely than other sonars to result in auditory effects. Research has shown that marine mammals are more susceptible to hearing loss within frequencies of best hearing. Hearing loss is most likely to occur at or above the dominant frequency of the sound source, not below. The recovery of hearing thresholds begins after an exposure. Any hearing loss that is recovered is called temporary threshold shift (TTS), whereas any remaining threshold shift after recovery is considered AINJ. See the section titled *Hearing Loss and Auditory Injury* in the *Marine Mammal Acoustic Background* for additional information. TTS and AINJ due to sonars are estimated using criteria developed for marine mammal hearing groups and modeling methods described below in Section 2.2 (Quantifying Impacts on Marine Mammals from Acoustic and Explosive Stressors).

Masking: Masking can reduce the ranges over which marine mammals can detect biologically relevant sounds in the presence of high-duty cycle sources. Lower-duty cycle sonars have less of a masking effect, as the listener can detect signals of interest during the quiet periods between cycles. The reduction in range over which marine mammals communicate is highly dependent on the frequencies of the sonar and biological signal of interest, as well as the source levels of the sonar. High-frequency (10–100 kHz) sonars, including those typically used for mine hunting, navigation, and object detection, fall within the best hearing and vocalization ranges of most marine mammals. These sources often have medium to high duty cycles, but typically have lower source levels than anti-submarine warfare sonars. High frequencies attenuate more rapidly in the water due to absorption than do lower frequency sounds, thus producing a smaller zone of potential masking than mid and low frequencies. While high-frequency sonar has the potential to mask marine mammal vocalizations under certain conditions, reduction in available communication space or ability to locate prey is unlikely because of the small zone of effect.

Masking effects of sonar are typically transient and temporary for most hull-mounted sonars, as they are mobile, and masking is reduced as the spatial separation between the masker and signal of interest increases. Most anti-submarine warfare activities are geographically dispersed and last for a few hours, often with intermittent sonar use, and have a narrow frequency band (typically less than one-third octave). These factors reduce the likelihood of masking due to sonar used in anti-submarine warfare activities. In some cases, mammals can compensate for masking by changing their calls or moving away from the source. Some of these activities use mid-frequency hull-mounted high duty cycle sonars (MF1C) that increase the potential for auditory effects and masking. Overall, the use of MF1C is low relative to the use of low duty cycle hull-mounted sonar (MF1).

For large mysticetes, the range of best hearing is estimated between 0.1 and 10 kHz, which overlaps with low- and mid-frequency sonar sources; however, their vocalizations are below 1 kHz, which overlaps with low-frequency sources. Any auditory impacts (TTS and INJ) or masking from mid-frequency sonars would be less likely to affect communication than impacts due to low-frequency sonars*.* For the other mysticetes, the range of best hearing and vocalizations is between 1 and 30 kHz, which overlaps with mid- and high-frequency sonar sources. Masking from high-frequency sonar sources would be less likely to affect communication for these mysticetes than impacts due to mid-frequency sonars.

Odontocetes that use echolocation to hunt may experience masking of the echoes needed to find their prey when foraging near low-frequency and mid-frequency sonar sources. Communication sounds could also be masked by these sources. This effect is likely to be temporary in offshore areas where these sources operate most often. However, when sonars operate in nearshore areas such as homeports with a high level of anthropogenic activity, the opportunities for odontocetes to detect and interpret biologically relevant sounds may be reduced. Odontocetes with very high frequency hearing such as harbor porpoises may experience masking of echolocation and communication calls from close-proximity very-high-frequency sources, but these effects are likely to be transient and temporary.

Pinnipeds may also experience masking due to low and mid- frequency sources because their communication calls range from approximately 0.1–30 kHz. Some species of pinnipeds communicate primarily in air and would not experience masking due to sonar.

See the section titled *Masking* in the *Marine Mammal Acoustic Background* for additional information.

<u>Physiological response (stress)</u>: Physiological stress is an adaptive process that helps an animal cope with changing conditions. Marine mammals could experience a physiological change in heart rate, stress hormones, or immune system due to sound exposure. Currently, the sound characteristics that correlate with physiological responses in marine mammals are poorly understood, as are the ultimate consequences of these changes. Because there are many unknowns regarding the occurrence of acoustically induced stress responses in marine mammals, any physiological response (e.g., hearing loss or injury) or significant behavioral response is assumed to be associated with a stress response. See the section titled *Physiological Response* in the *Marine Mammal Acoustic Background* for additional information.

<u>Behavioral response</u>: Marine mammals only behaviorally respond to sounds they can hear or otherwise perceive. Marine mammals may react in several ways depending on the sound's characteristics, their experience with the sound source, and whether they are traveling, breeding, or feeding. Behavioral responses may include alerting, terminating feeding dives and surfacing, diving, or swimming away. Marine mammals' reaction to sonar can vary based on the individual, species, and context. See the section titled *Behavioral Reactions* in the *Marine Mammal Acoustic Background* for additional information, including a summary of best available science and supporting citations for responses to sonars by each of the behavioral groups listed below. Behavioral responses to sonars are estimated

using criteria developed for marine mammal behavioral groups and modeling methods described below in Section 2.2 (Quantifying Impacts on Marine Mammals from Acoustic and Explosive Stressors). The sensitivity to behavioral disturbance due to sonars differs among marine mammal groups as follows:

- Mysticetes are the least behaviorally sensitive group. Behavioral reactions in mysticetes are much more likely within a few kilometers of a sound source. Mysticetes have been observed to route around sound sources placed in their migration path.
- Large odontocetes such as killer whales and pilot whales have been observed to temporarily cease natural behaviors such as feeding, avoid the sonar source, or even move towards the sound source, as seen in pilot whales. These same behavioral responses have been observed in delphinids, both in captivity and in the field; however, this group appears to be less sensitive to sound and anthropogenic disturbance than other cetacean species.
- Responses of beaked whales have been carefully studied on Navy ranges, including the Southern California Anti-Submarine Warfare Range (SOAR) west of San Clemente Island in the SOCAL Range Complex and the Pacific Missile Range Facility (PMRF) west of Kauai, Hawaii. Beaked whales exposed to sonar or other active acoustic sources may discontinue feeding dives and avoid the area during anti-submarine warfare activities. In areas where anti-submarine warfare training exercises occur with some regularity, beaked whales leave the area but return within a few days after the event ends (e.g., Henderson et al., 2015; Henderson et al., 2016; Jacobson et al., 2022; Manzano-Roth et al., 2016; Tyack et al., 2011). Population levels of beaked whales and other odontocetes on Navy fixed ranges that have been operating for decades appear to be stable. In areas where beaked whales are unlikely to regularly encounter naval sonar activity, beaked whales may be more likely to be displaced for longer periods of time (e.g., Stanistreet et al., 2022). Significant behavioral reactions to sonar are likely when beaked whales are exposed to anti-submarine sonar within a few tens of kilometers, especially for prolonged periods (a few hours or more). Avoidance likely decreases the potential for hearing loss for these species.
- Harbor porpoises are small odontocetes that are sensitive to anthropogenic activity and avoid anthropogenic sound sources at low received levels. Behavioral reactions are more likely than with most other odontocetes.
- Pinnipeds in water are generally tolerant of anthropogenic sound and activity. They may not react at all until the sound source is approaching within a few hundred meters and then may alert, ignore the stimulus, change their behaviors, or avoid the immediate area by swimming away, diving, or hauling out.

For sonars with applicable activity-based mitigation (see *Mitigation*), trained Lookouts observe defined mitigation zones for marine mammals and indicators that marine mammals may be present. The mitigation zones encompass the ranges to auditory injury for all marine mammals for all sonars shown in 2.5.1 (Ranges to Effects for Sonars and Other Transducers), including the ship hull-mounted sonars, MF1 and MF1C.

Because sonars may result in the incidental take of marine mammals (auditory impacts and significant behavioral responses), sonar impacts are modeled per the methods presented in Section 2.2 (Quantifying Impacts on Marine Mammals from Acoustic and Explosive Stressors). Impacts on each marine mammal stock are discussed and quantified below in Section 2.4 (Species Impact Assessments). Conclusions *regarding impacts from sonars used during military readiness activities for ESA-listed species are provided in Section 2.4 (Species Impact Assessments).*

2.1.2 IMPACTS FROM AIR GUNS

Air guns use bursts of pressurized air to create intermittent, broadband, impulsive sounds. Air gun use during military readiness activities is limited and unlike large-scale seismic surveys that use multiple large air guns. Air gun use would occur nearshore in the SOCAL Range Complex under Intelligence, Surveillance, and Reconnaissance activities, and greater than 3 NM from shore in the Hawaii, NOCAL, and SOCAL Range Complexes under Acoustic and Oceanographic Research.

Air gun sounds are within the hearing range of all marine mammals. Potential impacts from air guns could include temporary hearing loss, masking, behavioral reactions, and physiological responses (stress).

All marine mammals are susceptible to auditory effects from impulsive sounds such as those from air guns. TTS and AINJ due to air guns are estimated using criteria developed for marine mammal hearing groups and modeling methods described below in Section 2.2 (Quantifying Impacts on Marine Mammals from Acoustic and Explosive Stressors). Ranges to auditory effects for marine mammals exposed to air guns are in Section 2.5.2 (Ranges to Effects for Air Guns). When using air guns, trained Lookouts observe defined mitigation zones for marine mammals and indicators that marine mammals may be present (see *Mitigation*). The mitigation zones encompass the ranges to auditory injury for all marine mammals.

If marine mammals are exposed to sounds from air guns, they may experience masking and could potentially react with short-term behavioral reactions and physiological response (see the *Marine Mammal Acoustic Background* section for details). It should be noted that many observations of marine mammal reactions to air guns are from oil and gas exploration activities that use large air gun arrays and operate continuously for multiple weeks to cover large areas of the ocean. Military readiness activities, in contrast, use fewer air guns over a much shorter period and a limited area. Reactions are less likely to occur or rise to the same level of severity as during seismic surveys.

Impacts from seismic air guns have been studied in several mysticete species, including gray whales, humpback whales, and blue whales. Mysticetes react to air guns in a variety of ways, ranging from startle responses, changing respiration, vocal, dive, or surface behaviors (e.g., tail slapping), and strong avoidance responses (e.g., swimming rapidly away from the seismic vessels, habitat displacement). Exposed mysticetes will sometimes tolerate the disturbance and continue their natural behavior patterns or return to the area once the air gun activity ceases. Certain factors (e.g., activity intensity, proximity, behavioral context, species) may influence whether a mysticete tolerates air gun noise or leaves the area until the seismic activity ceases.

Impacts from air guns have been studied in several odontocete species, including sperm whales, beluga whales, and harbor porpoises. Odontocetes may react in a variety of ways to air guns, which include changes in feeding, dive, and vocal behavior, habitat displacement, or showing no response at all. If disturbed while engaged in activities such as feeding or reproductive behaviors, odontocetes may be more likely to ignore or tolerate the disturbance and continue their natural behavior patterns, as seen in sperm whales.

Impacts from air guns have not been studied in many species of pinnipeds, but there is evidence of wild ringed seals avoiding a seismic vessel by a short distance (less than 250 m). Research in captive pinnipeds shows mild evasive behavioral responses. Pinnipeds may be the least sensitive taxonomic group to most noise sources and are likely to respond to loud impulsive sound sources only at close ranges by startling or ceasing foraging, but only for brief periods before returning to their previous behavior. Pinnipeds may even experience mild TTS before exhibiting a behavioral response (Southall et al., 2007). If disturbed while engaged in activities such as feeding or reproductive behaviors, pinnipeds may be more likely to ignore or tolerate the disturbance and continue their natural behavior patterns.

Because noise from air guns may result in the incidental take of marine mammals (auditory impacts and significant behavioral responses), air gun impacts are modeled per the methods presented in Section 2.2 (Quantifying Impacts on Marine Mammals from Acoustic and Explosive Stressors). *Impacts on each marine mammal stock are quantified below in Section 2.4 (Species Impact Assessments). Conclusions regarding impacts from air guns used during military readiness activities for ESA-listed species are provided in Section 2.4 (Species Impact Assessments).*

2.1.3 Impacts from Pile Driving

Marine mammals could be exposed to sounds from impact (installation only) and vibratory (installation and extraction) pile driving during the Expeditionary Warfare activity - Port Damage Repair training at Port Hueneme, California throughout the year (pile driving would not occur during testing activities). No other locations within the HCTT Study Area would have pile driving activity. Only two species are anticipated to be present where pile driving activities would take place: California sea lions and harbor seals. There are no critical habitats that would be impacted by pile driving activities. There would be no impacts due to pile driving for any stock of marine mammal in California outside of Port Hueneme, because there is no geographic overlap of pile driving with species occurrence. Although some coastal species passing near the entrance of the port may detect sound from pile driving activities, behavioral responses from these exposures are not expected to rise to the level of take under military readiness.

Port Damage Repair training activities are made up of multiple events, each which could occur up to 12 times per year. Each training event is comprised of up to seven separate modules, each which could occur up to three iterations during a single event (for a maximum of 21 modules). Training events would last a total of 30 days, of which pile driving is only anticipated to occur for a maximum of 14 days. Sound from pile driving activities could occur over several hours in each day, though breaks in pile driving are taken frequently to reposition the drivers between piles. Depending on where the activity occurs at Port Hueneme, transmission of pile driving noise may be reduced by existing pier structures. As a standard operating procedure, the Navy performs soft starts at reduced energy during an initial set of strikes from an impact hammer. Soft starts may “warn” marine mammals and cause them to move away from the sound source before impact pile driving increases to full operating capacity. Soft starts were not considered when calculating the number of marine mammals that could be impacted, nor was the possibility that marine mammals could avoid the training area. Therefore, absent these considerations, the impact determination is overly conservative.

Sounds from the impact hammer are impulsive, broadband, and dominated by lower frequencies. The impulses are within the hearing range of marine mammals. Sounds produced from a vibratory hammer are similar in frequency range as that of the impact hammer, except the levels are much lower than for the impact hammer, especially when extracting piles from sandy, nearshore ground, and the sound is continuous while operating. AINJ, TTS, and behavioral responses due to pile driving are estimated using criteria developed for marine mammal hearing groups and modeling methods described below in Section 2.2 (Quantifying Impacts on Marine Mammals from Acoustic and Explosive Stressors). Ranges to effects for marine mammals exposed to impact and vibratory pile driving are shown in Section 2.5.3

(Ranges to Effects for Pile Driving). During pile driving, trained Lookouts observe defined mitigation zones for marine mammals and indicators that marine mammals may be present (see *Mitigation*). The pile driving mitigation zone (100 yd.) encompasses the ranges to AINJ for otariids and, for most pile types, phocids, as well as the ranges to TTS for a subset of pile types for otariids and phocids. After a sighting, the 15-min. recommencement wait period would cover the average dive times of the marine mammal species that could be present in the mitigation zone, especially considering the shallow waters inside the port where pile driving activities occur. If impacts occur, it would be more likely that marine mammals may experience brief periods of masking, physiological responses, or behavioral reactions.

Vibratory and impact pile driving (at 60 strikes per minute) may cause masking. The effect would be temporary, lasting the amount of time it would take to drive a pile, with pauses before the next pile is driven. Furthermore, Port Damage Repair activities occur in shallow, nearshore areas where ambient noise levels are already typically high. Port Hueneme is a military port with potentially high ambient noise levels due to vessel traffic and port activities. Given these factors, significant masking is unlikely to occur in marine mammals due to exposure to sound from impact pile driving or vibratory pile driving/extraction.

If marine mammals are exposed to sounds from pile driving or extraction, they could potentially react with physiological (stress) responses, short-term behavioral reactions, or be displaced from the port (see the *Marine Mammal Acoustic Background* section).

Because noise from pile driving may result in the incidental take of marine mammals (auditory impacts and significant behavioral responses), pile driving impacts are modeled per the methods presented in Section 2.2 (Quantifying Impacts on Marine Mammals from Acoustic and Explosive Stressors). Impacts on each marine mammal stock present in the affected area are quantified below in Section 2.4 (Species Impact Assessments). Conclusions regarding impacts from pile driving during military readiness activities for ESA-listed species are provided in Section 2.4 (Species Impact Assessments).

2.1.4 Impacts from Vessel Noise

Marine mammals may be exposed to vessel-generated noise throughout the Study Area. Military readiness activities with vessel-generated noise would be conducted as described in the *Proposed Activities* and *Activity Descriptions* sections. Specifically, Navy vessel traffic in Hawaii is heaviest south of Pearl Harbor, and in Southern California Navy vessel traffic is heaviest around San Diego and roughly within 50 NM of shore, though these activities could occur throughout the Study Area, as described in the *Acoustic Habitat* section. The four amphibious approach lanes on the coast of central California bordering NOCAL and PSMR near Mill Creek Beach, Morro Bay, Pismo Beach, and Vandenberg Space Force Base are sources of nearshore vessel noise as well. Navy traffic has clear routes from Hawaii to the Mariana Islands, Japan and San Diego, and from San Diego north to the Pacific Northwest. Vessel movements involve transits to and from ports to various locations within the Study Area. Many ongoing and proposed military readiness activities involve maneuvers by various types of surface ships, boats, and submarines (collectively referred to as vessels), as well as unmanned systems. During training, combatant speeds generally range from 10 to 14 knots; however, vessels can and will, on occasion, operate within the entire spectrum of their specific operational capabilities. A variety of smaller craft and unmanned vessels can be operated within the Study Area. Small craft types, sizes, and speeds vary. In all cases, the vessels will be operated in a safe manner consistent with the local conditions. Activities involving vessel movements occur intermittently and are variable in duration, ranging from a few hours up to multiple weeks.

Noise from vessels generally lacks the amplitude and duration to cause any hearing loss in marine mammals under realistic conditions. Noise from vessels is generally low-frequency (10 to hundreds of Hertz), although at close range or in shallow water some sound energy can extend above 100 kHz at received levels above 100 dB re 1 µPa (Hermannsen et al., 2014). Although periods of broadband noise tend to be brief, occurring only as a vessel is passing within a few hundred meters, vessel noise could lead to short-term masking for all marine mammal species. Vessels have been linked to minor behavioral responses, although it is difficult to separate responses to the noise from reactions to the physical presence of the vessel. Physiological response has also been linked to chronic vessel noise, such as that in shipping lanes or heavily trafficked whale-watch areas. However, based on the relatively low source levels of many vessels, and the transient nature of vessel noise during military readiness activities, any responses by marine mammals to vessels and associated noise are unlikely to be significant. Best available science on responses to vessel noise, including behavioral responses, stress, and masking, is summarized in the *Marine Mammal Acoustic Background* section.

Vessel traffic related to the proposed activity would pass near marine mammals on an incidental basis. Ports such as Honolulu and San Diego are heavily trafficked with private and commercial vessels in addition to naval vessels. Non-military vessels dominate vessel traffic in shipping lanes off California, including out of the major ports of San Francisco, Los Angeles, and Long Beach (see maps of total and military vessel traffic off Hawaii and California in *Acoustic Habitat*). Proposed military vessel transits would comprise a small portion of overall vessel traffic and are unlikely to cause significant behavioral responses or long-term abandonment of habitat by a marine mammal. The Action Proponents will implement mitigation for vessel movement to avoid the potential for marine mammal vessel strikes, as discussed in the *Mitigation* section. The mitigation for vessel movements (i.e., maneuvering to maintain a specified distance from a marine mammal) will also help the Navy avoid or reduce potential impacts from vessel noise on marine mammals.

When the level of vessel noise is above the sound of interest, and in a similar frequency band, masking could occur (see the section titled *Masking* in the *Marine Mammal Acoustic Background*). Vessel noise can mask vocalizations and other biologically relevant sounds (e.g., sounds of prey or predators) that marine mammals rely on. Potential masking can vary depending on the ambient noise level within the environment, the received level and frequency of the vessel noise, and the received level, frequency, and relative position of the sound of biological interest. In the open ocean, ambient noise levels are between about 60 and 80 dB re 1 µPa in the band between 10 Hz and 10 kHz due to a combination of natural (e.g., wind) and anthropogenic sources (Urick, 1983), while inshore noise levels, especially around busy ports, can exceed 120 dB re 1 µPa. This analysis assumes that any sound that is above ambient noise levels and within an animal's hearing range may potentially cause masking. However, the degree of masking increases with increasing noise levels; a noise that is just detectable over ambient levels is unlikely to cause any substantial masking. Masking by passing ships or other sound sources transiting the Study Area would be short term and intermittent, and therefore unlikely to result in any substantial costs or consequences to individual animals or populations. Areas with increased levels of ambient noise from anthropogenic noise sources such as areas around busy shipping lanes and near harbors and ports may cause sustained levels of masking for marine mammals, which could reduce an animal's ability to find prey, find mates, socialize, avoid predators, or navigate. However, Navy vessels make up a very small percentage of the overall traffic (two orders of magnitude lower than commercial ship traffic in the Study Area), and the rise of ambient noise levels in these areas is related to all ocean users, including commercial and recreational vessels and shoreline development and industrialization.

Surface combatant ships (e.g., guided missile destroyer, guided missile cruiser, and Littoral Combat Ship) and submarines are designed to be very quiet to evade enemy detection and typically travel at speeds of 8 - 15 knots. Actual acoustic signatures and source levels of combatant ships and submarines are classified; however, they are quieter than most other motorized ships. Still, these surface combatants and submarines are likely to be detectable by marine mammals over open-ocean ambient noise levels at distances of up to a few kilometers, which could cause masking for a few minutes as the vessel passes by. Other Navy ships and small vessels have higher source levels, like equivalently sized commercial ships and private vessels, however many of these are concentrated in homeports, which are typically industrialized areas with elevated ambient noise levels.

Ship noise tends to be low-frequency and broadband; therefore, it may have the largest potential to mask mysticetes that vocalize at lower frequencies compared to other marine mammals. Noise from large vessels and outboard motors on small craft can produce source levels of 160 to over 200 dB re 1 μPa at 1 m. Therefore, in the open ocean, noise from noncombatant vessels may be detectable over ambient levels for tens of kilometers, and some masking, especially for mysticetes, is possible. In noisier inshore areas around ports and ranges, vessel noise may be detectable above ambient for only several hundred meters. Some masking of mysticete communication is likely from noncombatant vessels, on par with similar commercial and recreational vessels, especially in quieter, open-ocean environments.

Vessel noise has the potential to disturb marine mammals and elicit an alerting, avoidance, or other behavioral reaction. Most studies have reported that marine mammals react to vessel sounds and traffic with short-term interruption of feeding, resting, or social interactions (Magalhães et al., 2002; Richardson et al., 1995; Watkins, 1981). Some species respond negatively by retreating or responding to the vessel antagonistically, while other animals seem to ignore vessel noises altogether or are attracted to the vessel (Watkins, 1986). Marine mammals are frequently exposed to vessels due to research, ecotourism, commercial and private vessel traffic, and government activities. It is difficult to differentiate between responses to vessel sound and visual cues associated with the presence of a vessel; thus, it is assumed that both play a role in prompting reactions from animals.

Based on studies of several species, mysticetes are not expected to be disturbed by vessels that maintain a reasonable distance from them, which varies with vessel size, geographic location, and tolerance levels of individuals. Pinniped data largely indicates tolerance of vessel approaches, especially for animals in the water. Odontocetes could have a variety of reactions to passing vessels, including attraction, bow-riding, increased traveling time, decreased feeding behaviors, diving, or avoidance of the vessel, which may vary depending on their prior experience with vessels. Kogia whales, harbor porpoises, and beaked whales have been observed avoiding vessels. Some masking to odontocete communication is likely from noncombatant vessels, on par with similar commercial and recreational vessels, especially in quieter, open-ocean environments.

Vessels operated by the Action Proponents do not purposefully approach marine mammals and are not expected to elicit significant behavioral responses. Marine mammal reactions to vessel noise associated with proposed activities are likely to be minor and short term, leading to no significant reactions and no long-term consequences.

Pursuant to the MMPA, vessel noise during military readiness activities as described under the Proposed Action will not result in the unintentional taking of marine mammals incidental to those activities. Conclusions regarding impacts from activities that produce vessel noise during military readiness activities for ESA-listed species are provided in Section 2.4 (Species Impact Assessments).

2.1.5 Impacts from Aircraft Noise

Marine mammals may be exposed to aircraft-generated noise throughout the Study Area. Military readiness activities with aircraft would be conducted as described in the *Proposed Activities* and *Activity Descriptions* sections. Both manned and unmanned fixed- and rotary-wing (e.g., helicopters) aircraft are used for a variety of military readiness activities throughout the Study Area. Tilt-rotor impacts would be similar to fixed-wing or rotary-wing aircraft impacts, depending on the aircraft mode. Most of these sounds would be concentrated around airbases and fixed ranges within each of the range complexes. Aircraft noise could also occur in the waters immediately surrounding aircraft carriers at sea during takeoff and landing or directly below hovering rotary-wing aircraft that are near the water surface.

Aircraft produce extensive airborne noise from either turbofan or turbojet engines. An infrequent type of aircraft noise is the sonic boom, produced when the aircraft exceeds the speed of sound. Rotary-wing aircraft produce low-frequency sound and vibration. Transmission of sound from a moving airborne source to a receptor underwater is influenced by numerous factors, but significant acoustic energy is primarily transmitted into the water directly below the craft in a narrow cone, as discussed in detail in the *Acoustic Primer* section. Underwater sounds from aircraft are strongest just below the surface and directly under the aircraft. Additional characteristics of aircraft noise are described in the *Acoustic Stressors* section.

Sound from aircraft noise, including occasional sonic booms, lack the amplitude or duration to cause any hearing loss in marine mammals underwater. Aircraft would pass quickly overhead and rotary-wing aircraft (e.g., helicopters) may hover at lower altitudes for longer durations, though still for relatively brief periods, considering the transient nature of both the aircraft and marine mammals. Potential impacts from aircraft noise are limited to masking of other biologically relevant sounds, and brief behavioral and physiological response reactions as aircraft passes overhead. Based on the short duration of potential exposure to aircraft noise, behavioral and physiological response reactions, if they did occur, are unlikely to be significant. The duration of masking due to hovering rotary-wing aircraft would be limited to the short duration of hovering events.

Marine mammals may respond to both the physical presence and to the noise generated by aircraft, making it difficult to attribute causation to one or the other stimulus. In addition to noise produced, all low-flying aircraft make shadows, which can cause animals at the surface to react. Rotary-wing aircrafts may also produce strong downdrafts, a vertical flow of air that becomes a surface wind, which can also affect an animal's behavior at or near the surface.

Many of the observations of marine mammal reactions are to aircraft flown for whale-watching and marine research purposes. Marine mammal survey aircraft are typically used to locate, photograph, track, and sometimes follow animals for long distances or for long periods of time, all of which results in the animal being much more frequently located directly beneath the aircraft (in the cone of the loudest noise and potentially in the shadow of the aircraft) for extended periods. Military aircraft would not follow marine mammals. In contrast to whale-watching excursions or research efforts, overflights would not result in prolonged exposure of marine mammals to overhead noise or encroachment.

In most cases, exposure of a marine mammal to fixed-wing aircraft presence and noise would be brief as the aircraft quickly passes overhead. Animals would have to be at or near the surface at the time of an overflight to be exposed to appreciable sound levels. Takeoffs and landings occur at established airfields as well as on vessels at sea at unspecified locations across the Study Area. Takeoffs and landings from vessels could startle marine mammals; however, these events only produce in-water noise at any given location for a brief period as the aircraft climbs to cruising altitude. Some sonic booms from aircraft could startle marine mammals, but these events are transient and happen infrequently at any given location within the Study Area. Repeated exposure to most individuals over short periods (days) is extremely unlikely, except for animals that are resident in inshore locations around ports, on fixed ranges (e.g., SOAR), or during major training exercises. These animals could be subjected to multiple overflights per day; however, aircraft would pass quickly overhead, typically at altitudes above 3,000 ft., which would make marine mammals unlikely to respond. No long-term consequences for individuals or populations would be expected.

Daytime and nighttime activities involving rotary-wing aircrafts may occur for extended periods of time, typically 1 to 3 hours in some areas. During these activities, rotary-wing aircrafts would typically transit throughout an area and may hover over the water. Longer activity durations and periods of time where rotary-wing aircrafts hover may increase the potential for behavioral reactions, startle reactions, and physiological response. Low-altitude flights of rotary-wing aircrafts during some activities, often under 100 ft., may elicit a somewhat stronger behavioral response due to the proximity to marine mammals, the slower airspeed and therefore longer exposure duration, and the downdraft created by the rotary-wing aircraft's rotor. Marine mammals would likely avoid the area under the rotary-wing aircraft.

Most fixed-wing aircraft and rotary-wing aircraft activities are transient in nature, although rotary-wing aircrafts could also hover for extended periods (5 to 15 minutes). The likelihood that marine mammals would occur or remain at the surface while an aircraft transits directly overhead would be low. Rotary-wing aircrafts that hover in a fixed location for an extended period could increase the potential for exposure. However, impacts from military readiness activities would be highly localized and concentrated in space and duration.

The consensus of all the studies reviewed is that aircraft noise would cause only small temporary changes in the behavior of marine mammals. Specifically, marine mammals at or near the surface when an aircraft flies overhead at low altitude may startle, divert their attention to the aircraft, or avoid the immediate area by swimming away or diving. No more than short-term reactions are likely. No long-term consequences for individuals, species, or stocks would be expected.

Pursuant to the MMPA, aircraft noise during military readiness activities as described under the Proposed Action will not result in the unintentional taking of marine mammals incidental to those activities. Conclusions regarding impacts from activities that produce aircraft noise during military readiness activities for ESA-listed species are provided in Section 2.4 (Species Impact Assessments).

2.1.6 Impacts from Weapons Noise

Marine mammals may be exposed to sounds caused by the firing of weapons, objects in flight, and impact of non-explosive munitions on the water surface during activities conducted at sea.[1] This incidental noise is collectively called weapons noise. Military readiness activities using gunnery and other weapons that generate firing noise would be conducted as described in the *Proposed Activities*

[1] Impacts on hauled-out pinnipeds due to land-based launches at San Nicolas Island in PMSR and at the PMRF in the Hawaii Range Complex are addressed separately.

and *Activity Descriptions* sections*.* The locations where gunnery and other munitions may be used are shown in the *Munitions* data section. Most weapons noise is attributable to gunnery activities.

Most activities involving large caliber naval gunfire or other munitions fired or launched from a vessel are conducted more than 12 NM from shore. The Action Proponents will implement mitigation to avoid or reduce potential impacts from weapon firing noise during large-caliber gunnery activities, as discussed in the *Mitigation* section. For explosive munitions, only associated firing noise is considered in the analysis of weapons noise. The noise produced by the underwater detonation of explosive weapons is analyzed in Section 2.1.7 (Impacts from Explosives).

The firing of a weapon may have several components of associated noise. Firing of guns could include sound generated in air by firing a gun (muzzle blast) and a crack sound due to a low amplitude shock wave generated by a supersonic projectile. Most in-air sound would be reflected at the air-water interface. Underwater sounds would be strongest just below the surface and directly under the firing point. Any sound that enters the water only does so within a narrow cone below the firing point or path of the projectile. Vibration from the blast propagating through a ship's hull, the sound generated by the impact of an object with the water surface, and the sound generated by launching an object underwater are other sources of impulsive sound in the water. Sound due to missile and target launches is typically at a maximum at initiation of the booster rocket.

A gun fired from a ship on the surface of the water propagates a blast wave away from the gun muzzle into the water. Average peak sound pressure in the water measured directly below the muzzle of the gun and under the flight path of the shell (assuming it maintains an altitude of only a few meters above the water surface) was approximately 200 dB re 1 µPa. Animals at the surface of the water, in a narrow footprint under a weapons trajectory, could be exposed to naval gunfire noise and may exhibit brief startle reactions, avoidance, diving, or no reaction at all. Due to the short term, transient nature of gunfire noise, animals are unlikely to be exposed multiple times within a short period. Behavioral reactions would likely be short term (minutes) and are unlikely to lead to substantial costs or long-term consequences for individuals, species, or stocks.

Sound due to Missile and Target Launches is typically at a maximum at initiation of the booster rocket and rapidly fades as the missile or target travels downrange. These sounds would be transient and of short duration, lasting no more than a few seconds at any given location. Many missiles and targets are launched from aircraft, which would produce minimal noise in the water due to the altitude of the aircraft at launch. Missiles and targets launched by ships or near the water surface may expose marine mammals to levels of sound that could produce brief startle reactions, avoidance, or diving. Due to the short-term, transient nature of launch noise, animals are unlikely to be exposed multiple times within a short period. Reactions by marine mammals to these specific stressors have not been recorded; however, marine mammals would be expected to react to weapons noise as they would other transient sounds. Behavioral reactions would likely be short term (minutes) and are unlikely to lead to long-term consequences for individual, species, or stocks.

Some objects, such as certain non-explosive practice munitions, could impact the water with great force. Animals within the area may hear the impact of non-explosive ordnance on the surface of the water and would likely alert, startle, dive, or avoid the immediate area. Significant behavioral reactions from marine mammals would not be expected due to non-explosive ordnance impact noise; therefore, long-term consequences for the individual, species, or stocks are unlikely.

Pursuant to the MMPA, weapons noise during military readiness activities as described under the Proposed Action will not result in the unintentional taking of marine mammals incidental to those activities. Conclusions regarding impacts from activities that produce weapons noise during military readiness activities for ESA-listed species are provided in Section 2.4 (Species Impact Assessments).

2.1.7 Impacts from Explosives

Marine mammals may be exposed to sound and energy from explosions in the water and near the water surface associated with the proposed activities. Activities using explosives would be conducted as described in the *Proposed Activities* and *Activity Descriptions* sections. Most explosive activities would occur in the SOCAL Range Complex, the Hawaii Range Complex, and PMSR, although activities with explosives would also occur in other areas as described in the *Activity Descriptions* section.

Characteristics, quantities, and net explosive weights of in-water explosives used during military readiness activities are provided in the *Acoustic Stressors* section. The use of in-water explosives would increase from the prior analysis for training activities and would decrease slightly for testing. There is an overall reduction in the use of most of the largest explosive bins (bin E8 [> 60–100 pounds (lb.) net explosive weight (NEW)] and above) for training and a decrease in two of the largest explosive bins (bin E10 [> 250–500 lb. NEW] and E11 [> 500–650 lb. NEW]) under testing activities. There would be notable increases in the smaller explosive bins (E7 [> 20–60 lb. NEW] and below) under training and testing activities, except for bin E1 (0.1–0.25 lb. NEW) which would decrease under testing activities. Small ship shock trials (bin E16 [> 7,250–14,500 lb. NEW]) not previously analyzed are currently proposed under testing activities.

Most activities involving in-water (including surface) explosives associated with large caliber naval gunfire, missiles, bombs, or other munitions are conducted more than 12 NM from shore. This includes Small Ship Shock Trials that could occur in the SOCAL Range Complex. Sinking Exercises are conducted greater than 50 NM from shore.

Species present in shallower water could be exposed to activities conducted closer to shore. Certain activities with explosives may be conducted close to shore at locations identified in the Activity Descriptions section and Appendix H (Description of Systems and Ranges) of the HCTT EIS/OEIS. This includes certain Mine Warfare and Expeditionary Warfare activities. In the Hawaii Range Complex explosive activities could occur at specified ranges and designated locations around Oahu, including the Puuloa Underwater Range and designated locations in and near Pearl Harbor. In the SOCAL Range Complex, explosive activities could occur near San Clemente Island, in the Silver Strand Training Complex, and in other designated mine training areas along the Southern California coast.

The types of activities with detonations below the surface include Mine Warfare, activities using explosive torpedoes, and ship shock trials, as well as specific training and testing activities. Most explosive munitions used during military readiness activities, however, would occur at or just above the water surface (greater than 90 percent by count). These include those used during surface warfare activities, such as explosive gunnery, bombs, and missiles. Certain nearshore activities use explosives in the surf zone up to the beach, where most explosive energy is released in the air (refer to Appendix H, Description of Systems and Ranges, for location details). In the below quantitative analysis, impacts on marine mammals are over-estimated because in-air near surface and surf zone explosions are modeled as underwater explosions, with all energy assumed to remain in the water. Sound and energy from in-air detonations at higher altitudes would be reflected at the water surface and therefore are not analyzed further in this section and would have no effect on marine mammals.

Explosions produce loud, impulsive, broadband sounds that are within the hearing range of all marine mammals. Potential impacts from explosive energy and sound include mortality, non-auditory injury, behavioral reactions, physiological response, masking, and hearing loss.

Direct injury: The rapid, high magnitude pressure changes created by explosives can kill or injure marine mammals. Susceptibility to injury is estimated using data on terrestrial animals exposed to explosives. See the section titled *Direct Injury* in the *Marine Mammal Acoustic Background* for additional information.

Hearing loss: Exposure to an explosion may cause AINJ or TTS due to high intensity, broadband sounds with high peak pressures. There is limited information on hearing loss due to explosives, although there are data from other impulsive sources. See the sections titled *Hearing Loss and Auditory Injury* in the *Marine Mammal Acoustic Background* for additional information.

Masking: Activities that have multiple detonations such as some naval gunfire exercises may create brief periods of broadband masking of biologically relevant sounds. Because these periods are so brief, any impacts would be limited. See the sections titled *Masking* in the *Marine Mammal Acoustic Background* for additional information.

Behavioral and physiological (stress) response: If marine mammals are exposed to impulsive sounds such as those from explosives, they may react in a variety of ways, which may include alerting, startling, breaking off feeding dives and surfacing, diving, or swimming away, changing vocalization, or showing no response at all. Because noise from most activities using explosives is short term and intermittent, and because detonations usually occur within a small area, behavioral reactions from marine mammals are likely to be short-term and low to moderate severity. Physiological responses including stress responses could occur. See the sections titled *Physiological Response* and *Behavioral Reactions* in the *Marine Mammal Acoustic Background* for additional information.

Injury (including mortality), AINJ, TTS, and behavioral responses due to explosives are estimated using criteria developed for marine mammal hearing groups and modeling methods described below in Section 2.2 (Quantifying Impacts on Marine Mammals from Acoustic and Explosive Stressors). Impact ranges for marine mammals exposed to explosive sound and energy are shown in Section 2.5.4 (Ranges to Effects for Explosives).

As discussed in the *Mitigation* section, the Action Proponents will implement mitigation to relocate, delay, or cease detonations when a marine mammal is sighted within or entering a mitigation zone to avoid or reduce potential explosive impacts. The visual observation distances described in the section *Mitigation* are designed to cover the distance to mortality and reduce the potential for injury due to explosives. The quantitative analysis for this proposed action predicts that mortalities could occur. These predicted mortalities are shown in the quantified impacts on each stock in Section 2.4 (Species Impact Assessments) and are not further reduced to account for mitigation. Most training mortalities and a portion of the testing mortalities are attributable to Mine Warfare activities, including Mine Neutralization Explosive Ordnance Disposal, Amphibious Breaching, and Underwater Demolition Qualification and Certification. A large portion of the testing mortalities are attributable to Small Ship Shock Trial. Both types of activities have extensive pre- and during event visual observation requirements as described in *Mitigation* that would reduce the risk that these mortalities would occur. No marine mammal mortalities have been identified during multi-day post-event observations following previous Ship Shock Trials. One occurrence of mortalities due to placed explosives during a Navy activity is known (see *Direct Injury Due to Explosives* in the *Marine Mammal Background*).

Because in-water explosives may result in the incidental take of marine mammals (mortality, non-auditory injury, auditory effects, and significant behavioral responses), explosive impacts are modeled per the methods presented in Section 2.2 (Quantifying Impacts on Marine Mammals from Acoustic and Explosive Stressors). Impacts on each marine mammal stock are quantified below in Section 2.4 (Species Impact Assessments). Conclusions regarding impacts from explosives used during military readiness activities for ESA-listed species are provided in Section 2.4 (Species Impact Assessments).

2.2 Quantifying Impacts on Marine Mammals from Acoustic and Explosive Stressors

The following section provides an overview of key components of the modeling methods used in this analysis to estimate the number and types of acoustic and explosive impacts on marine mammals. The *Quantitative Analysis TR, Criteria and Thresholds TR, Density TR,* and *Dive Profile TR* detail the quantitative process and show specific data inputs to the models. Except for pile driving, impacts are modeled using the Navy Acoustic Effects Model. Pile driving is modeled using methods described in the *Quantitative Analysis TR.* The detailed analysis of pile driving during Port Damage Repair training at Port Hueneme is in the *Pile Driving Analysis*.

2.2.1 The Navy Acoustic Effects Model

The Navy Acoustic Effects Model (NAEMO) was developed to conduct a comprehensive acoustic impact analysis for use of sonars, air guns, and explosives[2] in the marine environment. This model considers the physical environment, including bathymetry, seafloor composition/sediment type, wind speed, and sound speed profiles, to estimate propagation loss. The propagation information combined with data on the locations, numbers, and types of military readiness activities and marine resource densities provides estimated numbers of effects to each stock.

Individual animals are represented as “animats,” which function as dosimeters and record acoustic energy from all active underwater sources during a simulation of a training or testing event. Each animat’s depth changes during the simulation according to the typical depth pattern observed for each species. During any individual modeled event, impacts on individual animats are considered over 24-hour periods.

The model estimates the number of instances in which an effect threshold was exceeded over the course of a year, it does not estimate the number of times an individual in a population may be impacted over a year. Some individuals could be impacted multiple times, while others may not experience any impact.

NAEMO (described in the *Quantitative Analysis TR*) underwent several notable changes from the prior analysis that influence estimates of the number of marine mammals that could be impacted in each training or testing event.

- Broadband sonar bins are split into one octave sub-bins, propagation calculations performed, and then the energy in each one-octave bin is summed at the receiver (i.e., animat). Broadband sources

[2] Explosives analyzed in NAEMO include those that are expected to occur in air within 30 ft. (9 m) of the water surface (e.g., those that detonate at a surface target). These explosives are modeled at 0.1 m depth with no release at the surface.

were represented and modeled in previous analyses using only the source's center frequency. Using the full frequency spectrum of the source, as opposed to only the center frequency, may lead to higher weighted received levels for some hearing groups, dependent on the overlap of source frequencies with the auditory range of the hearing group. This will increase sound exposure level (SEL)-based impacts (i.e., TTS and AINJ) for broadband sources in this analysis versus prior analyses for the same event. Sometimes in prior analyses, broadband sonar sources were not analyzed for some hearing groups if the center frequency was beyond the group's frequency cutoffs. Now considering the full broadband frequency spectra of the signal, some previously discounted hearing groups are now assessed for impacts from those sources.

- The impulsive propagation model was updated to use an equation that was more suitable for use in water. The total peak pressure and overall energy of both equations is the same. However, because of the slower decay time of the updated equation, there would be a slight increase in modeled non-auditory injury and mortality as compared to prior analyses.
- Animal avoidance of high source levels was incorporated into the Navy Acoustic Effects Model, with marine mammal avoidance thresholds based on their sensitivity to behavioral response. Some species that are less sensitive to behavioral response (i.e., most odontocetes and mysticetes) had less reduction in AINJ due to avoidance than in the prior analysis, leading to higher AINJ estimates. Additional details on the avoidance process are discussed further in Section 2.2.2 (Quantifying Impacts on Hearing).

2.2.2 Quantifying Impacts on Hearing

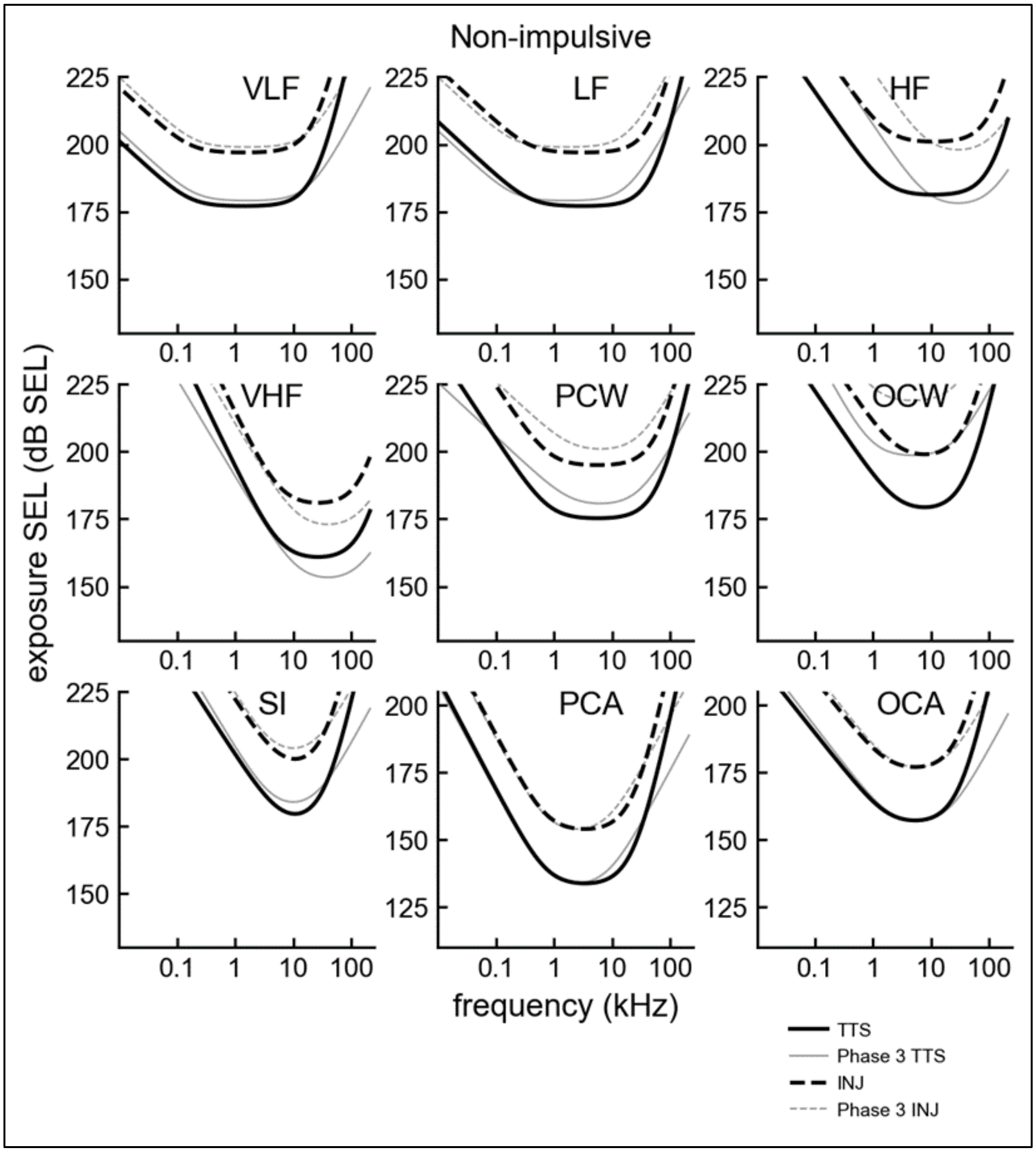
The auditory criteria and thresholds used in this analysis have been updated since the prior assessment of impacts due to military readiness activities in the Study Area. They incorporate new best available science since the release of NMFS guidance for assessing the effects of sound on marine mammal hearing (National Marine Fisheries Service, 2018a) and since the publication of recommendations by the expert panel on marine mammal auditory criteria (Southall et al., 2019).

The best way to illustrate frequency-dependent susceptibility to auditory effects is an exposure function. For each marine mammal auditory group, exposure functions for TTS and AINJ (previously called PTS, but now called AINJ to clarify that this is inclusive of neural injury) incorporate both the shape of the group's auditory weighting function and its weighted threshold value for either TTS or AINJ. The updated exposure functions and the exposure functions used in the prior analysis of impacts (Phase 3) are shown together in Figure 2.2-1 and Figure 2.2-2. Exposure functions for non-impulsive sounds are in Figure 2.2-1. Impulsive sounds are analyzed using two criteria, SEL and peak pressure. Figure 2.2-2 shows the exposure functions for the SEL-based criteria and Table 2.2-1 shows the peak pressure criteria used for impulsive sounds.

The auditory criteria and thresholds (described in the *Criteria and Thresholds TR*) underwent several notable changes from the prior analysis that influence estimates of the number of marine mammals that could be impacted in each training or testing event.

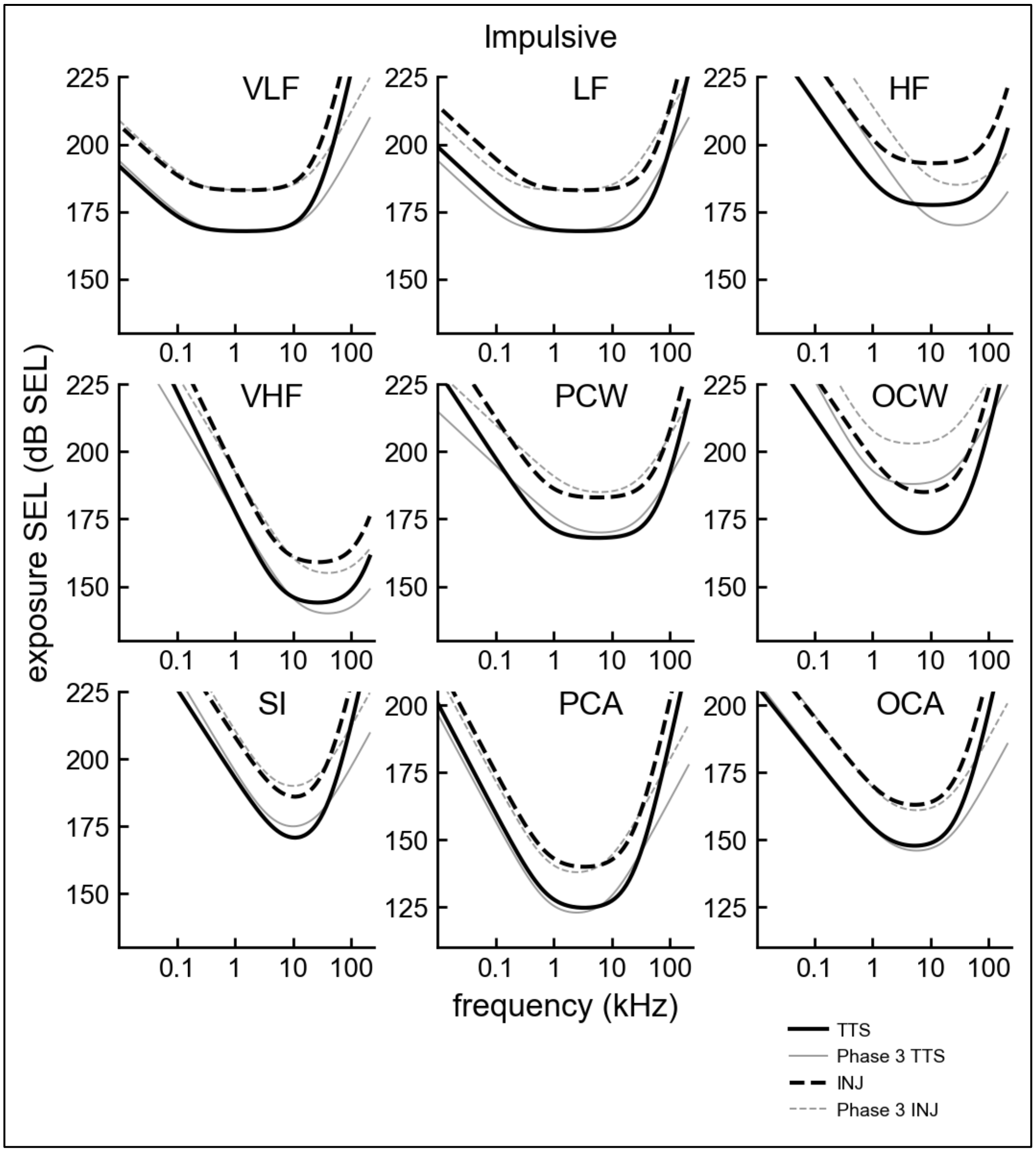
- The mysticetes have been split from one auditory group (the low frequency cetaceans, LF) into two auditory groups: the LF (including minke, humpback, gray, Rice's, Bryde's, and sei whales), and the very low frequency cetaceans, VLF (blue, fin, right, and bowhead whales). While the VLF auditory group retains similar susceptibility to auditory effects as the prior analysis, the new LF auditory group is predicted to be more susceptible to effects at higher frequencies and less susceptible to effects at lower frequencies. Consequently, for LF species, estimated auditory effects due to sources at frequencies above 10 kHz are substantially higher than in prior analysis of the same activities.

- The auditory group previously called the mid-frequency cetaceans (MF) is now called the high frequency cetaceans (HF). All species previously in the MF cetacean auditory group (most odontocetes) are now in the HF cetacean auditory group, and there is no MF cetacean exposure function. In the future, there may be sufficient data to support splitting the current HF cetacean auditory group into MF and HF auditory groups, with certain larger odontocetes (sperm, beaked, and killer whales) in the MF auditory group.
- The HF cetaceans are predicted to be much more susceptible to auditory effects at low and mid-frequencies than previously analyzed. Consequently, the estimated auditory effects due to sources under 10 kHz, including MF1 hull-mounted sonar and other anti-submarine warfare sonars, are substantially higher for this auditory group than in prior analyses of the same activities.
- The auditory group previously called the high frequency cetaceans (HF) is now called the very high frequency cetaceans (VHF). This auditory group, which includes harbor porpoises and Kogia whales, is predicted to be less susceptible to auditory effects at high frequencies (above 10 kHz) than previously analyzed. Consequently, estimated impacts on this group from high frequency sources is slightly lower than prior analyses of the same activities.
- The phocid carnivores (PCW) are predicted to be slightly more susceptible and otariids and other marine carnivores (OCW) are predicted to be substantially more susceptible to auditory effects across their hearing range than previously analyzed. Consequently, estimated auditory effects for PCW and OCW are higher than in prior analyses of the same activities.



Note: Auditory groups are very low frequency cetaceans (VLF), low frequency cetaceans (LF), high frequency cetaceans (HF), very high frequency cetaceans (VHF), phocid carnivores in water and air (PCW and PCA), otariids and other marine carnivores in water and in air (OCW and OCA), and sirenians (SI). SI are not in HCTT Study Area. Heavy solid lines —Phase 4 TTS exposure functions. Thin solid lines —Phase 3 TTS exposure functions. Heavy dashed lines —Phase 4 AINJ exposure functions. Thin dashed lines —Phase 3 AINJ exposure functions. Figure taken from U.S. Department of the Navy (2024a).

Figure 2.2-1: Marine Mammal TTS and AINJ Exposure Functions for Sonars and Other Non-Impulsive Sources



Note: Auditory groups are very low frequency cetaceans (VLF), low frequency cetaceans (LF), high frequency cetaceans (HF), very high frequency cetaceans (VHF), phocid carnivores in water and air (PCW and PCA), otariids and other marine carnivores in water and in air (OCW and OCA), and sirenians (SI). SI are not in HCTT Study Area. Heavy solid lines —Phase 4 TTS exposure functions. Thin solid lines —Phase 3 TTS exposure functions. Heavy dashed lines —Phase 4 AINJ exposure functions. Thin dashed lines —Phase 3 AINJ exposure functions. Figure taken from U.S. Department of the Navy (2024a).

Figure 2.2-2: Marine Mammal TTS and AINJ Exposure Functions for Impulsive Sources

Table 2.2-1: Peak SPL Thresholds for Auditory Impacts on Marine Mammals from Impulsive Sources

Hearing Group	TTS		AINJ		Change
	Phase 3	Phase 4	Phase 3	Phase 4	
VLF & LF	213	216	219	222	+3
HF	224	224	230	230	0
VHF	196	196	202	202	0
OCW	226	224	232	230	-2
PCW	212	217	218	223	+5

Note: values are unweighted peak pressures in dB re 1 µPa underwater. VLF = very low frequency cetacean, LF = low frequency cetacean, HF = high frequency cetacean, VHF = very high frequency cetacean, OCW = otariid in water, PCW = phocid in water.

The instances of AINJ and TTS predicted by the Navy Acoustic Effects Model are not reduced to account for activity-based mitigation in this analysis, unlike prior analyses. Still, it is likely that some model-predicted instances of AINJ and TTS would not occur during actual events using platforms and acoustic sources with applicable mitigation. If Lookouts sight a marine mammal within or entering a mitigation zone, the use of sonars, air guns, pile drivers, and explosives would be delayed, relocated, powered down, or ceased, as appropriate for the source as described in the *Mitigation* section. This would reduce an animal's sound exposure level or prevent an exposure that could cause hearing loss altogether.

The Navy Acoustic Effects Model estimates the reduction in cumulative sound exposure level due to marine mammal avoidance of high-level sonar exposures. Initiation of aversive behavior is based on the applicable behavioral response function for a species. Avoidance speeds and durations are estimated from baseline species data and actual sonar exposure data, when available. The estimated cumulative exposure level, including any reductions due to avoidance (if initiated), is compared to the thresholds for AINJ and TTS to assess auditory impacts. If the thresholds for AINJ or TTS are not exceeded, the potential for behavioral response is assessed based on the highest exposure in the simulation. This analysis assumes that a small portion (5 percent) of delphinids in the odontocete behavioral group would not avoid most events but would stay in the vicinity to engage in bow-riding or other behaviors near platforms (i.e., the cumulative sound exposure level is not reduced through avoidance). A detailed explanation of the new avoidance model and the species avoidance factors are in the *Quantitative Analysis TR (U.S. Department of the Navy, 2024b)*.

The ability to reduce cumulative sound exposure level depends on susceptibility to auditory effects, sensitivity to behavioral disturbance, and characteristics of the sonar source, including duty cycle, source level, and frequency. Table 2.2-2 shows the percentage reduction of AINJ across all the modeled activities in this analysis due to avoidance. The reduction in AINJ due to avoidance differs across activities and between auditory and behavioral groups. Groups that are relatively less sensitive to behavioral disturbance compared to susceptibility to auditory effects are less likely to avoid AINJ; these include the Mysticete and Odontocete behavioral groups. Groups that are relatively more sensitive to behavioral disturbance compared to susceptibility to auditory effects are more likely to avoid AINJ; these include the Sensitive Species and Pinniped behavioral groups. The reduction in AINJ for most groups is less than assumed in prior analyses[3] for most species except for beaked whales (High-Frequency cetacean auditory group and Sensitive Species behavioral group).

Table 2.2-2: Reduction in AINJ due to Avoiding Sonars in the Navy Acoustic Effects Model Across Activities

FHG	MYST	ODONT	SENS	PINN
VLF	14 - 20 %	-	-	-
LF	4 - 50 %	-	-	-
HF	-	67 - 96 %	96 - 100 %	-
VHF	-	44 - 46 %	87 - 87 %	-
PW	-	-	-	84 - 93 %
OT	-	-	-	78 - 95 %

version: 20241031

Recovery from TTS after a sound exposure is not quantified in this analysis (see the *Marine Mammal Acoustic Background* section). Small amounts of TTS (a few dB) typically begin to recover immediately after the sound exposure and may fully recover in minutes, while larger amounts of TTS require longer to recover. Most TTS fully recovers within 24 hours, but larger shifts could take days to fully recover. In general, TTS quantified based on SEL for intermittent sound exposures is likely over-estimated because some recovery from TTS may occur in the quiet periods between sounds, especially when the duty cycle is low. Lower duty cycles allow for more time between sounds and therefore more of an opportunity for hearing to recover. Modeled effects using the SEL-based criteria are therefore likely to accurately predict impacts from higher duty cycle sources and certainly overestimate impacts from lower duty cycle sources.

See Section 2.5 (Ranges to Effects) for information on the ranges to TTS and AINJ with distance based on the type of sound sources and hearing group, as well as several other factors.

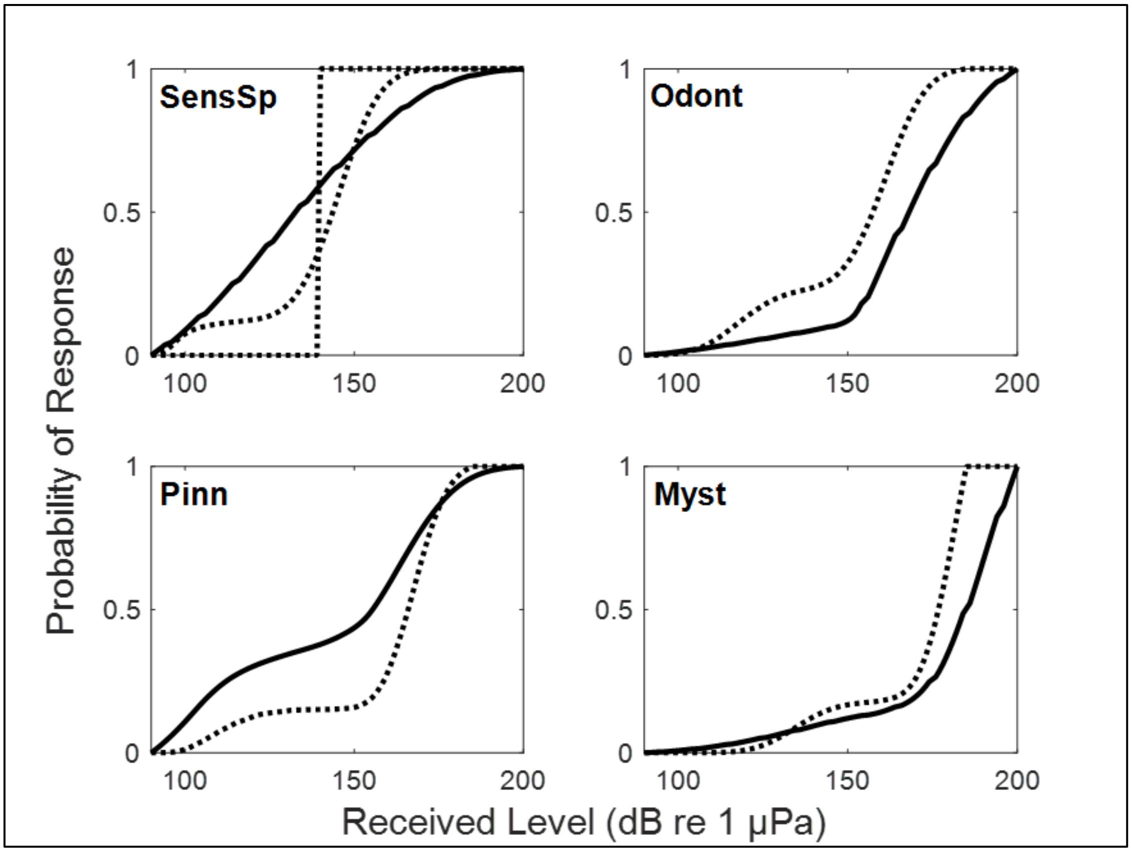
2.2.3 Quantifying Behavioral Responses to Sonars

Criteria and thresholds for behavioral responses have been updated since the prior analysis (see *Criteria and Thresholds TR*). Notable differences between the prior and updated criteria and thresholds for behavioral responses to sonars are as follows:

- Beaked whales and harbor porpoise are in a combined Sensitive Species behavioral group (previously, these groups had unique response functions). Other behavioral groupings remain the same: Mysticetes (all baleen whales), Odontocetes (most toothed whales, dolphins, and porpoises), and Pinnipeds (true seals, sea lions, walruses, polar bears).
- Behavioral cut-off conditions have been revised. The prior analysis only applied distance cut-offs. This analysis applies a dual cut-off condition based on both distance and received level. The cut-off distances have also been revised. These updates are described at the end of this section.

[3] In prior analyses, the reduction in AINJ due to avoidance was calculated outside of the Navy Acoustic Effects Model by applying a common reduction factor based on spreading loss from a hull-mounted sonar and assuming that all nearby animals would avoid the sound source (U.S. Department of the Navy, 2019). This resulted in reducing most NAEMO-predicted AINJ to TTS.

For each group, a biphasic behavioral response function was developed using best available data and Bayesian dose response models. The behavioral response functions are shown in Figure 2.2-3.



Notes: Revised behavioral response functions (solid lines) and prior behavioral response functions (Phase 3, dotted lines). SensSp = Sensitive Species, Odont = Odontocetes, Pinn = Pinnipeds, Myst = Mysticetes. Both the Phase 3 beaked whale behavioral response function and the Phase 3 harbor porpoise step function are plotted against the new Sensitive Species curve. Figure taken from U.S. Department of the Navy (2024a)

Figure 2.2-3: Behavioral Response Functions

Due to the addition of new data and the separation of some species groups, the most significant differences from prior analyses include the following:

- The Sensitive Species behavioral response function is more sensitive at lower received levels but less sensitive at higher received levels than the prior beaked whale and harbor porpoise functions.
- The Odontocete behavioral response function is less sensitive across all received levels due to including additional behavioral response research. This will result in a lower number of behavioral responses than in the prior analysis for the same event, but also reduces the avoidance of auditory effects.
- The Pinniped in-water behavioral response function is more sensitive due to including additional captive pinniped data. Only three behavioral studies using captive pinnipeds were available for the derivation of the behavioral response function. Behavioral studies of captive animals can be difficult to extrapolate to wild animals due to several factors (e.g., use of trained subjects). This means the

pinniped behavioral response function likely overestimates effects compared to observed reactions of wild pinnipeds to sound and anthropogenic activity.

- The Mysticete behavioral response function is less sensitive across most received levels due to including additional behavioral response research. This will result in a lower number of behavioral responses than in the prior analysis for the same event, but also reduces the avoidance of auditory effects.

The behavioral response functions only relate the highest received level of sound during an event to the probability that an animal will have a behavioral response. Currently, there are insufficient data to develop criteria that include the context of an exposure, characteristics of individual animals, behavioral state, duration of an exposure, sound source duty cycle, the number of individual sources in an activity, or how loud the animal may perceive the sonar signal to be based on the frequency of the sonar versus the animal's hearing range, although these factors certainly influence the severity of a behavioral response.

The behavioral response functions also do not account for distance. At moderate to low received levels the correlation between probability of reaction and received level is very poor and it appears that other variables mediate behavioral reactions (e.g., Ellison et al., 2011) such as the distance between the animal and the sound source. Data suggest that beyond a certain distance, significant behavioral responses are unlikely. At shorter ranges (less than 10 km) some behavioral responses have been observed at received levels below 140 dB re 1 µPa. Thus, proximity may mediate behavioral responses at lower received levels. Since most data used to derive the behavioral response functions is within 10 km of the source, probability of reaction at farther ranges is not well-represented. Therefore, the source-receiver range must be considered separately to estimate likely significant behavioral reactions.

This analysis applies behavioral cut-off conditions to responses predicted using the behavioral response functions. Animals within a specified distance and above a minimum probability of response are assumed to have a significant behavioral response. The cut-off distance is based on the farthest source-animal distance across all known studies where animals exhibited a significant behavioral response. Animals beyond the cut-off distance but with received levels above the sound pressure level associated with a probability of response of 0.50 on the behavioral response function are also assumed to have a significant behavioral response. The actual likelihood of significant behavioral reactions occurring beyond the distance cut-off is unknown. Significant behavioral responses beyond 100 km are unlikely based on source-animal distance and attenuated received levels. The behavioral cut-off conditions are shown in

Table 2.2-3. Additional information on the derivation of the cut-off conditions is in the *Criteria and Thresholds TR*.

Table 2.2-3: Phase IV Behavioral Cut-off Conditions for each Species Group

Behavioral Group	Received level associated with p(0.50) on the behavioral response function[1]	Cut-off Range[2]
Sensitive Species[1]	133 dB re 1 µPa	40 km
Odontocetes	168 dB re 1 µPa	15 km
Mysticetes	185 dB re 1 µPa	10 km
Pinnipeds	156 dB re 1 µPa	5 km

[1] A minimum p(response) condition was not applied in the prior Phase 3 analysis. [2] Distance cutoffs for moderate source level/single platform and high source level/multi-platform conditions in Phase 3: beaked whales (25/50 km), harbor porpoises (20/40 km), odontocetes (10/20 km), mysticetes (10/20 km), and pinnipeds 5/10 km).

See Section 2.5 (Ranges to Effects) for information on the probability of behavioral response with distance based on the type of sonar and behavioral group, as well as several other factors.

2.2.4 Quantifying Behavioral Responses to Air Guns, Pile Driving, and Explosives

Behavioral responses are quantified for air guns, pile driving (impact and vibratory), and explosions. These stressors are all impulsive sounds except for vibratory pile driving, which is a continuous, broadband non-impulsive sound. The thresholds used to quantify behavioral responses to air guns, pile driving, and explosions are described in the *Criteria and Thresholds TR* and are listed in Table 2.2-4. These thresholds are the same as those applied in the prior analysis of these stressors in the Study Area, although the explosive behavioral threshold has shifted, corresponding to changes in the TTS thresholds as explained below.

Table 2.2-4: Behavioral Response Thresholds for Air Gun, Pile Driving, and Explosive Sounds

Sound Source	Behavioral Threshold
air gun	160 dB rms re 1 µPa SPL
impact pile driving	160 dB rms re 1 µPa SPL
vibratory pile driving	120 dB rms re 1 µPa SPL
multiple explosions	5 dB less than the TTS onset threshold (weighted SEL)
single explosions or one cluster	TTS onset threshold (weighted SEL)

While seismic and pile driving data provide the best available science for assessing behavioral responses to impulsive sounds by marine mammals, it is likely that these responses represent a worst-case scenario compared to responses to explosives used in military readiness activities, which would typically consist of single impulses or a cluster of impulses (i.e., acute sounds), rather than long-duration, repeated impulses (i.e., potentially chronic sounds).

For single explosions at received sound levels below hearing loss thresholds, the most likely behavioral response is a brief alerting or orienting response. Since no further sounds follow the initial brief impulses, significant behavioral reactions would not be expected to occur. If a significant response were to occur, this analysis assumes it would be within the range of auditory impacts (AINJ and TTS). This reasoning was applied to previous shock trials and is extended to the criteria used in this analysis. Because of this approach, the number of auditory impacts is higher than the number of behavioral impacts in the quantified results for some stocks.

If more than one explosive event occurs within any given 24-hour period within a military readiness activity, criteria are applied to predict the number of animals that may have a behavioral reaction. For events with multiple explosions, the behavioral threshold used in this analysis is 5 dB less than the TTS onset threshold. This value is derived from observed onsets of behavioral response by test subjects (bottlenose dolphins) during non-impulse TTS testing (Schlundt et al., 2000).

See Section 2.5 (Ranges to Effects) for information on the behavioral response distances from these stressors.

2.2.5 Quantifying Non-Auditory Injury due to Explosives

The criterion for mortality is based on severe lung injury observed in terrestrial mammals exposed to underwater explosions as recorded in Goertner (1982). The criteria for non-auditory injury are based on slight lung injury or gastrointestinal tract injury observed in the same data set. Mortality and slight lung injury impacts on marine mammals are estimated using impulse thresholds based on both calf/pup/juvenile and adult masses (see *Criteria and Thresholds TR*). The peak pressure threshold applies to all species and age classes. Unlike the prior analysis, this analysis relies on the onset rather than the mean estimated threshold for these effects. This revision results in a small increase in the predicted non-auditory injuries and mortalities for the same event versus prior analyses. Thresholds are provided in Table 2.2-5 for use in non-auditory injury assessment for marine mammals exposed to underwater explosives.

Table 2.2-5: Thresholds for Estimating Ranges to Potential Effect for Non-Auditory Injury

Effect	Threshold
Onset Mortality - Impulse	$103M^{1/3}\left(1+\frac{D}{10.1}\right)^{1/6}$ Pa-s
Onset Injury - Impulse (Non-auditory)	$47.5M^{1/3}\left(1+\frac{D}{10.1}\right)^{1/6}$ Pa-s
Onset Injury - Peak Pressure (Non-auditory)	237 dB re 1 µPa peak

Where M is animal mass (kg) and D is animal depth (m).

See Section 2.5 (Ranges to Effects) for information on the distance to which non-auditory injury and mortality would extend from a detonation based on the size of the explosion, the marine mammal species, as well as several other factors.

2.3 Assessing Impacts on Individuals and Populations

2.3.1 Severity of Behavioral Responses to Military Readiness Activities

The statutory definition of Level B harassment of marine mammals for military readiness activities is the “disruption of natural behavioral patterns, including, but not limited to, migration, surfacing, nursing, breeding, feeding, or sheltering, to a point where such behavioral patterns are abandoned or significantly altered” (Section 3(18)(B) of the MMPA)). The terms “significant response” or “significant behavioral response” are used to describe behavioral reactions that may lead to an abandonment or significant alteration of a natural behavior pattern. Defining when a behavioral response becomes significant, as well as setting corresponding predictive exposure threshold values, is challenging. Whether an animal discernably responds, and the severity of that response are likely influenced by the animal's life experience, motivation, and conditioning; the physical condition of the animal; and the context of the exposure (Ellison et al. 2015, Southall et al. 2007, Southall et al. 2019).

Behavioral responses can be generally categorized as low, moderate, or high severity. Low severity responses are within an animal's range of typical (baseline) behaviors and would not be considered significant. High severity responses are those with a higher likelihood of consequences to growth, survival, or reproduction, such as behaviors that increase the risk of injury, prolonged separation of a female and dependent offspring, prolonged displacement from foraging areas, or prolonged disruption of breeding behavior. High severity reactions would always be considered significant, even if no direct negative outcome is observed. For example, separation of a killer whale mother-calf pair was observed when they were approached by a vessel with an active sonar source during a behavioral response study (Miller et al., 2014), but the animals rejoined once the ship passed.

Stranding is a very high severity response. Use of mid-frequency sonar has been associated with atypical mass strandings of beaked whales (Bernaldo de Quirós et al., 2019; D'Amico et al., 2009). Five stranding events, mostly involving beaked whales, have been attributed to U.S. Navy active sonar use. The confluence of factors that contributed to those strandings is now better understood (see the *Background* section), and U.S. Navy sonar has not been identified as a causal factor in an atypical mass stranding since 2006. Other high severity responses have not been observed during observations of actual training or testing activities. The Navy does not anticipate that marine mammal strandings or mortality will result from the operation of sonar during military readiness activities in the study area. Through adaptive management under the MMPA, NMFS and the Navy will determine the appropriate way to proceed if a causal relationship were to be found between Navy activities and a future stranding.

The behavioral responses predicted in this analysis are likely moderate severity within the scale presented in Southall et al. (2021b). Examples of moderate severity responses include avoidance, changes in vocalization, reduced foraging, reduced surfacing, and changes in courtship behavior. If moderate behaviors are sustained long enough to be outside of normal daily variations in feeding, reproduction, resting, migration/movement, or social cohesion, they are considered significant.

Given the available data on marine mammal behavioral responses, this analysis errs toward overestimating the number of significant behavioral responses. It is not possible to ascertain the true significance of most observed reactions that underlie the behavioral response functions used in this analysis. The behavioral criteria assume that most reactions that lasted for the duration of a sound exposure or longer were significant, regardless of exposure duration. It is possible that some short duration responses would not rise to the level of harassment as defined above. In addition, the experimental designs used during some behavioral response studies with non-captive animals were unlike military readiness activities in important ways. These differences include closely approaching and tagging subject animals; following subjects before the exposure; vectoring towards avoiding animals; or multiple close passes by focal animal groups. In contrast, military platforms would not purposely undertake such close approaches nor make directed movements toward animals. As researchers have improved experimental designs in subsequent behavioral response studies, more recent data better reflects responses in contexts more closely matching exposures during military readiness activities. Interpreting studies with captive animals presents other challenges, as captive animals may have different behavioral motivations than non-captive animals, and the context of exposure (confined environment, distance from source) differs from non-captive exposures. Thus, some behavioral reactions associated with acoustic received levels then used to develop behavioral risk functions may have been influenced by other aspects of the experimental exposures.

2.3.2 Potential Opportunities to Mitigate Auditory and Non-Auditory Injury

Visual observation of mitigation zones and nearby sea space is prescribed in the section *Mitigation*. In summary, trained Lookouts would be positioned on surface vessels, aircraft, piers, or the shore to observe designated mitigation zones around stressors prior to and during the use of certain sound sources and explosives. The specified mitigation zones are the largest areas Lookouts can reasonably be expected to observe during typical activity conditions, while being practical to implement from an operational standpoint. When a marine mammal (and in some instances, indicators of marine mammal presence like floating concentrations of vegetation) is sighted within or entering a mitigation zone, sound-producing activities are delayed, relocated, powered down, or ceased. These actions either reduce an acoustic dose (in the case of an ongoing acoustic stressor) or prevent an injurious exposure altogether (in the case of a single exposure like an explosion).

Ranges to auditory effects (AINJ and TTS) for marine mammals exposed to sonars are in Section 2.5.1 (Ranges to Effects for Sonar and Other Transducers) for the following sonars: hull-mounted surface ship sonar (bins MF1, MF1C, and MF1K), helicopter dipping sonar, sonobuoy sonar, and towed mine-hunting sonar. The median ranges to AINJ for all hearing groups due to hull-mounted sonars are encompassed by the applicable mitigation zones (200 yd. shut down/500 yd. power down/1,000 yd. power down). The median ranges to AINJ for all hearing groups for the remaining sonar are encompassed by the applicable mitigation zone (200 yd. shut down). Ranges to mortality for marine mammal exposed to in-water explosions are in Section 2.5.4 (Ranges to Effects for Explosives) for all bins. Mitigation ranges for explosives differ depending on the type of activity. In all cases, the mitigation zones encompass the ranges to mortality for the bin sizes that may be used.

Although the mitigation zones cover the range to AINJ for most sonar sources in most conditions, this analysis does not reduce model-predicted impacts on account for visual observations. Instead, the Navy Acoustic Effects Model identified the number of instances that animats with doses exceeding thresholds for AINJ (sonar) also had their closest points of approach within applicable mitigation zones. These instances are considered potential mitigation opportunities, which would be further influenced by other factors such as the sightability of the species and viewing conditions, as discussed in the *Mitigation* section. These instances were only assessed using the applicable mitigation zone size for platforms and sources with visual observation requirements. The closest point of approach considers any predicted animal avoidance of a sound source in the activity.

The results for activities that use sonar and have at least one model-predicted AINJ in any of the marine mammal auditory groups are shown in Table 2.3-1. Activities that have no predicted auditory injuries (following the rounding rules presented below, under Section 2.4 [Species Impact Assessments]) are not shown in Table 2.3-1. The mixed results across activities are due to a variety of factors. Some scenarios under each activity may include platforms or sources that do not have applicable visual observation requirements. Other activities may occur in locations where there are low numbers of animals in an auditory group; thus, the ratio is sensitive to the limited number of instances modeled. Most auditory injuries to the HF cetacean auditory group have an associated closest point of approach in a mitigation zone. Some of these will be observed and the exposure minimized or avoided because of mitigation. A portion (5 percent) of the auditory group was assumed to not avoid in the model to account for close approach behaviors like bow-riding. In an actual event, if delphinids were observed bow-riding, the activity could continue without powering down or ceasing the sonar, as described in the *Mitigation* section.

Table 2.3-1: Potential Mitigation Opportunities During Activities with Sonar

Activity Name	VLF	LF	HF	VHF	PCW	OCW
Acoustic and Oceanographic Research (ONR)	45%	46%	44%	62%	11%	30%
Airborne Dipping Sonar Minehunting Test	-	-	-	100%	-	-
Anti-Submarine Warfare Mission Package Testing	100%	100%	100%	100%	-	100%
Anti-Submarine Warfare Torpedo Exercise - Helicopter	100%	-	-	-	-	-
Anti-Submarine Warfare Torpedo Exercise - Ship	100%	100%	100%	99%	100%	100%
Anti-Submarine Warfare Torpedo Test (Aircraft)	-	100%	-	-	-	-
Anti-Submarine Warfare Tracking - Unmanned Vehicles (USMC)	100%	-	100%	100%	-	-
Anti-Submarine Warfare Tracking Exercise - Ship	96%	100%	100%	98%	100%	100%
At-Sea Sonar Testing	97%	96%	100%	77%	100%	100%
Civilian Port Defense	-	27%	91%	75%	100%	-
Composite Training Unit Exercise (Amphibious Ready Group/Marine Expeditionary Unit)	100%	100%	100%	100%	-	100%
Composite Training Unit Exercise (Strike Group)	100%	100%	100%	99%	100%	100%
Countermeasure Testing	-	100%	100%	56%	-	-
Innovation and Demonstration Exercise	100%	99%	100%	87%	100%	100%
Intelligence, Surveillance, Reconnaissance (NAVWAR)	49%	85%	0%	73%	100%	0%
Medium Coordinated Anti-Submarine Warfare	100%	100%	100%	97%	100%	100%
Mine Countermeasures - Mine Neutralization - Remotely Operated Vehicles	-	-	-	100%	-	-
Mine Countermeasures - Ship Sonar	-	-	-	74%	-	-
Multi-Domain Unmanned Autonomous Systems	-	-	100%	96%	100%	-
Multi-Warfare Exercise	100%	100%	100%	93%	100%	100%
Pierside Sonar Testing	-	-	-	-	-	100%
Rim of the Pacific Exercise	100%	100%	100%	100%	-	-
Semi-Stationary Equipment Testing	-	-	100%	11%	-	-
Signature Analysis Operations	-	-	-	100%	-	-
Small Joint Coordinated Anti-Submarine Warfare	100%	100%	100%	92%	100%	100%
Submarine Navigation	-	-	-	100%	-	-
Submarine Sonar Maintenance and Systems Checks	-	-	0%	-	-	100%
Surface Ship Sonar Maintenance and Systems Checks	-	100%	100%	94%	-	100%
Surface Ship Sonar Testing/Maintenance (NAVSEA)	-	-	100%	64%	-	-
Surface Warfare Testing	-	-	-	1%	-	-
Surface Warfare Torpedo Exercise - Submarine	-	-	-	27%	-	-
Task Force/Sustainment Exercise	100%	100%	100%	97%	100%	100%
Torpedo (Explosive) Testing	-	-	-	41%	-	-
Torpedo (Non-Explosive) Testing	-	100%	96%	24%	-	100%
Training and End-to-End Mission Capability Verification - Torpedo	-	-	-	35%	-	-
Undersea Range System Test	-	-	-	100%	-	-
Undersea Warfare Testing	100%	100%	100%	99%	100%	100%
Unmanned Underwater Vehicle Testing	-	-	-	100%	-	-
Unmanned Underwater Vehicle Training - Certification and Development	-	-	-	84%	-	-
Vehicle Testing	100%	100%	86%	20%	-	15%

Table Created: 26 Jul 2024 4:29:55 PM

Similarly for explosives, this analysis does not reduce model-predicted impacts on account for visual observations, even though the mitigation zones cover the range to mortality. For this Proposed Action, all predicted instances of mortality occurred within the associated mitigation zones for each type of explosive. Therefore, the predicted instances of mortality are over-estimated, as it is likely that some animals in the mitigation zone will be observed, especially for species that are highly visible such as delphinids in pods and for activities with nearby lookouts, and the exposure avoided, as described in *Mitigation.* If mortalities are predicted for any stock, the likely causal activity is identified in this analysis and associated mitigation identified. Based on the ranges to effect for explosives, most of the predicted non-auditory injuries would also occur within the applicable mitigation zones.

All instances of AINJ caused by air guns are predicted to occur within the mitigation zone (200 yd.).

2.3.3 Behavioral Responses by Distance and Sound Pressure Level

Figure 2.3-1 and Figure 2.3-2 provide the total number of predicted behavioral responses under a maximum year of activities for each behavioral response group (i.e., Odontocetes, Mysticetes, Pinnipeds, and Sensitive Species) across all activities and all sonar sources without applying TTS or AINJ thresholds. In other words, in these plots, behavioral response functions were applied to all animats in the Navy's acoustic effects model, assuming animals that did receive TTS or AINJ would also be likely to exhibit a behavioral response. For these two figures, the total bar height represents the total number of behavioral responses as indicated on the vertical axis, whereas the dark gray bars indicate the number of *significant* behavioral responses as defined for military readiness activities using the distance and probability of response cut-off conditions described at the end of Section 2.2.3 (Quantifying Behavioral Responses to Sonars) and presented in Table 2.2-3 for each behavioral response group.

Figure 2.3-1 shows the total number of behavioral responses in 6-dB SPL bins representing the highest received SPL. All exposures equal to or above the received level associated with p(0.50) on the applicable behavioral response function are assumed to be significant in this analysis. A portion of behavioral responses predicted at lower received levels (as low as 100 dB SPL) are also assumed to be significant. These exposures are due to sources with lower source levels while within the cutoff ranges in Table 2.2-3. Overall, there are few exposures to sonar above 200 dB SPL.

Figure 2.3-2 shows the total number of behavioral responses in 5-km bins. For odontocetes and mysticetes, few significant behavioral responses are estimated beyond the cutoff ranges in Table 2.2-3, which are 15 km and 10 km, respectively. For pinnipeds, all behavioral responses within 5 km are assumed to be significant. Some significant behavioral responses for higher source level sonars are predicted out to and beyond 50 km. All behavioral responses within 40 km are assumed to be significant for sensitive species, with some significant responses predicted as far as 100 km for the highest-level sonar sources. For mid-frequency bins in open ocean, there is a strong convergence zone between 50 km – 60 km and a second convergence zone starting beyond 95 km. This explains the spike in predicted behavioral responses at these distances in this Study Area.

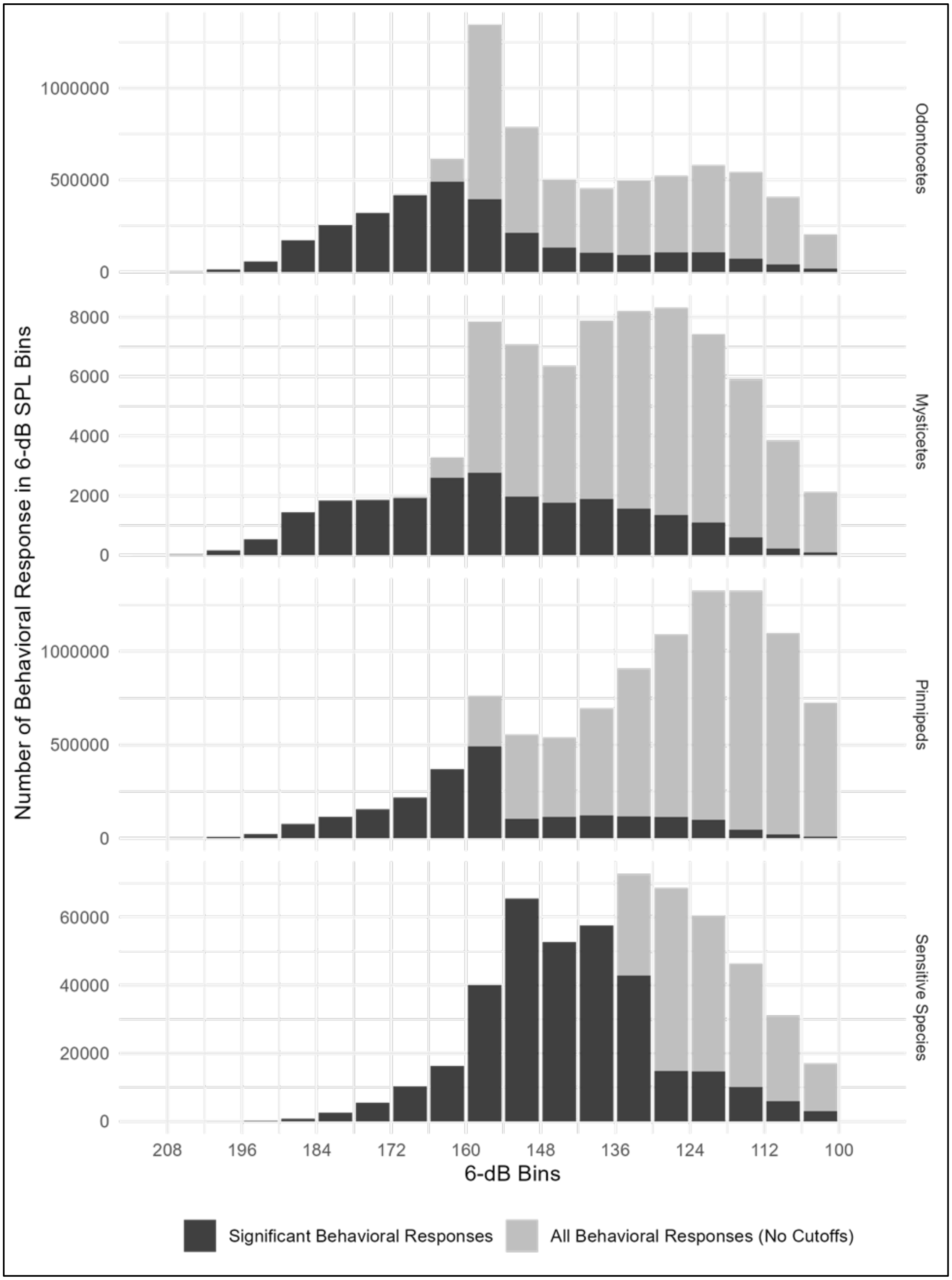


Figure 2.3-1: Total Predicted Instances of Marine Mammal Behavioral Responses in the Study Area by Received Level

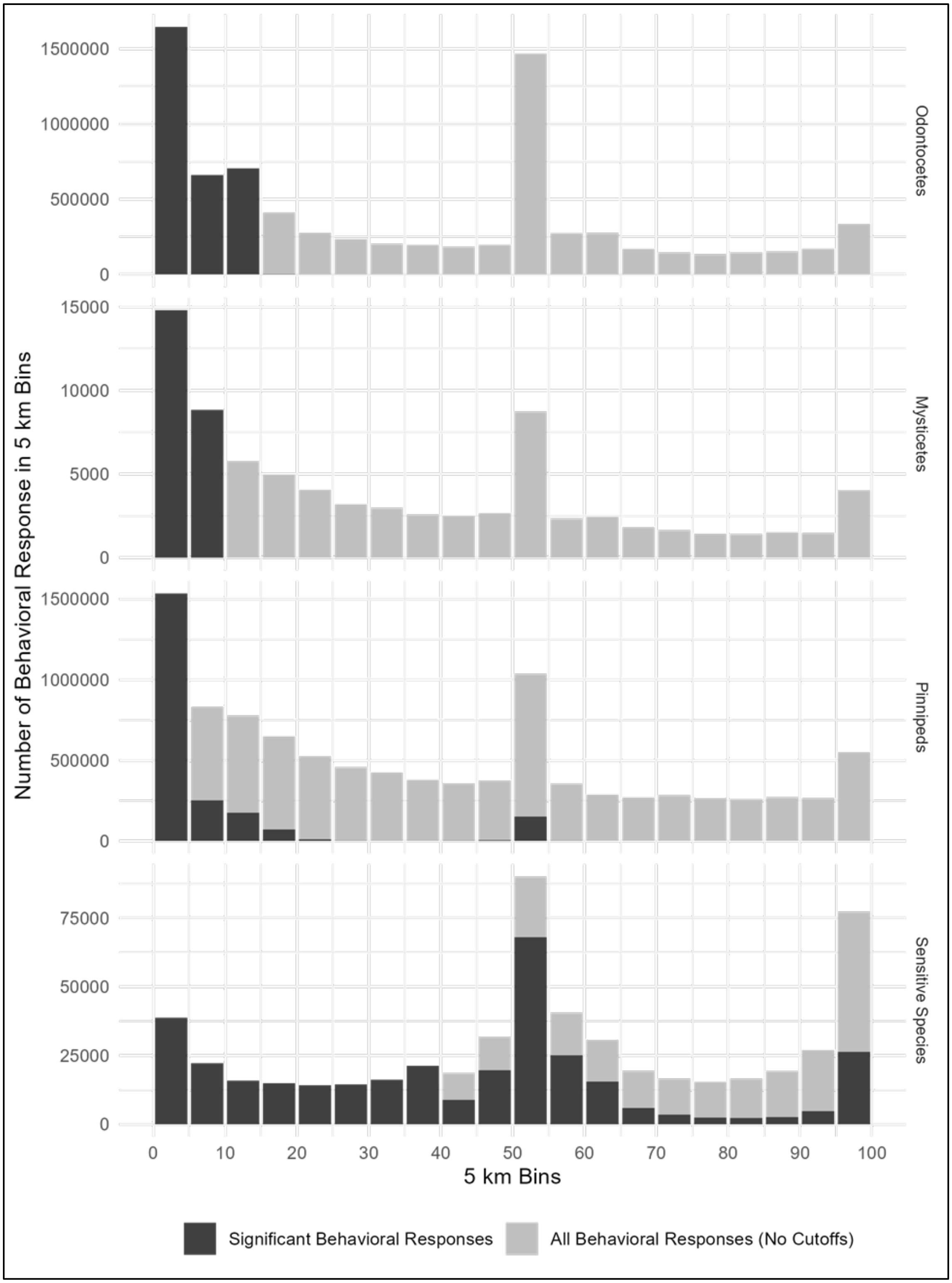


Figure 2.3-2: Total Predicted Instances of Marine Mammal Behavioral Responses in the Study Area by Distance

2.3.4 RISKS TO MARINE MAMMAL POPULATIONS

To issue a Letter of Authorization under the MMPA, NMFS must determine that an impact "cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival." Assessing the consequences to a marine mammal population due to individual, short-term responses can be difficult and has been the subject of many studies.

Given the scope of the Proposed Action and the current state of the science regarding marine mammals, there is no known method to determine or predict the age, sex, or reproductive condition of the various species of marine mammals predicted to be impacted because of the proposed training and testing.

This analysis adapts the assessment of species vulnerability described in Southall et al. (2023). The relativistic risk assessment approach in Southall et al. (2023) was designed to compare risk to populations from specific industry impact scenarios at different locations or times of year. This approach may not be suitable for many military readiness activities, for which alternate spatial or seasonal scenarios are not usually feasible. However, the concepts considered in that framework's population vulnerability assessment are useful in this analysis, including population status (endangered or threatened), population trend (decreasing, stable, or increasing), population size, and chronic exposure to other anthropogenic or environmental stressors. These stock vulnerability factors are provided for every stock in the Study Area in Table 2.3-4 for ESA-listed species and in Table 2.3-5 for species that are not ESA-listed.

This analysis also relies on the population consequences of disturbance themes identified in Keen et al. (2021). These themes fall into three categories: *life history traits, environmental conditions, and disturbance source characteristics*.

Life history trait definitions used in this analysis are shown in Table 2.3-2. Life history traits include:

- Movement ecology (resident/nomadic/migratory): Resident animals that have small home ranges relative to the size and duration of an impact zone would have a higher risk of repeated exposures to an ongoing activity. Animals that are nomadic over a larger range may have less predictable risk of repeated exposure. For resident and nomadic populations, overlap of a stressor with feeding or reproduction depend more on time of year rather than location in their habitat range. In contrast, migratory animals may have higher or reduced potential for exposure during feeding and reproduction based on both location, time of the year, and duration of an activity. The risk of repeated exposure during individual events may be lower during migration as animals maintain directed transit through an area.
- Reproductive strategy (capital/income/mixed): Reproduction is energetically expensive for female marine mammals. Mysticetes and phocids are capital breeders. Capital breeders rely on their capital, or energy stores, to migrate, maintain pregnancy, and nurse a calf. Capital breeders would be more resilient to short-term foraging disruption due to their reliance on built-up energy reserves. Otariids and most odontocetes are income breeders, which rely on some level of income, or regular foraging, to give birth and nurse a calf. Income breeders would be more sensitive to the consequences of disturbances that impact foraging during lactation. Some species exhibit traits of both, such as beaked whales.
- Body size (small/medium/large): Smaller animals require more food intake per unit body mass than large animals. They must consume food on a regular basis and are likely to be non-migratory and

income breeders. The smallest odontocetes, the porpoises, must maintain high metabolisms to maintain thermoregulation and cannot rely on blubber stores for long periods of time, whereas larger odontocetes can more easily thermoregulate. The larger size of other odontocetes is an adaptation for deep diving that allows them to access high quality mesopelagic and bathypelagic prey. Both small and large odontocetes have lower foraging efficiency than the large whales. The filter-feeding large whales (mysticetes) consume most of their food within several months of the year and rely on extensive lipid reserves for the remainder of the year. The metabolism of mysticetes allows for fasting while seeking prey patches during foraging season and prolonged periods of fasting outside of foraging season (Goldbogen et al., 2023). Their energy stores support capital breeding and long migrations. The effect of a temporary feeding disturbance is likely to have inconsequential impacts on a mysticete but may be consequential for small cetaceans. Despite their relatively smaller size, amphibious pinnipeds have lower thermoregulatory requirements because they spend a portion of time on land. For purposes of this assessment, marine mammals were generally categorized as small (less than 10 ft.), medium (10-30 ft.), or large (more than 30 ft.) based on length.

- Pace of life (slow/medium/fast): Populations with a fast pace of life are characterized by early age of maturity, high birth rates, and short life spans, whereas populations with a slow pace of life are characterized by later age of maturity, low birth rates, and long life spans. The consequences of disturbance in these populations differ. Although reproduction in populations with a fast pace of life are more sensitive to foraging disruption, these populations are quick to recover. Reproduction in populations with a slow pace of life is resilient to foraging disruption, but late maturity and low birth rates mean that long-term impacts on breeding adults have a longer-term effect on population growth rates. The discussion of “generation times” in the species impact analyses below are referring to that species’ age of maturity. Pace of life was categorized for each species in this analysis by comparing age at sexual maturity, birth rate interval, life span, body size, and feeding and reproductive strategy. Pace of life attribute definitions are shown in Table 2.3-3.

The above life history traits are identified for each NMFS-designated stock in the Study Area in Table 2.3-4 for ESA-listed species and in Table 2.3-5 for all other stocks in the Study Area. If a species or stock has life history trait characteristics that span two classifications, both are shown (e.g., if a species exhibits both resident and nomadic behavior, it is described as resident-nomadic in the table).

Table 2.3-2: Life History Characteristic Definitions

Life History Characteristic	Body Size	Feeding/Breeding Strategy	Pace of Life	Chronic Anthropogenic Risk Factors	Chronic Biological Risk Factors (Non-Noise)
Categories/ Definitions	[Small, Medium, Large]	[Capital, Income, Intermediate/ Mixed]	[Fast, Medium, Slow]	Risk from anthropogenic stressors (e.g., acoustic, fisheries interactions, vessel strike)	Presence of disease, parasites, prey limitations, or high predation
Source of Information	Keen et al. (2021)	Keen et al. (2021)	Keen et al. (2021)	SAR, Best Available Science, NMFS Species Profiles	SAR, Best Available Science, NMFS Species Profiles
Definitions	Small: <3 m Medium: 3 - 9 m Large: > 9 m	Capitol breeder- stores energy prior to parturition for lactation Income Breeder- feeds during lactation	See Table 2.3-3	Environmental factors outside of Action Proponent's noise-generating activities. Increased prevalence of third-party stressors may increase species-specific vulnerability to the potential disturbance (Southall et al., 2021a).	

Notes: < = less than; > = more than; NMFS = National Marine Fisheries Service; SAR= stock assessment report

Table 2.3-3: Pace of Life Attribute Definitions

Attribute[1]	Definitions		
	Fast	Medium	Slow
Body Size	Small	Medium	Large
Birth Rate Interval	1 to 2 years	2 to 3 years	3+ years
Sexual Maturity[2]	Up to 3.75 years on average	3.75 to 7 years on average	7+ years on average
Lifespan	Up to 29 years	29 to 50 years	50+ years
Pace of Life Overall	Majority (3+) fast attributes	Majority medium[3]	Majority (3+) slow attributes

[1] Attribute citations NMFS 2023, Keen et al. 2021
[2] If sexual maturity was reported as a range for a particular species, an average value was used.
[3] If there was not an equal number of attributes, justification based on body size and birth rate interval was used to make final category decision. For example, most pinniped species were an even mix of small, medium, and fast attributes. However, with their overall small body size and birth rate interval of one year, it was determined that they fall in the "fast" Pace of Life category overall.
Note: + = or more

Environmental conditions include external anthropogenic and biological risk factors (not associated with the proposed activities) that can stress individuals and populations, making them more susceptible to long-term consequences. These factors include fisheries interactions, pollution, climate change, vessel strike, and other anthropogenic noise sources. These additional stressors are also considered when assessing the overall vulnerability of a stock to repeated effects from acoustic and explosive stressors.

Disturbance source characteristics include overlap with biologically important habitats, the duration and frequency (how often it occurs) of disturbance, and the nature and context of the exposure. In this analysis, disturbance source characteristics are considered as follows:

- The numbers and types of effects are estimated in areas that are (1) designated critical habitats for ESA-listed species and (2) Biologically Important Areas (BIAs), which are reproductive, feeding, and migration areas, and areas in which small and resident populations are concentrated (see the Marine Mammal Background for additional details). BIAs are specific to species and time of year and have no inherent regulatory authority. BIAs frequently overlap with designated critical habitat for ESA-listed species but may provide additional seasonal delineations for reproduction, feeding, or migration. They may also be hierarchical in that a larger “parent” BIA encompasses a smaller “child” BIA which often represents a higher use area.
- Information about the context of exposures can be obtained through the current exposure modeling process, including season, location of the activity, the distance from an acoustic source where an exposure threshold is exceeded, and the type of activity that resulted in modeled impacts.
- To obtain an estimate of the average number of times individual marine mammals within each stock may be affected annually, the total number of non-injurious (i.e., behavioral response, TTS) and injurious effects (i.e., AINJ, INJ, Mortality) are considered versus the population abundance.
- Activities that occur on instrumented ranges and within homeports, and long duration activities, such as major training exercises, require special consideration due to the potential for more frequent repeated impacts on individuals as compared to individuals living outside areas where military readiness activities may be concentrated.

Table 2.3-4: Stock Vulnerability Factors and Life History Traits for ESA-listed Marine Mammal Stocks within the Study Area

Species	Stock[1]	Movement Ecology	Body Size	Feeding/ Breeding Strategy	Pace of Life	Population Trend	Chronic Anthropogenic Risk Factors[2]	Other Chronic Risk Factors (Non-Noise)
Blue whale	Eastern North Pacific	Migratory	Large	Capital	Slow	Unk, but possibly increasing	Vessel strikes, fisheries interactions, habitat degradation, pollution, vessel disturbance, ocean noise	Climate change
Blue whale	Central North Pacific	Migratory	Large	Capital	Slow	Unk	Vessel strikes, fisheries interactions, habitat degradation, pollution, vessel disturbance, ocean noise	Climate change
False killer whale	Main Hawaiian Islands Insular	Resident-nomadic	Med	Income	Med	Appears to be decreasing	Fisheries interactions, contaminants	Climate change
Fin whale	California, Oregon, and Washington	Migratory-resident (SOCAL)	Large	Capital	Slow	Unk	Vessel strikes, fisheries interactions, habitat degradation, pollution, vessel disturbance, ocean noise	Climate change
Fin whale	Hawaiian	Migratory	Large	Capital	Slow	Unk	Vessel strikes, fisheries interactions, habitat degradation, pollution, vessel disturbance, ocean noise	Climate change
Gray whale	Western North Pacific	Migratory	Large	Capital	Slow	Unk	Vessel strikes, fisheries interactions, habitat degradation, pollution, vessel disturbance, ocean noise, subsistence hunting	Climate change
Humpback whale	Central America/ Southern Mexico - California – Oregon – Washington (Central America DPS)	Migratory	Large	Capital	Slow	Increasing	Vessel strikes, fisheries interactions, habitat degradation, pollution, vessel disturbance, ocean noise	Climate change
Humpback whale	Mainland Mexico - California – Oregon – Washington (Mexico DPS)	Migratory	Large	Capital	Slow	Unk	Vessel strikes, fisheries interactions, habitat degradation, pollution, vessel disturbance, ocean noise	Climate change
Killer whale	Eastern North Pacific Southern Resident	Resident- nomadic	Large	Income	Slow	Decreasing	Fisheries interactions, vessel strikes, ocean noise, limitation of preferred Chinook salmon prey, contaminants, disturbance from high levels of boat traffic (including whale watch, recreational, and commercial vessels)	Climate change
Sei whale	Eastern North Pacific	Migratory	Large	Capital	Slow	Unk	Vessel strikes, fisheries interactions, ocean noise	Climate change

Species	Stock[1]	Movement Ecology	Body Size	Feeding/ Breeding Strategy	Pace of Life	Population Trend	Chronic Anthropogenic Risk Factors[2]	Other Chronic Risk Factors (Non-Noise)
Sei whale	Hawaii	Migratory	Large	Capital	Slow	Unk	Vessel strikes, fisheries interactions, ocean noise	Climate change
Sperm whale	California, Oregon, and Washington	Migratory-resident	Large	Income	Slow	Unk, but possibly stable	Vessel strikes, fisheries interactions, ocean noise, marine debris, disease	Climate change
Sperm whale	Hawaii	Resident-migratory	Large	Income	Slow	Unk	Vessel strikes, fisheries interactions, ocean noise, marine debris, disease	Climate change
Hawaiian Monk Seal	Hawaiian	Resident	Small	Capital	Fast	Stable/ increasing	Fisheries interactions, illegal harassment, habitat degradation	Disease
Guadalupe Fur Seal	Mexico to California	Migratory	Small	Income	Fast	Increasing	Fisheries interactions, intentional illegal killing/harassment	Unknown
Southern Sea Otter	California Stock	Resident	Small	Income	Fast	Stable	Fisheries interactions, vessel strike, illegal killing	Disease, harmful algal blooms, predation

Notes: Unk = unknown, Med = medium

[1] Stock designations are from Pacific and Alaska Stock Assessment Reports prepared by NMFS (Carretta et al., 2023; Young, 2023) and the Sea Otter Stock Assessment Report prepared by USFWS (U.S. Fish and Wildlife Service, 2021).

[2] Fisheries interactions represents entanglement in fishing gear, including derelict fishing gear, and bycatch.

Table 2.3-5: Stock Vulnerability Factors and Life History Traits for non-ESA-listed Marine Mammal Stocks within the Study Area

Species	Stock[1]	Movement Ecology	Body Size	Feeding/ Breeding Strategy	Pace of Life	Population Trend	Chronic Anthropogenic Risk Factors[2]	Other Chronic Risk Factors (Non-Noise)
Baird's beaked whale	California, Oregon, and Washington	Nomadic, resident	Large	Mixed	Slow	Stable, possibly increasing	Fisheries interactions, ocean noise	Climate Change
Blainville's beaked whale	Hawaii	Nomadic, resident	Med	Mixed	Med	Unk	Fisheries interactions, ocean noise	Disease, climate change
Bryde's whale	Eastern Tropical Pacific	Unknown, likely migratory	Large	Capital	Slow	Unk	Vessel strikes, fisheries interactions, habitat degradation, pollution, vessel disturbance, ocean noise	Climate change
Bryde's whale	Hawaii	Unknown, likely migratory	Large	Capital	Slow	Unk	Vessel strikes, fisheries interactions, habitat degradation, pollution, vessel disturbance, ocean noise	Climate change
California sea lion	U.S. Stock	Resident-migratory	Small	Income	Fast	Stable	Fisheries interactions, power plant entrainment, illegal harassment,	Climate change, El Niño, harmful algal blooms

Species	Stock[1]	Movement Ecology	Body Size	Feeding/ Breeding Strategy	Pace of Life	Population Trend	Chronic Anthropogenic Risk Factors[2]	Other Chronic Risk Factors (Non-Noise)
							habitat degradation, vessel strike, chemical contaminants	
Common bottlenose dolphin	California Coastal	Nomadic	Small-Med	Income	Med	Stable, potentially increasing	Biotoxins, chemical contaminants, fisheries interactions, habitat alteration, illegal feeding and harassment, ocean noise, oil spills and energy exploration, vessel strikes	Disease, climate change
Common bottlenose dolphin	California, Oregon, and Washington Offshore	Nomadic	Small-Med	Income	Med	Unk	Fisheries interactions	Climate change
Common bottlenose dolphin	Hawaiian Pelagic	Nomadic	Small-Med	Income	Med	Unk	Fisheries interactions	Disease, climate change
Common bottlenose dolphin	Kauai and Niihau	Resident	Small-Med	Income	Med	Unk	Fisheries interactions	Disease, climate change
Common bottlenose dolphin	Oahu	Resident	Small-Med	Income	Med	Unk	Entanglement	Disease, climate change
Common bottlenose dolphin	Maui Nui (formerly4-Islands)	Resident	Small-Med	Income	Med	Unk	Entanglement	Disease, climate change
Common bottlenose dolphin	Hawaii Island	Resident	Small-Med	Income	Med	Unk	Fisheries interactions	Disease, climate change
Goose-beaked (Cuvier's) whale	California, Oregon, and Washington	Nomadic, resident	Med	Mixed	Med	Unk	Fisheries interactions, ocean noise	Climate Change
Goose-beaked (Cuvier's) whale	Hawaii	Nomadic, resident	Med	Mixed	Med	Unk	Fisheries interactions, ocean noise	Disease, climate change
Dall's porpoise	California, Oregon, and Washington	Nomadic	Small	Income	Fast	Unk but likely stable	Fishing gear fisheries interactions	Climate change
False killer whale	Hawaii Pelagic	Nomadic	Med	Income	Med	Unk	Fisheries interactions, contaminants	Climate change

Species	Stock[1]	Movement Ecology	Body Size	Feeding/ Breeding Strategy	Pace of Life	Population Trend	Chronic Anthropogenic Risk Factors[2]	Other Chronic Risk Factors (Non-Noise)
False killer whale	Northwestern Hawaiian Islands	Resident, nomadic	Med	Income	Med	Unk	Fisheries interactions, contaminants	Climate change
False killer whale	Eastern Tropical Pacific	Unk	Med	Income	Med	Unk	Fisheries interactions, contaminants	Climate change
Fraser's dolphin	Hawaii	Nomadic	Small	Income	Fast	Unk	Fisheries interactions	Climate change
Gray whale	Eastern North Pacific	Migratory	Large	Capital	Slow	Increasing[2]	Vessel strikes, fisheries interactions, habitat degradation, pollution, vessel disturbance, ocean noise, subsistence hunting	Climate change
Harbor porpoise	Northern California – Southern Oregon	Resident	Small	Income	Fast	Stable	Fisheries interactions, ocean noise (including acoustic deterrent devices or "seal bombs")	Climate change
Harbor porpoise	San Francisco – Russian River	Resident	Small	Income	Fast	Stable	Fisheries interactions, ocean noise (including acoustic deterrent devices or "seal bombs")	Climate change
Harbor porpoise	Monterey Bay	Resident	Small	Income	Fast	Stable	Fisheries interactions, ocean noise (including acoustic deterrent devices or "seal bombs")	Climate change
Harbor porpoise	Morro Bay	Resident	Small	Income	Fast	Increasing	Fisheries interactions, ocean noise (including acoustic deterrent devices or "seal bombs")	Climate change
Harbor seal	California	Resident	Small	Capital	Fast	Stable/ decreasing	Fisheries interactions, power plant entrainment, illegal harassment, vessel strike	Climate change, disease
Humpback whale	Hawai'i	Migratory	Large	Capital	Slow	Unk	Vessel strikes, fisheries interactions, habitat degradation, pollution, vessel disturbance, ocean noise	Climate change
Killer whale	Eastern North Pacific Offshore	Nomadic	Large	Income	Slow	Stable	Fisheries interactions, vessel strikes, ocean noise	Climate change
Killer whale	Eastern North Pacific Transient/West Coast Transient[7]	Nomadic	Large	Income	Slow	Unknown	Fisheries interactions, vessel strikes, ocean noise	Climate change
Killer whale	Hawaii	Nomadic	Large	Income	Slow	Unk	Fisheries interactions	Climate change
Long-beaked common dolphin	California	Nomadic	Small	Income	Med	Unk; apparent recent increase likely due to	Fisheries interactions, exposure to underwater detonations in coastal waters	Disease (domoic acid toxicity), climate change

Species	Stock[1]	Movement Ecology	Body Size	Feeding/ Breeding Strategy	Pace of Life	Population Trend	Chronic Anthropogenic Risk Factors[2]	Other Chronic Risk Factors (Non-Noise)
						distribution shifts north from waters off Mexico		
Longman's beaked whale	Hawaii	Nomadic- resident	Med	Mixed	Med	Unk	Fisheries interactions, ocean noise	Disease, climate change
Melon-headed whale	Hawaiian Islands	Resident-nomadic	Small	Income	Med	Unk	Fisheries interactions, ocean noise	Climate change
Melon-headed whale	Kohala Resident	Resident	Small	Income	Med	Unk	Fisheries interactions, ocean noise	Climate change
Melon-headed whale	Northern Gulf of Mexico	Resident-nomadic	Small	Income	Med	Unk	Fishery interaction, ocean noise, pollution, energy exploration and development, oil spills	Climate change
Mesoplodont beaked whales[3]	California, Oregon, and Washington	Resident - nomadic	Med	Mixed	Med	Unk, possibly increasing	Fisheries interactions, ocean noise	Climate change
Minke whale	California, Oregon, and Washington	Migratory-resident	Med-Large	Capital	Slow	Unk	Vessel strikes, fisheries interactions, habitat degradation, pollution, vessel disturbance	Climate change, disease
Minke whale	Hawaii	Migratory	Med-Large	Capital	Slow	Unk	Vessel strikes, fisheries interactions, habitat degradation, pollution, vessel disturbance	Climate change, disease
Northern right whale dolphin	California, Oregon, & Washington	Nomadic	Small	Income	Med	Unk	Fisheries interactions	Climate change
Northern elephant seal	California	Migratory	Small-Med	Capital	Fast	Increasing	Fisheries interactions, illegal harassment, chemical contaminants	–
Northern fur seal	California	Resident	Small	Income	Fast	Increasing	Fisheries interactions	Climate change, El Niño
Northern fur seal	Eastern Pacific	Migratory	Small	Income	Fast	Decreasing	Fisheries interactions, intentional killing/harassment, chemical contaminants	Climate change, disease
Pacific white-sided dolphin	California, Oregon, & Washington	Nomadic	Small	Income	Med	Unk	Entanglement, fisheries interactions	Climate change

Species	Stock[1]	Movement Ecology	Body Size	Feeding/ Breeding Strategy	Pace of Life	Population Trend	Chronic Anthropogenic Risk Factors[2]	Other Chronic Risk Factors (Non-Noise)
Pantropical spotted dolphin	Oahu	Resident	Small	Income	Med	Unk	Fisheries interactions	Disease, climate change
Pantropical spotted dolphin	Maui Nui (formerly 4-Islands)	Resident	Small	Income	Med	Unk	Fisheries interactions	Disease, climate change
Pantropical spotted dolphin	Hawaii Island	Resident	Small	Income	Med	Unk	Fisheries interactions	Disease, climate change
Pantropical spotted dolphin	Hawaii Pelagic	Nomadic	Small	Income	Med	Unk	Fisheries interactions	Disease, climate change
Pantropical spotted dolphin	Baja California peninsula, Mexico (not a designated stock)	Nomadic	Small	Income	Med	Unk	Fisheries interactions	Disease, climate change
Pygmy and dwarf sperm whales	California, Oregon, and Washington	Migratory, nomadic, resident	Small-Med	Income	Fast	Unk	Fisheries interactions, marine debris, ocean noise	Climate change
Pygmy and dwarf sperm whales	Hawaii	Migratory, nomadic, resident	Small-Med	Income	Fast	Unk	Fisheries interactions, marine debris, ocean noise	Climate change
Pygmy killer whale	Hawaii	Resident, nomadic	Small	Income	Med	Unk	Fisheries interactions, ocean noise	Climate change
Pygmy killer whale	California – Baja California peninsula, Mexico (not a designated stock)	Unk	Small	Income	Med	Unk	Fisheries interactions, ocean noise	Climate change
Risso's dolphin	California, Oregon, & Washington	Nomadic	Small-Med	Income	Med	Unk	Fisheries interactions	Disease, Climate change
Risso's dolphin	Hawaii	Nomadic	Small-Med	Income	Med	Unk	Fisheries interactions	Climate change
Rough-toothed dolphin	Hawaii	Resident, nomadic	Small	Income	Med	Unk	Fisheries interactions	Disease, climate change

Species	Stock[1]	Movement Ecology	Body Size	Feeding/ Breeding Strategy	Pace of Life	Population Trend	Chronic Anthropogenic Risk Factors[2]	Other Chronic Risk Factors (Non-Noise)
Short-beaked common dolphin	California, Oregon, and Washington	Nomadic	Small	Income	Med	Unk, possibly increasing	Fisheries interactions, exposure to underwater detonations in coastal waters	Climate change
Short-finned pilot whale	California, Oregon, & Washington	Nomadic	Med	Income	Slow	Unk	Fisheries interactions	Climate change
Short-finned pilot whale	Hawaii	Nomadic	Med	Income	Slow	Unk	Fisheries interactions	Climate change
Spinner dolphin	Hawaii Pelagic	Nomadic	Small	Income	Fast	Unk	Fisheries interactions, ocean noise	Disease, climate change
Spinner dolphin	Hawaii Island	Nomadic	Small	Income	Fast	Unk	Swim with the dolphin programs, ocean noise, fisheries interactions	Disease, climate change
Spinner dolphin	Oahu/4-Islands	Nomadic	Small	Income	Fast	Unk	Swim with the dolphin programs, ocean noise, fisheries interactions	Disease, climate change
Spinner dolphin	Kauai and Niihau	Nomadic	Small	Income	Fast	Unk	Swim with the dolphin programs, ocean noise, fisheries interactions	Disease, climate change
Steller sea lion	Eastern U.S.	Resident	Small	Income	Fast	Increasing	Fisheries interactions, harassment/ disturbance at rookeries, commercial aquaculture, illegal intentional killing, chemical contaminants	Climate change
Striped dolphin	California, Oregon, and Washington	Nomadic	Small	Income	Med	Unk	Fisheries interactions	Climate change
Striped dolphin	Hawaii	Nomadic	Small	Income	Med	Unk	Fisheries interactions	Disease, climate change

Notes: Unk = unknown; Med = medium

[1] Stock designations are from Pacific and Alaska Stock Assessment Reports prepared by NMFS (Carretta et al., 2023; Young, 2023).

[2] Fisheries interactions represents entanglement in fishing gear, including derelict fishing gear, and bycatch.

[3] Mesoplodont beaked whales off the U.S. west coast are managed as a single California/Oregon/Washington stock. This stock includes Blainville's, Hubbs', gingko-toothed, Perrin's, lesser (pygmy), and Stejneger's beaked whales.

The costs to marine mammals affected by acoustic and explosive stressors vary based on the type and magnitude of the effect.

- Marine mammals that experience masking may have their ability to communicate with conspecifics reduced, especially at farther ranges. However, larger mysticetes (e.g., blue whale, fin whale, sei whale) communicate at frequencies below those of mid-frequency sonar and even most low-frequency sonars. Other marine mammals that communicate at higher frequencies (e.g., minke whale, dolphins) may be affected by some short-term and intermittent masking. Odontocetes use echolocation to find prey and navigate. The echolocation clicks of odontocetes are above the frequencies of most sonar systems, especially those used during anti-submarine warfare. Therefore, echolocation associated with feeding and navigation in odontocetes is unlikely to be masked by sounds from sonars or other lower frequency broadband sound sources such as explosives. Sounds from mid-frequency sonar could mask killer whale vocalizations, making them more difficult to detect, especially at farther ranges. A single or even a few short periods of masking, if it were to occur, to an individual marine mammal per year are unlikely to have any long-term consequences for that individual.
- Threshold shifts do not necessarily affect all hearing frequencies equally, and typically occur at the exposure frequency or within an octave above the exposure frequency. Recovery from threshold shift begins almost immediately after the noise exposure ceases and can take a few minutes to a few days, depending on the severity of the initial shift, to recover. Most TTS, if it does occur, would likely be minor to moderate (i.e., less than 20 dB of TTS directly after the exposure) and would recover within a matter of minutes to hours. During the period that a marine mammal had hearing loss, social calls from conspecifics could be more difficult to detect or interpret. Killer whales are a primary predator of most other marine mammals. Some hearing loss could make killer whale calls more difficult to detect at farther ranges until hearing recovers. Odontocete echolocation clicks and vocalizations are at frequencies above a few tens of kHz for delphinids, beaked whales, and sperm whales, and above 100 kHz for harbor porpoises and Kogia whales. Echolocation associated with feeding and navigation in odontocetes could be affected by higher-frequency hearing loss but is unlikely to be affected by threshold shift at lower frequencies. It is unclear how or if mysticetes use sound for finding prey or feeding; therefore, it is unknown whether hearing loss would affect a mysticete's ability to locate prey or rate of feeding. A single or even a few TTS in an individual marine mammal per year are unlikely to have any long-term consequences for that individual.
- Auditory injury (AINJ) includes but is not limited to permanent hearing loss. AINJ that did occur would likely be of a small amount (single digit permanent threshold shift) or could cause other physiological changes without any permanent hearing loss (see the *Criteria and Thresholds TR*). In cases where AINJ results in permanent hearing loss, this could reduce an animal's ability to detect sounds that are important for survival (including sounds that facilitate breeding, signal feeding opportunities, and allow avoidance of predators, vessels, and other threats), which could have long-term consequences for individuals. However, permanent loss of some degree of hearing is a normal occurrence as mammals age (see the *Marine Mammal Background Section*). While a small decrease in hearing sensitivity may include some degree of energetic costs, it would be unlikely to impact behaviors, opportunities, or detection capabilities to a degree that would interfere with reproductive success or survival. However, individuals that are already in a compromised state at the time of exposure may be more likely to be impacted as compared to relatively healthy individuals.

- Exposures that result in non-auditory injuries may limit an animal's ability to find food, communicate with other animals, or interpret the surrounding environment. Impairment of these abilities can decrease an individual's chance of survival or impact its ability to successfully reproduce. The death of an animal would eliminate future reproductive potential, which is considered in the analysis of potential long-term consequences to the population.

Assessments of likely long-term consequences to populations of marine mammals are provided by empirical data gathered from areas where military readiness activities routinely occur. Substantial Navy-funded marine mammal survey data, monitoring data, and scientific research have been collected since 2006. These empirical data are beginning to provide insight on the qualitative analysis of the actual (as opposed to model-predicted numerical) impact on marine mammals resulting from training and testing activities based on observations of marine mammals generally in and around range complexes (see the *Background* section).

2.4 Species Impact Assessments

The following sections analyze impacts on each marine mammal stock under the Proposed Action and show model-predicted estimates of take for a maximum year of the proposed action. A star (*) is added to the species header if a species or a distinct population segment is listed as endangered or threatened under the ESA. The analyses rely on information on species presence and behavior in the Study Area presented in the *Marine Mammal Background*. That information is briefly summarized in each species impact analysis. The reader is referred to the *Marine Mammal Background* for additional detail and supporting references.

The methods used to quantify impacts for each substressor are described above in Section 2.2.2 (Quantifying Impact on Marine Mammals from Acoustic and Explosive Stressors). The methods used to assess significance of individual impacts and risks to marine mammal populations are described above in Section 2.3 (Assessing Impacts on Individuals and Populations).

For each stock, a multi-sectioned table quantifies impacts as follows:

Section 1

The first section shows the number of instances of each effect type that could occur due to each substressor (sonar, air gun, pile driving, or explosives) over a maximum year of activity. Impacts are shown by type of activities (Navy training [including U.S. Marine Corps], Coast Guard training, Navy testing activities, or Army training). No in-water explosives or acoustic stressors would result from Air Force activities. While impacts on each stock are assessed holistically, this breakout by types of activities corresponds to the incidental take authorizations requested under the Marine Mammal Protection Act for this Proposed Action.

The number of instances of effect is not the same as the number of individuals that could be affected, as some individuals in a stock could be affected multiple times, whereas others may not be affected at all. The instances of effect are those predicted by the Navy's Acoustic Effects Model and are not further reduced to account for activity-based mitigation that may reduce effects near some sound sources and explosives as described in the *Mitigation* section.

In the modeling, instances of effect are calculated within 24-hour periods of each individually modeled event. Impacts are assigned to the highest order threshold exceeded at the animat, which is a dosimeter in the model that represents an animal of a particular species or stock. Non-auditory injuries are assumed to outrank auditory effects, and auditory effects are assumed to outrank significant behavioral responses. In all instances any auditory impact or injury are assumed to represent a concurrent significant behavioral response. For example, if a significant behavioral response and TTS are predicted for the same animat in a modeled event, the effect is counted as a TTS in the table.

For most activities, total impacts are based on multiplying the average expected impacts at a location by the number of times that activity is expected to occur. This is a reasonable method to estimate impacts for activities that occur every year and multiple times per year. There is one exception to that approach in this analysis: Small Ship Shock Trials (a testing activity using explosives). This activity does not occur every year and has a very small number of total events over seven years. The maximum impacts on any stock in warm or cold season are used.

The summation of instances of effect includes all fractional values caused by averaging multiple modeled iterations of individual events. Impacts are only rounded to whole numbers at the level of substressor and type of activities. Rounding follows standard rounding rules, in which values less than 0.5 round down to the lower whole number, and values equal to or greater than 0.5 round up to the higher whole number.

- A zero value (0) indicates that the sum of impacts is greater than true zero but less than 0.5. These impacts are described in the species analysis as "negligible."
- A dash (-) indicates that no impacts are predicted (i.e., a "true" zero). This would occur when there is no overlap of an animat in the modeling with a level of acoustic exposure that would result in any possibility of impacts. Non-auditory injury and mortality are only associated with use of explosives; thus, these types of effects are also true zeroes for any other acoustic substressor.
- A one in parentheses (1) indicates that predicted impacts round to zero in a maximum year of activity, but a single impact is predicted over seven years when summing the fractional risks across years. This is explained further below.
- If there are no modeled impacts from a substressor, even though a stressor could occur in a region where a species may be present, this is described as "no effect" in the species analysis and the substressor is not shown on the impact table.
- If there are comparatively few instances of modeled impacts from a substressor, this result will be described in the species analysis as "limited."
- If there is no geographic overlap between the use of a stressor and the potential presence of a species, this is stated in the analysis.

The summation of impacts across seven years is shown in Section 2.4.5 (Impact Summary Tables). The seven-year sum accounts for any variation in the annual levels of activities. The seven-year sum includes any fractional impact values predicted in any year, which is then rounded following standard rounding rules. That is, the seven-year impacts are not the result of summing the rounded annual impacts.

If a seven-year sum is larger than the annual modeled impacts multiplied by seven, the annual maximum impacts shown in the stock impact tables were increased by dividing the seven-year sum of impacts by seven then rounding up to the nearest integer. For example, this could happen if maximum annual modeled impacts are 1.34 (rounds to 1 annually) and seven-year modeled impacts are 8.60 (rounds to 9), where 9 divided by 7 years (9 ÷ 7 = 1.29) is greater than the rounded annual impact of 1. In this instance, the maximum annual impacts would be adjusted from 1 to 2 based on rounding up 1.29 to 2. In multiple instances, this approach resulted in increasing the maximum annual impacts predicted by the Navy's Acoustic Effects Model.

Section Two

The second section estimates the average number of times an individual in the stock would be affected in a maximum year of activity. The annual impacts per individual is the sum of all instances of effect divided by the population abundance estimate. The annual injurious impacts per individual is only the sum of injuries (auditory, non-auditory, and mortality) divided by the population abundance estimate. The term "injury" in the following species assessments is an inclusive category and may include auditory or non-auditory injuries. When a statement is specific to a type of injury, the injury type (auditory or non-auditory) will be stated.

To estimate repeated impacts across large areas relative to species geographic distributions, comparing the impacts predicted in the Navy's Acoustic Effects Model to abundances predicted using the Navy Marine Species Density Database (NMSDD) models is usually preferable. Per that approach, the ratios of impacts on abundances are based on the same underlying assumptions about a species presence applied in the modeling. The estimates of abundance in NOAA's stock abundance reports, however, may better account for stocks that extend beyond the geographic extent of west coast density models in the NMSDD, such as migratory whales or Alaska stocks. They may also provide a better estimate for stocks that are closely monitored, such as certain ESA-listed species. For each stock, therefore, the population abundance estimate used to assess the potential for repeated takes is the greater of (1) the best population estimate from the stock abundance report prepared by NOAA or (2) the average abundance predicted by the NMSDD.

The annual average abundance values are shown in Table 2.4-1 for stocks with modeled impacts in the Study Area. For the California Study Area, the NMSDD abundances are based on the extent of the west coast density models, which include areas off the Baja California peninsula of Mexico to the south but are truncated to the north and west of the California portion of the Study Area as shown in the *Density TR*. For some species, the NMSDD abundances are based on density models that extend up to the northern extent of the west coast U.S Exclusive Economic Zone, beyond the HCTT Study Area. These are noted in the table. In some instances, even this larger extent does not cover the full range of a species or stock. For the Hawaii Study Area, the NMSDD abundances are based on a buffer around the Hawaiian island chain. Thus, island-associated species are encompassed, but abundances of wider-ranging species may be under-estimated.

NOAA's stock abundance report population estimates and NMSDD abundance estimates can differ substantially because these estimates may be based on different methods and data sources. NOAA's stock abundance reports only consider data from within the prior eight years, whereas the NMSDD considers a longer data history. NOAA's stock abundance reports estimate the number of animals in a population but not spatial densities. NMSDD uses predictive density models to estimate species presence, even where sighting data is limited or lacking altogether. Each density model is limited to the variables and assumptions considered by the original data source provider. These factors and others described in the *Density TR* should be considered when examining the estimated impact numbers in comparison to current population abundance information for any given species or stock.

This analysis does not estimate the distribution of instances of effect across a population (i.e., whether some animals in a population would be affected more times than others). The Navy's Acoustic Effects

Model does not currently model animat movements within, into, and out of the Study Area over a year. Additionally, while knowledge of stock movements and residencies is improving, significant data gaps remain.

Section Three

The third section shows the percent of total impacts that would occur within seasons and general geographic areas. The general geographic areas are Southern California (SOCAL), PMSR, Northern California (NOCAL), Hawaii Range Complex (HRC), and the high seas (transit lanes between the California and Hawaii portions of the Study Area). In the Hawaii Study Area, most activities using sonar and explosives would occur in the Hawaii Range Complex.

Section Four

The fourth section shows which activities are most impactful to a stock. Activities that cause five percent or more of total impacts on a stock are shown.

Section Five (when applicable)

The fifth section shows additional geographical context of impacts. This includes impacts in critical habitats (designated for ESA-listed species) and impacts within Biologically Important Areas. Impacts within these areas may be due to activities within or outside of those areas. Impacts in Biologically Important Areas are only shown for the months that they are in effect. Some Biologically Important Areas consist of a larger “Parent” area and a smaller “Core” or “Child” area within the “Parent.” Impacts shown for “Parent” areas do not exclude the impacts in the “Core” or “Child” areas (i.e., these should not be added to obtain a total count of impacts in the Biologically Important Areas, as some impacts would be double-counted).

The examination of impacts on a *species* within its critical habitat should not be conflated with the analysis of impacts on the critical *habitat* itself or its essential features.

Maps and descriptions of Biologically Important Areas are in the *Marine Mammal Background*. Biologically Important Areas represent areas and times where marine mammal species are known to concentrate for activities related to reproduction, feeding, and migration, as well as the known ranges of small and resident populations. Biologically Important Areas have no legal, statutory, or regulatory power.

Table 2.4-1: Estimated Abundances of Stocks Present in the HCTT Study Area[1]

Species	Stock	SAR[2]	NMSDD[3]
Mysticetes			
Blue whale*	Eastern North Pacific	1,898	3,233[9]
Blue whale*	Central North Pacific	133	170
Bryde’s whale	Hawai'i	791[2]	766
Bryde’s whale	Eastern Tropical Pacific	UNK[6]	69[11]
Fin whale*	Hawai'i	203	226
Fin whale*	California/Oregon/Washington	11,065	12,304[9]
Gray whale	Eastern North Pacific	26,960	10,863[11]
Gray whale*	Western North Pacific	290	110[11]
Humpback whale	Hawai'i	11,278	9,806
Humpback whale*	Mainland Mexico - California/Oregon/Washington	3,477	3,741[9]

Species	Stock	SAR[2]	NMSDD[3]
Humpback whale*	Central America/Southern Mexico - California/Oregon/Washington	1,496	1,603[9]
Minke whale	Hawai'i	438	509
Minke whale	California/Oregon/Washington	915	1,342[9]
Sei whale*	Hawai'i	391	452
Sei whale*	Eastern North Pacific	864[2]	155[11]
Odontocetes			
Baird's beaked whale	California/Oregon/Washington	1,363	871[9]
Blainville's beaked whale	Hawai'i	1,132	1,300
Bottlenose dolphin	California Coastal	453	182
Bottlenose dolphin	California/Oregon/Washington Offshore	3,477	42,395[9,10]
Bottlenose dolphin	Maui Nui (formerly 4-Islands)	64[2]	65
Bottlenose dolphin	Hawai'i Island	136[2]	138
Bottlenose dolphin	Kaua'i/Ni'ihau	112[2]	113
Bottlenose dolphin	O'ahu	112[2]	113
Bottlenose dolphin	Hawai'i Pelagic	24,669[2]	25,120
Goose-beaked (Cuvier's) whale	Hawai'i	4,431	5,116
Goose-beaked (Cuvier's) whale	California/Oregon/Washington	5,454	13,531[9,10]
Dall's porpoise	California/Oregon/Washington	16,498	61,840[9]
Dwarf sperm whale	Hawai'i	UNK[6]	43,246
Dwarf sperm whale	California/Oregon/Washington	UNK[7]	2,462[8,11]
False killer whale	Baja, California Peninsula Mexico[4]	NA	1,990
False killer whale*	Main Hawaiian Islands Insular	138[2]	98
False killer whale	Northwest Hawaiian Islands	477	477
False killer whale	Hawai'i Pelagic	5,528[2]	2,400
Fraser's dolphin	Hawai'i	40,960	47,288
Harbor porpoise	Northern California/Southern Oregon	15,303	1,961[11]
Harbor porpoise	Monterey Bay	3,760	4,530
Harbor porpoise	San Francisco Russian River	7,777	9,974
Harbor porpoise	Morro Bay	4,191	3,885
Killer whale	Hawai'i	161	198
Killer whale*	Southern Resident	73	52
Killer whale	West Coast Transient	349	26[11]
Killer whale	Eastern North Pacific Offshore	300	155[11]
Long-beaked common dolphin	California	83,379	209,100[9]
Longman's beaked whale	Hawai'i	2,550	2,940
Melon-headed whale	Hawaiian Islands	40,647	46,949
Melon-headed whale	Kohala Resident	UNK[6]	447
Mesoplodont beaked whales[5]	California/Oregon/Washington	3,044	7,534[9]
Northern right whale dolphin	California/Oregon/Washington	29,285	68,935[9]
Pacific white-sided dolphin	California/Oregon/Washington	34,999	107,775[9]
Pantropical spotted dolphin	Maui Nui (formerly 4-Islands)	UNK[7]	2,674
Pantropical spotted dolphin	Hawai'i Island	UNK[7]	8,674
Pantropical spotted dolphin	O'ahu	UNK[7]	1,491
Pantropical spotted dolphin	Hawai'i Pelagic	67,313[2]	62,395

Species	Stock	SAR[2]	NMSDD[3]
Pantropical spotted dolphin	Baja, California Peninsula Mexico[4]	NA	70,889
Pygmy killer whale	Hawai'i	10,328	11,928
Pygmy killer whale	California - Baja, California Peninsula Mexico[4]	NA	874
Pygmy sperm whale	Hawai'i	42,083	48,589
Pygmy sperm whale	California/Oregon/Washington	4,111	2,462[8,11]
Risso's dolphin	Hawai'i	6,979[2]	8,649
Risso's dolphin	California/Oregon/Washington	6,336	19,357[9]
Rough-toothed dolphin	Hawai'i	83,915[2]	106,193
Short-beaked common dolphin	California/Oregon/Washington	1,056,308	1,049,117[9]
Short-finned pilot whale	Hawai'i	19,242[2]	23,117
Short-finned pilot whale	California/Oregon/Washington	836	831
Sperm whale*	Hawai'i	5,707	6,062
Sperm whale*	California/Oregon/Washington	2,606[2]	4,549[9]
Spinner dolphin	Hawai'i Island	665	670
Spinner dolphin	Kaua'i Ni'ihau	UNK[6]	606
Spinner dolphin	O'ahu/4-Islands	UNK[6]	355
Spinner dolphin	Hawai'i Pelagic	UNK[6]	6,807
Striped dolphin	Hawai'i Pelagic	64,343[2]	68,909
Striped dolphin	California/Oregon/Washington	29,988	160,551[9]
Pinnipeds			
California sea lion	United States	257,606	199,121[11,12]
Guadalupe fur seal*	Mexico	34,187	48,780[12, 13]
Harbor seal	California	30,968	13,343[12]
Hawaiian monk seal*	Hawai'i	1,564[2]	967[12]
Northern elephant seal	California Breeding	187,386	49,526[11]
Northern fur seal	California	14,050	14,115
Northern fur seal	Eastern Pacific	626,618	89,110[11,12]
Steller sea lion	Eastern	36,308	3,181[11, 12]

SAR: Stock Assessment Report, UNK: Unknown, * = ESA-listed

[1] Values are shown for stocks (or species) with modeled impacts in the Study Area. If a stock is not shown in this table, that stock had no modeled impacts or was not included in the impact modeling because there was no overlap with areas where sonar, air gun, pile driving, or explosive use is anticipated.

[2] Best abundance estimates are from Pacific and Alaska Stock Assessment Reports prepared by NMFS and include the 2023 draft updates (Carretta et al., 2023; Young, 2023).

[3] See the *Density TR* for additional information.

[4] There is no NMFS-designated stock for this population.

[5] Mesoplodont beaked whales off the U.S. west coast are managed as a single California/Oregon/Washington stock. This stock includes Blainville's, Perrin's, lesser (pygmy), Stejneger's, gingko-toothed, and Hubbs' beaked whales.

[6] No SAR population estimate due to lack of recent data (within the last eight years).

[7] No SAR population estimate due to insufficient data.

[8] The NMSDD abundance estimate for Kogia whales is equally split between dwarf and pygmy sperm whales.

[9] Includes the extent of draft NMSDD models off Oregon and Washington.

[10] NMSDD abundances greatly exceed the SAR estimates because the density models predict animals south to areas off the Baja, California Peninsula, Mexico and/or far offshore. For analyzing repeated impacts, animals predicted to be in those locations are assumed to be in the same populations as the NMFS-designated stocks.

[11] A large portion of the range of the stock exceeds the NMSDD extent.

[12] NMSDD in-water densities do not include the portion of pinnipeds that are hauled out.

[13] NMSDD abundance for the Guadalupe fur seal assumes no haul out (see the *Density TR*).

2.4.1 Impacts on Mysticetes

The mysticetes have been split from the previous inclusive LF cetacean auditory group into two auditory groups: the VLF and LF cetaceans. The predicted hearing range of the VLF cetaceans resembles the previous combined auditory group for all mysticetes, whereas the predicted hearing range for the revised LF cetacean group is shifted to slightly higher frequencies.

For sonar exposures, the behavioral response function indicates less sensitivity to behavioral disturbance than predicted in the prior analysis. As described in 2.2.2 (Quantifying Impacts on Hearing), the methods to model avoidance of sonars have been revised to base a species' probability of an avoidance responses on the behavioral response function. Because the probability of behavioral response has decreased for the Mysticete behavioral group while the estimated susceptibility to auditory effects has increased (primarily for the LF hearing group), this analysis predicts more auditory impacts than the prior analysis. In addition, the cut-off conditions for predicting significant behavioral responses have been revised as shown in Section 2.2.3 (Quantifying Behavioral Responses to Sonars). These factors interact in complex ways that the results of this analysis challenging to compare to prior analyses.

Mysticetes would not be exposed to nearshore pile driving in Port Hueneme. Impacts due to non-modeled acoustic stressors are discussed above in Section 2.1.4 (Impacts from Vessel Noise), Section 2.1.5 (Impacts from Aircraft Noise), and Section 2.1.6 (Impacts from Weapons Noise).

2.4.1.1 Blue Whale (*Balaenoptera musculus*)*

Blue whales are in the VLF cetacean auditory group and the Mysticete behavioral group. Two stocks are in the Study Area – the Eastern North Pacific stock and Central North Pacific stock. Blue whales are ESA-listed as endangered throughout their range with no designated DPSs. Model-predicted impacts are presented in Table 2.4-2 and Table 2.4-3. The Eastern North Pacific and Central North Pacific stocks of blue whales are migratory populations that can occur near the coast, over the continental shelf, or in oceanic waters.

The Eastern North Pacific stock of blue whales range from the northern Gulf of Alaska to the eastern tropical Pacific. This stock forages in their hierarchal feeding BIAs in coastal, shelf beak, and deep waters off California in warmer months (June through November) and migrates to areas farther south (Gulf of California) in colder months to breed. In recent years they have been reported to spend more time (averaging over 8 months) on feeding grounds in the Southern California Bight. While this stock can be found along both the California shelf and in deep offshore water, the highest densities of blue whales are predicted along nearshore Southern California where most impacts would occur. Blue whales may be impacted while foraging in the designated BIAs. Most impacts are due to Anti-Submarine Warfare activities in the SOCAL Range Complex. Acoustic and Oceanographic Research using low and mid-frequency sonars also contribute to predicted impacts. Most impacts due to explosives are attributable to Mine Warfare activities in the SOCAL Range Complex. Some impacts are attributable to Small Ship Shock Trials. Both activities have specific activity-based mitigation that may reduce the number of impacts on marine mammals in the area (see the *Mitigation* section for details). The risk of impacts due to air guns is negligible. Most impacts are auditory effects because mysticetes are relatively less sensitive to disturbance.

The Central North Pacific stock of blue whales migrate from their feeding grounds in the Gulf of Alaska to Hawaii in winter. While they are found in the Hawaii Study Area, they are not sighted frequently or year-round. Most impacts would occur in the Hawaii Range Complex during the cold season (winter to spring) and would be due to Anti-Submarine Warfare activities. Because fewer blue whales are present in this region, there are comparatively fewer impacts on this stock. Impacts due to explosives are limited, and no impacts due to air guns are predicted.

On average, individuals in the Eastern North Pacific stock could be impacted a couple times a year, and individuals in the Central North Pacific stock would be impacted less than once per year. There are no non-auditory injuries predicted for either stock. The average individual risk of auditory injury in both populations is low. The Central North Pacific stock's risk of auditory injury from testing sonar is low (less than one) in any year, but an auditory injury is shown in the maximum year of impacts due to summing risk across seven years and following the rounding approach discussed in Section 2.4 (Species Impact Assessments). The risk of auditory injury in either stock may be reduced through activity-based mitigation because blue whales are moderately sightable.

The risk of repeated impacts on individuals and consequences to populations from disturbances of individuals can be mediated by certain life history traits of a species. Blue whales are large capital breeders with a slow pace of life. They are expected to be resilient to short-term foraging disruptions due to their reliance on built-up energy reserves. Population trends for blue whales are unknown, but possibly increasing in the Eastern North Pacific. Both stocks are endangered. Their slow pace of life means that long-term impacts on breeding adults could have a longer-term effect on population growth rates.

A case study examined long-term effects of changing environmental conditions and exposure to military sonar for Eastern North Pacific blue whales on the SOCAL Range Complex based on the description of sonar use in the previous action (2018 HSTT EIS/OEIS). According to the model, only a ten-fold increase in sonar activity combined with a shift in geographical location to overlap with main feeding areas of blue whales would result in a moderate decrease in lifetime reproductive success. Even in such extreme instances, there was still no effect on survival (Pirotta et al., 2022).

The limited instances of predicted behavioral and non-injurious auditory impacts are unlikely to result in any long-term impacts on individuals, although individuals who suffer an auditory injury may experience minor energetic costs. Most predicted impacts are temporary auditory effects that are unlikely to contribute to any long-term impacts on individuals. Long-term consequences to the stock are unlikely.

Based on the analysis presented above, activities that produce vessel, aircraft, and weapons noise during training activities <u>may affect, but are not likely to adversely affect,</u> blue whales. The use of sonars and explosives during training activities <u>may affect, and are likely to adversely affect,</u> blue whales. Activities that involve the use of pile driving are <u>not applicable</u> to blue whales because there is no geographic overlap of this stressor with species occurrence. Air gun activities are not conducted during training.

Based on the analysis presented above, the use of air guns and activities that produce vessel, aircraft, and weapons noise during testing activities <u>may affect, but are not likely to adversely affect,</u> blue whales. The use of sonars and explosives during testing activities <u>may affect, and are likely to adversely affect,</u> blue whales. Pile diving activities are not conducted during testing.

Table 2.4-2: Estimated Effects to the Eastern North Pacific Stock of Blue Whales over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Air gun	Navy Testing	0	-	-	-	-
Explosive	Navy Training	65	81	1	-	-
Explosive	Navy Testing	21	25	2	-	-
Explosive	USCG Training	(1)	-	-	-	-
Sonar	Navy Training	646	1,924	16	-	-
Sonar	Navy Testing	696	1,094	8	-	-
Sonar	USCG Training	18	-	-	-	-
Maximum Annual Total		**1,447**	**3,124**	**27**	**-**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
3,233	1.42	0.01

Season	Percent of Total Effects		
	SOCAL	PMSR	NOCAL
Warm	44%	7%	5%
Cold	43%	1%	1%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	17%
Acoustic and Oceanographic Research (ONR)	Navy Testing	11%
Medium Coordinated Anti-Submarine Warfare	Navy Training	10%
Intelligence, Surveillance, Reconnaissance (NAVWAR)	Navy Testing	8%
Small Joint Coordinated Anti-Submarine Warfare	Navy Training	7%
At-Sea Sonar Testing	Navy Testing	6%
Composite Training Unit Exercise (Strike Group)	Navy Training	6%

Area Type	Area Name (Active Months)	BEH	TTS	AINJ	INJ	MORT
F-BIA-C	West Coast (6,7,8,9,10,11)	37	60	1	-	-
F-BIA-P	West Coast (6,7,8,9,10,11)	461	645	3	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
BIA Types: S - Small/Resident population, M - Migratory, F - Feeding, R - Reproductive, P - Parent, C - Child/Core
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Table 2.4-3: Estimated Effects to the Central North Pacific Stock of Blue Whales over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Explosive	Navy Training	(1)	-	-	-	-
Sonar	Navy Training	10	56	0	-	-
Sonar	Navy Testing	5	19	(1)	-	-
Sonar	USCG Training	(1)	-	-	-	-
Maximum Annual Total		**17**	**75**	**1**	**-**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
170	0.55	0.01

Season	Percent of Total Effects: HRC	Percent of Total Effects: High Seas
Warm	29%	1%
Cold	66%	4%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Medium Coordinated Anti-Submarine Warfare	Navy Training	36%
Acoustic and Oceanographic Research (ONR)	Navy Testing	14%
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	9%
Submarine Sonar Maintenance and Systems Checks	Navy Training	9%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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2.4.1.2 Fin Whale (*Balaenoptera physalus*)*

Fin whales are in the VLF cetacean auditory group and the Mysticete behavioral group. Two stocks are in the Study Area – the California, Oregon, and Washington stock and the Hawaiian stock. Fin whales are ESA-listed as endangered throughout their range with no designated DPSs. Model-predicted impacts are presented in Table 2.4-4 and Table 2.4-5.

The California, Oregon, and Washington stock of fin whales is a migratory-resident population that travels along the entire U.S. west coast, either in long-range movements or short seasonal trips. They may be present throughout the year in southern and central California, as the Southern California Bight is likely home to a small year-round resident population. However, there are generally higher densities farther offshore in the summer and fall, and closer to shore in winter and spring. Fin whales have the largest hierarchal feeding BIAs spanning the coast of California from June to November, which overlap more with PMSR and SOCAL compared to NOCAL, as the Core BIAs are generally farther offshore in northern California. Impacts would be attributable to various activities in summer and fall (warm season), with most impacts occurring in Southern California year-round. Fin whales may be impacted while foraging in the designated BIAs. Most impacts are due to Anti-Submarine Warfare activities. Acoustic and Oceanographic Research using low and mid-frequency sonars also contribute to predicted impacts. Most impacts are auditory effects because mysticetes are relatively less sensitive to disturbance. Impacts from explosives would occur from a variety of activities, including Ship Shock Trials, Explosive Ordnance Disposal (EOD) Mine Neutralization, and Amphibious Breaching activities, some of which have specific on-site mitigations to reduce the number of impacts on marine mammals in the area (see the *Mitigation* section for details). The risk of impacts due to air guns is negligible.

Fin whales have higher abundances in temperate and polar waters and are not frequently seen in warm, tropical waters. While fin whales are found in the Hawaii Study Area, they are not sighted frequently or year-round. The Hawaii stock of fin whales likely only migrate to the Study Area during fall and winter, which is when they are most likely to experience impacts in the Hawaii Range Complex. Like the California, Oregon, and Washington stock, most impacts on fin whales in Hawaii are due to Anti-Submarine Warfare activities. Because fewer fin whales are present in this region, there are comparatively fewer impacts on this stock. Impacts due to explosives, or injuries due to any stressor, are unlikely.

On average, individuals in the California, Oregon, and Washington stock could be impacted about once a year, and individuals in the Hawaii stock would be impacted less than once per year. The average risk of injury is low, although auditory injuries are predicted, especially for the California, Oregon, and Washington stock. The Hawaii stock's risk of auditory injury from Navy testing sonar is also low (less than one) in any year, but an auditory injury is shown in the maximum year of impacts due to summing risk across seven years and following the rounding approach discussed in Section 2.4 (Species Impact Assessments). The same is true for the California, Oregon, and Washington stock's risk of non-auditory injury; the impact from Navy training explosives is very low (less than one) in any year, but a non-auditory injury is shown in the maximum year of impacts due to summing risk across seven years and following the rounding approach. The risk of these injuries may be reduced through visual observation mitigation.

The risk of repeated impacts on individuals and consequences to populations from disturbances of individuals can be mediated by certain life history traits of a species. Fin whales are large capital breeders with a slow pace of life. They are expected to be resilient to short-term foraging disruptions due to their reliance on built-up energy reserves. Population trends for fin whales are unknown. Both stocks are endangered. Their slow pace of life means that long-term impacts on breeding adults could have a longer-term effect on population growth rates.

On average, the limited instances of predicted behavioral and non-injurious auditory impacts are unlikely to result in any long-term impacts on individuals, although individuals who suffer an injury may experience minor energetic costs. Most predicted impacts are temporary auditory effects that are unlikely to contribute to any long-term impacts on individuals. Long-term consequences to the stock are unlikely. Long-term consequences to both stocks of fin whales are unlikely.

Based on the analysis presented above, activities that produce vessel, aircraft, and weapons noise during training activities <u>may affect, but are not likely to adversely affect,</u> fin whales. The use of sonars and explosives during training activities <u>may affect, and are likely to adversely affect,</u> fin whales. Activities that involve the use of pile driving are <u>not applicable</u> to fin whales because there is no geographic overlap of this stressor with species occurrence. Air gun activities are not conducted during training.

Based on the analysis presented above, the use of air guns and activities that produce vessel, aircraft, and weapons noise during testing activities <u>may affect, but are not likely to adversely affect,</u> fin whales. The use of sonars and explosives during testing activities <u>may affect, and are likely to adversely affect,</u> fin whales. Pile diving activities are not conducted during testing.

Table 2.4-4: Estimated Effects to the California, Oregon, and Washington Stock of Fin Whales over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Air gun	Navy Testing	0	0	-	-	-
Explosive	Navy Training	98	114	5	(1)	-
Explosive	Navy Testing	76	69	6	0	-
Explosive	USCG Training	0	0	0	-	-
Sonar	Navy Training	1,727	5,470	22	-	-
Sonar	Navy Testing	1,741	4,144	21	-	-
Sonar	USCG Training	62	-	-	-	-
Maximum Annual Total		**3,704**	**9,797**	**54**	**1**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
12,304	1.10	0.00

Season	Percent of Total Effects		
	SOCAL	PMSR	NOCAL
Warm	28%	19%	23%
Cold	23%	4%	2%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Medium Coordinated Anti-Submarine Warfare	Navy Training	21%
Acoustic and Oceanographic Research (ONR)	Navy Testing	17%
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	11%
At-Sea Sonar Testing	Navy Testing	10%
Anti-Submarine Warfare Torpedo Exercise - Ship	Navy Training	6%
Intelligence, Surveillance, Reconnaissance (NAVWAR)	Navy Testing	6%

Area Type	Area Name (Active Months)	BEH	TTS	AINJ	INJ	MORT
F-BIA-C	West Coast (6,7,8,9,10,11)	1,405	3,974	19	-	-
F-BIA-P	West Coast (6,7,8,9,10,11)	1,977	5,653	28	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
BIA Types: S - Small/Resident population, M - Migratory, F - Feeding, R - Reproductive, P - Parent, C - Child/Core
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Table 2.4-5: Estimated Effects to the Hawaii Stock of Fin Whales over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Explosive	Navy Training	(1)	0	0	-	-
Explosive	Navy Testing	(1)	0	-	-	-
Sonar	Navy Training	12	46	0	-	-
Sonar	Navy Testing	5	19	(1)	-	-
Sonar	USCG Training	2	-	-	-	-
Maximum Annual Total		**21**	**65**	**1**	**-**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
226	0.38	0.00

	Percent of Total Effects	
Season	HRC	High Seas
Warm	24%	1%
Cold	73%	2%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Medium Coordinated Anti-Submarine Warfare	Navy Training	30%
Acoustic and Oceanographic Research (ONR)	Navy Testing	16%
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	13%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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2.4.1.3 Bryde's Whale (*Balaenoptera brydei/edeni*)

Bryde's whales are in the LF cetacean auditory group and the Mysticete behavioral group. Two stocks are in the Study Area – the Eastern Tropical Pacific and the Hawaii stock. Model-predicted impacts are presented in Table 2.4-6 and Table 2.4-7.

Little is known about the movements of Bryde's whales in the Study Area, but seasonal shifts in their distribution occur toward and away from the equator in winter and summer. Therefore, both populations of Bryde's whales are at least somewhat migratory populations that travel within their tropical and subtropical ranges year-round.

Little is known about the density of the Eastern Tropical Pacific stock other than there appears to be a higher density of Bryde's whales in Southern California compared to the previous analysis. Within the California Study Area, the Eastern Tropical Pacific Stock of Bryde's whales have the highest density in Southern California, which is where they are most likely to experience impacts. Most impacts are due to Intelligence, Surveillance, and Reconnaissance testing activities which include unmanned aerial vehicles, unmanned surface vehicles, unmanned bottom crawlers, and unmanned underwater vehicles that use a variety of active sonar. A small number of auditory injuries are predicted from sonar and explosive activities, but no non-auditory injuries are predicted for this stock.

Bryde's whales are the only baleen whale found in Hawaiian waters year-round, and the only mysticete in Hawaii that does not undergo predictable north-south seasonal migrations. However, Bryde's whales occur mostly in offshore waters of the North Pacific. A population of Bryde's whales congregates near the Main Hawaiian Islands, and while they occur there at a consistently lower density, this population overlaps areas where Anti-Submarine Warfare activities would occur. Most impacts on this stock are due to these activities. Most impacts are auditory effects because mysticetes are relatively less sensitive to disturbance. Impacts from explosives would be limited. There would be no impacts due to air guns for either stock.

It is not possible to accurately predict the potential for repeated impacts on individuals in Eastern Tropical Pacific stock. The NMSDD only covers a small portion of the area expected to be inhabited by this population in the eastern Pacific Ocean. Most of this population is present south of the Study Area. Still, the number of predicted impacts is very low, thus the risk of repeated exposures is likely negligible. On average, individuals in the Hawaii stock would experience non-injurious impacts less than once per year. A very small number of auditory injuries could occur to individuals in this stock due to sonar testing and training, although the Hawaii stock's risk of auditory injury from Navy testing sonar is very low (less than one) in any year, but an auditory injury is shown in the maximum year of impacts due to summing risk across seven years and following the rounding approach discussed in Section 2.4 (Species Impact Assessments). The same is true for the Eastern Tropical Pacific stock's risk of auditory injury; the impact from Navy training sonar and Navy testing explosives is very low (less than one) in any year, but a non-auditory injury is shown in the maximum year of impacts due to summing risk across seven years and following the rounding approach. The risk of injury may be reduced through visual observation mitigation.

Consequences to individuals and consequences to populations from disturbances of individuals can be mediated by certain life history traits of a species. Being large capital breeders, Bryde's whales have a slow pace of life and may be less susceptible to impacts from foraging disruption. Even somewhat migratory movement ecology combined with the overall low number of predicted impacts for this stock means the risk of consequences to any individual is low. Long-term consequences to either population is unlikely.

Table 2.4-6: Estimated Effects to the Eastern Tropical Pacific Stock of Bryde's Whales over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Explosive	Navy Training	12	39	1	-	-
Explosive	Navy Testing	3	3	(1)	-	-
Sonar	Navy Training	48	80	(1)	-	-
Sonar	Navy Testing	47	89	2	-	-
Sonar	USCG Training	1	-	-	-	-
Maximum Annual Total		**111**	**211**	**5**	**-**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
69	4.74	0.07

Season	Percent of Total Effects			
	SOCAL	PMSR	NOCAL	High Seas
Warm	39%	2%	2%	1%
Cold	50%	3%	2%	1%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Intelligence, Surveillance, Reconnaissance (NAVWAR)	Navy Testing	18%
Mine Countermeasure Technology Research	Navy Testing	11%
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	8%
Medium Coordinated Anti-Submarine Warfare	Navy Training	6%
Surface Ship Object Detection	Navy Training	6%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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Table 2.4-7: Estimated Effects to the Hawaii Stock of Bryde's Whales over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Explosive	Navy Training	1	(1)	0	-	-
Explosive	Navy Testing	(1)	1	0	-	-
Explosive	Army Training	(1)	(1)	-	-	-
Sonar	Navy Training	41	263	2	-	-
Sonar	Navy Testing	22	75	(1)	-	-
Sonar	USCG Training	2	-	-	-	-
Maximum Annual Total		**68**	**341**	**3**	**-**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
791	0.52	0.00

Season	Percent of Total Effects	
	HRC	High Seas
Warm	40%	3%
Cold	53%	4%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Medium Coordinated Anti-Submarine Warfare	Navy Training	30%
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	13%
Submarine Sonar Maintenance and Systems Checks	Navy Training	12%
Acoustic and Oceanographic Research (ONR)	Navy Testing	9%
Vehicle Testing	Navy Testing	6%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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2.4.1.4 Humpback Whale (*Megaptera novaeangliae*)*

Humpback whales are in the LF cetacean auditory group and the Mysticete behavioral group. Three stocks are in the Study Area – the Central America/Southern Mexico/California, Oregon, and Washington stock (the Central America DPS - endangered), the Mainland Mexico stock/California, Oregon, and Washington stock (part of the Mexico DPS - threatened), and the Hawaii stock (the Hawaii DPS – not ESA-listed).

2.4.1.4.1 ESA-listed Humpback Whales (Central America DPS and Mexico DPS)

Model-predicted impacts are presented in Table 2.4-8 and Table 2.4-9.

Humpback whales in the California Study Area are most abundant in shelf and slope waters which are areas of high productivity. While they are often sighted near shore, they also frequently travel through deep offshore waters during migration. The Central America/Southern Mexico/California, Oregon, and Washington stock (Central America DPS) migrates from breeding grounds in Central America to their northern feeding grounds, parts of which are in the California Study Area. Similarly, the Mainland Mexico stock/California, Oregon, and Washington stock (part of the Mexico DPS) of humpback whales migrates from breeding grounds in Mexico to their northern feeding grounds, parts of which are in the California Study Area. Unlike the Central American stock, humpback whales of the Mainland Mexico stock also migrate to the northeast (e.g., Alaska, Andalusian Islands, Russia).

The Central America/Southern Mexico/California, Oregon, and Washington stock (Central America DPS) of humpback whales may be present in the Study Area year-round, but specifically utilize hierarchal feeding ground BIAs March through November. This stock of humpback whales migrates through California with peak abundance December through June ("cold season"), when humpbacks are most likely to be impacted by sonar training and testing activities in Southern California. Some impacts on humpback whales would occur in critical habitat, and they may be impacted while foraging in the BIAs off the coast of California. Most impacts are due to Anti-Submarine Warfare activities. Most impacts are auditory effects because mysticetes are relatively less sensitive to disturbance. Impacts from explosives would be limited and the risk of impacts due to air guns is negligible.

The Mainland Mexico stock/California, Oregon, and Washington stock (part of the Mexico DPS) of humpback whales shares a similar migration pattern with the Central America/Southern Mexico/California, Oregon, and Washington stock, and has the highest abundance in California Study Area during the cold season, when humpbacks are most likely to be impacted by sonar training and testing activities in Southern California. Some impacts on humpback whales would occur in critical habitat, and they may be impacted while foraging in the hierarchal BIAs off the coast of California. Most impacts are due to Anti-Submarine Warfare activities, including on humpback whale critical habitat. Most impacts are auditory effects because mysticetes are relatively less sensitive to disturbance. Impacts from explosives would be limited and the risk of impacts due to air guns is negligible.

On average, individuals in the Central America/Southern Mexico/California, Oregon, and Washington stock (Central America DPS) or the Mainland Mexico stock/California, Oregon, and Washington stock (part of the Mexico DPS) of humpback whales could be impacted about once a year. These impacts are most likely to occur in the cold season when humpbacks would be migrating and feeding along California. The average risk of injury is low, although it is likely that some auditory injuries could occur, particularly from sonar activities during Navy training events. The risk of a single non-auditory injury from testing explosives is low (less than one) in any year for the Mainland Mexico stock/California, Oregon, and Washington stock, but a non-auditory injury is shown in the maximum year of impacts due to summing risk across seven years and following the rounding approach discussed in Section 2.4 (Species Impact Assessments). This auditory injury is shown in the maximum year of impacts per the summation and rounding approach discussed above. The risk of injury may be reduced through activity-based mitigation.

The risk of repeated exposures to individuals and consequences to populations from disturbances of individuals can be mediated by certain life history traits of a species. Humpback whales are large capital breeders with a slow pace of life. Although some impacts are likely to occur when humpbacks are engaged in feeding behavior, they are expected to be resilient to short-term foraging disruptions due to their reliance on built-up energy reserves. Although the Central America/Southern Mexico/California, Oregon, and Washington stock population may be increasing, they are also endangered. The Mainland Mexico stock/California, Oregon, and Washington stock of humpback whales is depleted and threatened. Both stocks of humpback whales that migrate along California face the added risk of pot and trap fishery entanglements, which are the most common source of injury to humpback whales in the area. Humpback whales' slow pace of life means that long-term impacts on breeding adults could have a longer-term effect on population growth rates.

The limited instances of predicted behavioral and non-injurious auditory impacts are unlikely to result in any long-term impacts on individuals, although individuals who suffer an auditory or non-auditory injury may experience minor energetic costs. Most predicted impacts are temporary auditory effects that are unlikely to contribute to any long-term impacts on individuals. Long-term consequences to the stock are unlikely.

Based on the analysis presented above, activities that produce vessel, aircraft, and weapons noise during training activities <u>may affect, but are not likely to adversely affect,</u> humpback whales in the Central American DPS. The use of sonars and explosives during training activities <u>may affect, and are likely to adversely affect,</u> humpback whales in the Central American DPS. Activities that involve the use of pile driving are <u>not applicable</u> to humpback whales in the Central American DPS because there is no geographic overlap of this stressor with species occurrence. Air gun activities are not conducted during training.

Based on the analysis presented above, the use of air guns and activities that produce vessel, aircraft, and weapons noise during testing activities <u>may affect, but are not likely to adversely affect,</u> humpback whales in the Central American DPS. The use of sonars and explosives during testing activities <u>may affect, and are likely to adversely affect,</u> humpback whales in the Central American DPS. Pile diving activities are not conducted during testing.

Based on the analysis presented above, activities that produce vessel, aircraft, and weapons noise during training activities <u>may affect, but are not likely to adversely affect,</u> humpback whales in the Mexico DPS. The use of sonars and explosives during training activities <u>may affect, and are likely to adversely affect,</u> humpback whales in the Mexico DPS. Activities that involve the use of pile driving are <u>not applicable</u> to humpback whales in the Mexico DPS because there is no geographic overlap of this stressor with species occurrence. Air gun activities are not conducted during training.

Based on the analysis presented above, the use of air guns and activities that produce vessel, aircraft, and weapons noise during testing activities <u>may affect, but are not likely to adversely affect,</u> humpback whales in the Mexico DPS. The use of sonars and explosives during testing activities <u>may affect, and are likely to adversely affect,</u> humpback whales in the Mexico DPS. Pile diving activities are not conducted during testing.

<u>*Critical Habitat*</u>

The critical habitats designated by NMFS for humpback whales encompass biological features essential to conservation of the species (81 *Federal Register* 4838). One essential feature was identified for humpback whale critical habitat, defined as prey species, primarily euphausiids and small pelagic schooling fishes, of sufficient quality, abundance, and accessibility within humpback whale feeding areas to support feeding and population growth. The northern units (Unit 15, 16, and 17) overlap the NOCAL Range Complex, which are key areas essential for humpback whale foraging and migration. The only biological feature designated by NMFS for the Central America and Mexico DPS of humpback whales is the presence of euphausiids (krill) and small fish such as pacific sardines, northern anchovy, and pacific herring, particularly in the San Francisco-Monterey Bay Area within the northern units. The southern units (Units 17 and 18) overlap PMSR and the northern portion of the SOCAL Range Complex, which are also BIAs for foraging. Maps of these critical habitats are in the *Marine Mammal Background*.

While use of sonar and noise produced by vessels, aircraft, and weapons firing would overlap critical habitat, they would not affect the essential prey feature in the critical habitat that is essential for the reproduction, rest and refuge, health, continued survival, conservation, and recovery of this species. Non-impulsive sound sources, such as sonars, have not been known to cause direct injury or mortality to fish under conditions that would be found in the wild (Halvorsen et al., 2012a; Kane et al., 2010; Popper et al., 2007) and would only be expected to result in behavioral reactions or potential masking in fishes and marine invertebrates. Most sonar sources proposed for use during training and testing activities overlapping or adjacent to critical habitat in the Study Area would not fall within the frequency range of marine invertebrate or fish hearing, thereby presenting no plausible route of effect on humpback whale prey species. The few sources used within invertebrate and fish hearing range would be limited and typically transient, as shown in Appendix A (Activity Descriptions) and examined in the *Impacts on Fishes from Acoustic and Explosive Stressors* section. Pile driving would only occur in Point Hueneme, thus would not overlap critical habitat for humpback whales. Limited use of air guns could occur in critical habitat. Air guns may affect prey species very close to the source, although the single air guns used during testing are less powerful than those used in seismic surveys. Any impacts would be minimal, localized, and would not overall reduce aggregations of prey species.

Explosive stressors that occur in the NOCAL Range Complex, PMSR, and SOCAL Range Complex would overlap Central America DPS and Mexico DPS designated critical habitat. Use of explosives may kill or injure prey species that are present near these explosives. As shown in the Section 4.4.4 (Range to Effects for Explosives), the median range to fish mortality due to explosives categorized as E12 (> 675–1,000 lb. NEW), the largest explosive proposed in the humpback whale critical habitat, is up to 760 m. However, the largest explosive bins are very limited in number and would not occur in the NOCAL Range Complex, which includes the humpback whale feeding ground near the San Francisco-Monterey Bay Area, nor in PMSR. The ranges for smaller explosive bins are correspondingly shorter. Specifically, the median range to fish mortality due to an E3 (> 0.5–2.5 lb. NEW) explosive, the largest explosive proposed in the NOCAL Range Complex, is 64 m. In the NOCAL Range Complex, any explosive activities will be at least 12 NM from the closest point of land, which will avoid or reduce impacts on fish in nearshore habitat areas. Although any impacts on prey fishes and invertebrates would be limited due to the limited number and size of explosives proposed for use in the NOCAL Range Complex, a small number of prey items that could be present in the nearby and overlapping critical habitat could no longer be available; however, injuries would not be anticipated to remove prey items from the population. Fish prey items that occur within the PMSR and SOCAL Range Complex portions of designated critical habitat and within the estimated ranges to mortality may be killed. Those that are killed within any portion of the proposed critical habitat would no longer be available as prey items. Other potential impacts from exposure to explosions include injury, TTS, physiological stress and behavioral reactions. The ranges to these lower level impacts would be considerably larger than the range to mortality. However, these impacts would not be anticipated to remove individuals (prey) from the population, nor would any non-mortal temporary or isolated impacts on prey items be expected to reduce the quality of prey in terms of nutritional content.

Sonars and vessel, aircraft, and weapons noise during training activities would have <u>*no effect*</u> *on designated critical habitats for humpback whales in the Central American DPS. The use of explosives during training activities* <u>*may affect, but is not likely to adversely affect,*</u> *designated critical habitats for humpback whales in the Central American DPS. Activities that involve the use of pile driving are* <u>*not applicable*</u> *to humpback whale critical habitats because there is no geographic overlap of this stressor with those critical habitats. Air gun activities are not conducted during training.*

Sonars and vessel, aircraft, and weapons noise during testing activities would have <u>*no effect*</u> *on designated critical habitats for humpback whales in the Central American DPS. The use of air guns and explosives during testing activities* <u>*may affect, but is not likely to adversely affect,*</u> *designated critical habitats for humpback whales in the Central American DPS. Pile diving activities are not conducted during testing.*

Sonars and vessel, aircraft, and weapons noise during training activities would have <u>*no effect*</u> *on designated critical habitats for humpback whales in the Mexico DPS. The use of explosives during* *training activities may affect, but is not likely to adversely affect, designated critical habitats for humpback whales in the Mexico DPS. Activities that involve the use of pile driving are not applicable to humpback whale critical habitats because there is no geographic overlap of this stressor with those critical habitats. Air gun activities are not conducted during training.*

Sonars and vessel, aircraft, and weapons noise during testing activities would have no effect on designated critical habitats for humpback whales in the Mexico DPS. The use of air guns and explosives during testing activities may affect, but is not likely to adversely affect, designated critical habitats for humpback whales in the Mexico DPS. Pile diving activities are not conducted during testing.

Table 2.4-8: Estimated Effects to the Central America/Southern Mexico DPS within the California, Oregon, and Washington Stock of Humpback Whales over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Air gun	Navy Testing	0	-	-	-	-
Explosive	Navy Training	18	27	(1)	-	-
Explosive	Navy Testing	13	11	1	-	-
Explosive	USCG Training	0	0	-	-	-
Sonar	Navy Training	166	831	13	-	-
Sonar	Navy Testing	343	472	4	-	-
Sonar	USCG Training	7	-	-	-	-
Maximum Annual Total		**547**	**1,341**	**19**	**-**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
1,603	1.19	0.01

Season	Percent of Total Effects		
	SOCAL	PMSR	NOCAL
Warm	5%	6%	17%
Cold	51%	14%	6%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Medium Coordinated Anti-Submarine Warfare	Navy Training	20%
Anti-Submarine Warfare Tracking Exercise – Ship	Navy Training	12%
Intelligence, Surveillance, Reconnaissance (NAVWAR)	Navy Testing	11%
Acoustic and Oceanographic Research (ONR)	Navy Testing	10%
At-Sea Sonar Testing	Navy Testing	7%
Anti-Submarine Warfare Torpedo Exercise – Ship	Navy Training	6%
Unmanned Underwater Vehicle Testing	Navy Testing	5%

Area Type	Area Name (Active Months)	BEH	TTS	AINJ	INJ	MORT
Critical Habitat	CA Central Coast (All)	25	111	1	-	-
Critical Habitat	CA North Coast (All)	0	1	-	-	-
Critical Habitat	Channel Islands Area (All)	30	141	2	-	-
Critical Habitat	San Francisco Monterey Bay Area (All)	28	295	4	-	-
F-BIA-C	West Coast (3,4,5,6,7,8,9,10,11)	7	28	1	-	-
F-BIA-P	West Coast (3,4,5,6,7,8,9,10,11)	40	214	3	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
BIA Types: S - Small/Resident population, M - Migratory, F - Feeding, R - Reproductive, P - Parent, C - Child/Core
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Table 2.4-9: Estimated Effects to the Mainland Mexico DPS within the California, Oregon, and Washington Stock of Humpback Whales over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Air gun	Navy Testing	0	0	-	-	-
Explosive	Navy Training	35	85	3	-	-
Explosive	Navy Testing	31	29	1	(1)	-
Explosive	USCG Training	(1)	0	-	-	-
Sonar	Navy Training	375	1,906	31	-	-
Sonar	Navy Testing	818	1,155	8	-	-
Sonar	USCG Training	14	-	-	-	-
Maximum Annual Total		**1,274**	**3,175**	**43**	**1**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
3,741	1.20	0.01

	Percent of Total Effects			
Season	SOCAL	PMSR	NOCAL	High Seas
Warm	6%	6%	17%	0%
Cold	52%	12%	6%	1%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Medium Coordinated Anti-Submarine Warfare	Navy Training	19%
Intelligence, Surveillance, Reconnaissance (NAVWAR)	Navy Testing	12%
Anti-Submarine Warfare Tracking Exercise – Ship	Navy Training	11%
Acoustic and Oceanographic Research (ONR)	Navy Testing	10%
At-Sea Sonar Testing	Navy Testing	7%
Anti-Submarine Warfare Torpedo Exercise – Ship	Navy Training	6%
Undersea Warfare Testing	Navy Testing	5%

Area Type	Area Name (Active Months)	BEH	TTS	AINJ	INJ	MORT
Critical Habitat	CA Central Coast (All)	54	222	4	-	-
Critical Habitat	CA North Coast (All)	0	3	0	-	-
Critical Habitat	Channel Islands Area (All)	71	307	4	-	-
Critical Habitat	San Francisco Monterey Bay Area (All)	64	680	10	-	-
F-BIA-C	West Coast (3,4,5,6,7,8,9,10,11)	17	72	1	-	-
F-BIA-P	West Coast (3,4,5,6,7,8,9,10,11)	94	495	8	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
BIA Types: S - Small/Resident population, M - Migratory, F - Feeding, R - Reproductive, P - Parent, C - Child/Core
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2.4.1.4.2 Non-ESA-listed Humpback Whales (Hawaii DPS)

Model-predicted impacts are presented in Table 2.4-10.

The Hawaiian stock of humpback whales has particularly strong site fidelity on hierarchal reproductive BIAs in the nearshore waters surrounding the main Hawaiian Islands during peak breeding season (December through May), although whales may be present through June. Since humpback whales are only seasonally in the Hawaii Study Area, most impacts would occur during the cold season, and are very unlikely to occur during the warm season or on the high seas. Humpback whales may be impacted while engaging in reproductive behaviors in the designated BIAs. Most impacts are due to Anti-Submarine Warfare activities. Most impacts are auditory effects because mysticetes are relatively less sensitive to disturbance. Impacts from explosives would be limited and impacts from air guns would be unlikely.

On average, individuals in the Hawaii stock would be impacted less than once per year. These impacts are most likely to occur in the cold season when humpbacks would be seasonally present in the area and engaged in breeding behavior. The average risk of injury is low, although it is likely that some auditory injuries could occur, particularly from sonar activities during Navy training events. The risk of injury may be reduced through visual observation mitigation.

The risk of repeated exposures to individuals and consequences to populations from disturbances of individuals can be mediated by certain life history traits of a species. Humpback whales are large capital breeders with a slow pace of life. Although some impacts are likely to occur when humpbacks are engaged in feeding behavior, they are expected to be resilient to short-term foraging disruptions due to their reliance on built-up energy reserves. The Hawaii stock of humpback whales is not endangered, and their population trend is unknown. Humpback whales' slow pace of life means that long-term impacts on breeding adults could have a longer-term effect on population growth rates.

The limited instances of predicted behavioral and non-injurious auditory impacts are unlikely to result in any long-term impacts on individuals, although individuals who suffer an auditory injury may experience minor energetic costs. Most predicted impacts are temporary auditory effects that are unlikely to contribute to any long-term impacts on individuals. Long-term consequences to the stock are unlikely.

Table 2.4-10: Estimated Effects to the Hawaii Stock of Humpback Whales over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Air gun	Navy Testing	(1)	-	-	-	-
Explosive	Navy Training	48	58	7	-	-
Explosive	Navy Testing	40	32	2	-	-
Explosive	Army Training	3	1	-	-	-
Sonar	Navy Training	780	1,358	11	-	-
Sonar	Navy Testing	348	358	4	-	-
Sonar	USCG Training	7	-	-	-	-
Maximum Annual Total		**1,227**	**1,807**	**24**	**-**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
11,278	0.27	0.00

Season	Percent of Total Effects: HRC	Percent of Total Effects: High Seas
Warm	1%	0%
Cold	97%	2%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Medium Coordinated Anti-Submarine Warfare	Navy Training	13%
Anti-Submarine Warfare Torpedo Exercise – Ship	Navy Training	11%
Submarine Navigation	Navy Training	10%
Anti-Submarine Warfare Tracking Exercise – Ship	Navy Training	7%
Surface Ship Object Detection	Navy Training	6%
Anti-Submarine Warfare Torpedo Exercise – Submarine	Navy Training	6%
Acoustic and Oceanographic Research (ONR)	Navy Testing	6%

Area Type	Area Name (Active Months)	BEH	TTS	AINJ	INJ	MORT
R-BIA-C	Main Hawaiian Islands (1,2,3,4,5,12)	237	200	6	-	-
R-BIA-P	Main Hawaiian Islands (1,2,3,4,5,12)	838	545	10	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
BIA Types: S - Small/Resident population, M - Migratory, F - Feeding, R - Reproductive, P - Parent, C - Child/Core
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2.4.1.5 Minke Whale (*Balaenoptera acutorostrata*)

Minke whales are in the LF cetacean auditory group and the Mysticete behavioral group. Two stocks are in the Study Area – the California, Oregon, and Washington stock and the Hawaii stock. Model-predicted impacts are presented in Table 2.4-11 and Table 2.4-12.

The California, Oregon, and Washington stock generally congregates in nearshore waters over the continental shelf off California and has low variability in annual distribution patterns. Their year-round abundance in Southern California overlaps areas where Anti-Submarine Warfare activities would occur. Most impacts on this stock are due to these activities. Auditory impacts are also attributable to low and mid-frequency sonars during other testing activities, including those with higher duty cycles. Most impacts are auditory effects because mysticetes are relatively less sensitive to disturbance. The number of impacts due to explosives are limited and the risk of impacts due to air guns is negligible.

The Hawaii stock generally congregates in Hawaiian water in the colder months (fall to spring) and migrates to more productive areas in winter. Their seasonally high densities in Hawaii in the colder months overlaps areas where Anti-Submarine Warfare activities would occur. Most impacts on this stock are due to these activities. Most impacts are auditory effects because mysticetes are relatively less sensitive to disturbance. The number of impacts due to explosives are negligible.

On average, individuals in the California, Oregon, and Washington stock could be impacted a couple times a year, and individuals in the Hawaii stock would be impacted less than once per year. The average risk of injury is low, although auditory injuries are predicted. The risk of injury may be reduced through visual observation mitigation, although minke whales have a relatively low sightability.

The risk of repeated exposures to individuals and consequences to populations from disturbances of individuals can be mediated by certain life history traits of a species. Although they are the smallest mysticete, minke whales are large capital breeders with a slow pace of life. Migratory minke whales in Hawaii are likely to sustain fewer impacts during the warm season when their local abundance is lower, whereas impacts off the U.S. west coast would likely occur for more resident minke populations year-round. Although some impacts are likely to occur when minke whales are engaged in feeding behavior, they are expected to be resilient to short-term foraging disruptions due to their reliance on built-up energy reserves. Population trends for minke whales are unknown. Both stocks of minke whales are not endangered. Their slow pace of life means that long-term impacts on breeding adults could have a longer-term effect on population growth rates.

The limited instances of predicted behavioral and non-injurious auditory impacts are unlikely to result in any long-term impacts on individuals, although individuals who suffer an auditory injury may experience minor energetic costs. Most predicted impacts are temporary auditory effects that are unlikely to contribute to any long-term impacts on individuals. Long-term consequences to the stock are unlikely.

Table 2.4-11: Estimated Effects to the California, Oregon, and Washington Stock of Minke Whales over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Air gun	Navy Testing	0	-	-	-	-
Explosive	Navy Training	29	81	9	-	-
Explosive	Navy Testing	9	10	1	-	0
Explosive	USCG Training	0	0	-	-	-
Sonar	Navy Training	334	1,242	15	-	-
Sonar	Navy Testing	563	718	7	-	-
Sonar	USCG Training	7	-	-	-	-
Maximum Annual Total		**942**	**2,051**	**32**	**-**	**0**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
1,342	2.25	0.02

Season	Percent of Total Effects		
	SOCAL	PMSR	NOCAL
Warm	36%	7%	7%
Cold	39%	6%	5%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Medium Coordinated Anti-Submarine Warfare	Navy Training	14%
Anti-Submarine Warfare Tracking Exercise – Ship	Navy Training	13%
Intelligence, Surveillance, Reconnaissance (NAVWAR)	Navy Testing	12%
Acoustic and Oceanographic Research (ONR)	Navy Testing	8%
At-Sea Sonar Testing	Navy Testing	7%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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Table 2.4-12: Estimated Effects to the Hawaii Stock of Minke Whales over a Maximum Year of Proposed Activity

Source	Category	BEH	TTS	AINJ	INJ	MORT
Explosive	Navy Training	1	(1)	-	-	-
Explosive	Navy Testing	1	(1)	0	-	-
Explosive	Army Training	(1)	-	-	-	-
Sonar	Navy Training	27	200	2	-	-
Sonar	Navy Testing	12	50	(1)	-	-
Sonar	USCG Training	2	-	-	-	-
Maximum Annual Total		**44**	**252**	**3**	**-**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
509	0.59	0.01

Season	Percent of Total Effects	
	HRC	High Seas
Warm	29%	2%
Cold	67%	3%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Medium Coordinated Anti-Submarine Warfare	Navy Training	37%
Anti-Submarine Warfare Tracking Exercise – Ship	Navy Training	13%
Acoustic and Oceanographic Research (ONR)	Navy Testing	9%
Submarine Sonar Maintenance and Systems Checks	Navy Training	7%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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2.4.1.6 Gray Whale (*Eschrichtius robustus*)*

Gray whales are in the LF cetacean auditory group and the Mysticete behavioral group. Two stocks are in the Study Area – the Eastern North Pacific stock (not ESA-listed) and the Western North Pacific stock (the Western North Pacific DPS – endangered).

2.4.1.6.1 ESA-listed Gray Whales (Western North Pacific DPS)

Model-predicted impacts are presented in Table 2.4-13.

Gray whales are migratory marine mammals and could be present in the California Study Area during their northward and southward migrations from winter to spring, within 10 km of the coast. However, the Western North Pacific stock is very rare in the Study Area since it is critically endangered and abundance is very low. Impacts would be more likely in the cold season in Southern California as they migrate north. Their higher seasonal abundance in this area overlaps areas where Anti-Submarine Warfare activities would occur. Most sonar impacts on the Western North Pacific stock are due to these activities. Most impacts are auditory effects because mysticetes are relatively less sensitive to disturbance. Impacts from explosives would be extremely limited.

On average, individuals in the Western North Pacific stock would be impacted less than once per year. These impacts are most likely to occur in the cold season when gray whales would be only seasonally in the area during migration. The average risk of injury is very low, although it is possible that a couple auditory injuries could occur. Additionally, the risk of an auditory injury from training sonar is less than one in any year, but an auditory injury is shown in the maximum year of impacts due to summing risk across seven years and following the rounding approach discussed in Section 2.4 (Species Impact Assessments). Therefore, the risk of auditory injury from any source is unlikely (less than two) for the Western North Pacific stock. The risk of injury for this stock of gray whales may be reduced through visual observation mitigation.

The risk of repeated impacts on individuals and consequences to populations from disturbances of individuals can be mediated by certain life history traits of a species. Gray whales are large capital breeders with a slow pace of life. They are expected to be resilient to short-term foraging disruptions due to their reliance on built-up energy reserves. However, the Western North Pacific stock is endangered and shows no apparent signs of recovery. Their slow pace of life means that long-term impacts on breeding adults could have a longer-term effect on population growth rates.

The limited instances of predicted behavioral and non-injurious auditory impacts are unlikely to result in any long-term impacts on individuals, although individuals who suffer an auditory injury may experience minor energetic costs. Most predicted impacts are temporary auditory effects that are unlikely to contribute to any long-term impacts on individuals. Long-term consequences to the stock are unlikely.

Based on the analysis presented above, activities that produce vessel, aircraft, and weapons noise during training activities <u>may affect, but are not likely to adversely affect,</u> gray whales in the Western North Pacific DPS. The use of sonars and explosives during training activities <u>may affect, and are likely to adversely affect,</u> gray whales in the Western North Pacific DPS. Noise produced by pile driving would have <u>no effect</u> on gray whales in the Western North Pacific DPS. Air gun activities are not conducted during training.

Based on the analysis presented above, activities that produce vessel, aircraft, and weapons noise during testing activities <u>may affect, but are not likely to adversely affect,</u> gray whales in the Western North Pacific DPS. The use of sonars and explosives during testing activities <u>may affect, and are likely to</u>

adversely affect, gray whales in the Western North Pacific DPS. Noise produced by air guns would have no effect on gray whales in the Western North Pacific DPS. Pile diving activities are not conducted during testing.

Table 2.4-13: Estimated Effects to the Western North Pacific DPS of Gray Whales over a Maximum Year of Proposed Activity

Source	Category	BEH	TTS	AINJ	INJ	MORT
Explosive	Navy Training	(1)	(1)	0	-	-
Explosive	Navy Testing	2	(1)	0	-	-
Sonar	Navy Training	18	28	(1)	-	-
Sonar	Navy Testing	50	67	1	-	-
Sonar	USCG Training	(1)	-	-	-	-
Maximum Annual Total		**72**	**97**	**2**	**-**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
290	0.59	0.01

Season	Percent of Total Effects	
	SOCAL	PMSR
Warm	0%	0%
Cold	97%	3%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
At-Sea Sonar Testing	Navy Testing	21%
Intelligence, Surveillance, Reconnaissance (NAVWAR)	Navy Testing	19%
Anti-Submarine Warfare Torpedo Exercise – Ship	Navy Training	19%
Undersea Warfare Testing	Navy Testing	15%
Unmanned Underwater Vehicle Testing	Navy Testing	10%
Anti-Submarine Warfare Tracking Exercise – Ship	Navy Training	5%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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2.4.1.6.2 Non-ESA-listed Gray Whales (Eastern North Pacific DPS)

Model-predicted impacts are presented in Table 2.4-14.

The Eastern North Pacific stock of gray whales may be present in the California Study Area in higher densities than the Western North Pacific stock of gray whales since this stock is not endangered and has a greater abundance. Impacts on the Eastern North Pacific stock of gray whales would be more likely in the cold season as they migrate north of the Bering Sea to forage in the summer. Their higher seasonal abundance in the hierarchical migratory BIAs and non- hierarchical reproductive BIA, especially in Southern California, overlaps areas where Anti-Submarine Warfare activities would occur. Gray whales may be impacted while migrating and engaging in reproductive behaviors in the designated BIAs. Since multiple BIAs overlap geographically and sometimes seasonally, BIAs' impacts in Table 2.4-14 are not mutually exclusive. For example, the gray whale Northbound Phase A and Northbound Phase B BIAs are geographically the same but are distinct in demographic and season. The Phase B migration BIA is used by mother-calf pairs in a more limited seasonal window (March–May) compared to the Phase A migration BIA used by adults and juveniles (January–May). Most sonar impacts on the Western North Pacific stocks are due to these activities. Most impacts are auditory effects because mysticetes are relatively less sensitive to disturbance. Impacts from explosives would occur from a variety of activities, primarily Mine Warfare. No impacts are predicted for air guns.

On average, individuals in the Eastern North Pacific stock would be impacted less than once per year. These impacts are most likely to occur in the cold season when gray whales would be only seasonally in the area during migration. The average risk of injury is very low, although it is likely that some auditory injuries could occur, particularly from sonar during Anti-Submarine Warfare activities or explosives during Mine Warfare activities. The risk of injury for this stock of gray whales may be reduced through visual observation mitigation.

The risk of repeated impacts on individuals and consequences to populations from disturbances of individuals can be mediated by certain life history traits of a species. Gray whales are large capital breeders with a slow pace of life. They are expected to be resilient to short-term foraging disruptions due to their reliance on built-up energy reserves. Although the Eastern North Pacific stock of gray whales is not endangered, there was an unusual mortality event for this stock of gray whales within their range from 2019 to 2024, in which hundreds of whales died and decreased the population by 40%. Their slow pace of life means that long-term impacts on breeding adults could have a longer-term effect on population growth rates.

The limited instances of predicted behavioral and non-injurious auditory impacts are unlikely to result in any long-term impacts on individuals, although individuals who suffer an auditory injury may experience minor energetic costs. Most predicted impacts are temporary auditory effects that are unlikely to contribute to any long-term impacts on individuals. Long-term consequences to the stock are unlikely.

Table 2.4-14: Estimated Effects to the Eastern North Pacific DPS of Gray Whales over a Maximum Year of Proposed Activity

Source	Category	BEH	TTS	AINJ	INJ	MORT
Air gun	Navy Testing	0	-	-	-	-
Explosive	Navy Training	234	391	33	0	-
Explosive	Navy Testing	123	56	5	0	-
Explosive	USCG Training	0	(1)	-	-	-
Sonar	Navy Training	1,903	2,390	65	-	-
Sonar	Navy Testing	4,876	6,722	64	-	-
Sonar	USCG Training	15	-	-	-	-
Maximum Annual Total		**7,151**	**9,560**	**167**	**0**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
26,960	0.63	0.01

Season	Percent of Total Effects: SOCAL	PMSR
Warm	1%	0%
Cold	97%	2%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
At-Sea Sonar Testing	Navy Testing	20%
Intelligence, Surveillance, Reconnaissance (NAVWAR)	Navy Testing	19%
Anti-Submarine Warfare Torpedo Exercise - Ship	Navy Training	16%
Undersea Warfare Testing	Navy Testing	14%
Unmanned Underwater Vehicle Testing	Navy Testing	8%

Area Type	Area Name (Active Months)	BEH	TTS	AINJ	INJ	MORT
M-BIA-C	Northbound Phase A (1,2,3,4,5)	6,969	9,357	157	-	-
M-BIA-C	Northbound Phase B (3,4,5)	5,672	7,844	132	-	-
M-BIA-C	Southbound (11,12,1,2)	1,338	1,556	29	-	-
M-BIA-P	West Coast to Gulf of Alaska (11,12,1,2,3,4,5,6)	7,023	9,417	163	-	-
R-BIA	Northbound Phase B (3,4,5)	5,672	7,844	132	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.

Source	Category	BEH	TTS	AINJ	INJ	MORT

Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
BIA Types: S - Small/Resident population, M - Migratory, F - Feeding, R - Reproductive, P - Parent, C - Child/Core
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2.4.1.7 Sei Whale (*Balaenoptera borealis*)*

Sei whales are in the LF cetacean auditory group and the Mysticete behavioral group. Two stocks are in the Study Area – the Eastern North Pacific stock and the Hawaii stock. Sei whales are listed as endangered throughout their range with no designated DPSs. Model-predicted impacts are presented in Table 2.4-15 and Table 2.4-16.

Sei whales generally have higher abundances in the cold and deep water of the open ocean. The Eastern North Pacific stock of sei whales has some seasonal migrations that are less extensive compared to other mysticetes. This stock of sei whales is most frequently found in the offshore waters of California, and likely occur in the Transit Corridor portion of the Study Area. Their year-round higher densities in deep waters near Southern California overlap areas where Anti-Submarine Warfare activities would occur. Most impacts on this stock are due to these activities. Most impacts are auditory effects because mysticetes are relatively less sensitive to disturbance. The number of impacts due to explosives are limited and there are no predicted impacts due to air guns.

The Hawaii stock of sei whales is migratory, traveling from their cold subpolar latitudes to Hawaii in the winter. While they are not frequently detected in Hawaii, they are more likely to be on the Hawaii Range Complex in the cold season which overlaps areas where Anti-Submarine Warfare activities would occur. Most impacts on this stock are due to these activities. Most impacts are auditory effects because mysticetes are relatively less sensitive to disturbance. Impacts due to explosives are unlikely and there are no predicted impacts due to air guns.

On average, individuals from either stock would be impacted less than once per year. The average risk of injury is negligible, although a few auditory injuries are predicted. The risk of a single auditory injury from testing explosives or testing sonar is low (less than one) in any year for the Eastern North Pacific stock, but an auditory injury is shown in the maximum year of impacts due to summing risk across seven years and following the rounding approach discussed in Section 2.4 (Species Impact Assessments). Likewise, the risk of a single auditory injury from testing or training sonar is low (less than one) in any year for the Hawaii stock, but an auditory injury is shown in the maximum year of impacts due to summing risk across seven years and following the rounding approach. These auditory injuries are shown in the maximum year of impacts per the summation and rounding approach discussed above. Therefore, the risk of auditory injury from any source is unlikely for either the Eastern North Pacific and Hawaii stocks (less than three and two, respectively). The risk of injury may be reduced through activity-based mitigation because sei whales are moderately sightable.

The risk of repeated impacts on individuals and consequences to populations from disturbances of individuals can be mediated by certain life history traits of a species. Sei whales are large capital breeders with a slow pace of life. Migratory sei whales in Hawaii are likely to sustain fewer impacts during the warm season when their local abundance is lower, whereas impacts off the U.S. west coast, and particularly in Southern California are more likely to occur year-round. Sei whales are expected to be resilient to short-term foraging disruptions due to their reliance on built-up energy reserves. Population trends for sei whales are unknown. Both stocks are endangered. Their slow pace of life means that long-term impacts on breeding adults could have a longer-term effect on population growth rates.

Limited instances of predicted behavioral and non-injurious auditory impacts are unlikely to result in any long-term impacts on individuals, although individuals who suffer an auditory injury may experience minor energetic costs. Most predicted impacts are temporary auditory effects that are unlikely to contribute to any long-term impacts on individuals. Long-term consequences to the stock are unlikely.

Based on the analysis presented above, activities that produce vessel, aircraft, and weapons noise during training activities may affect, but are not likely to adversely affect, sei whales. The use of sonars and explosives during training activities may affect, and are likely to adversely affect, sei whales. Activities that involve the use of pile driving are not applicable to sei whales because there is no geographic overlap of this stressor with species occurrence. Air gun activities are not conducted during training.

Based on the analysis presented above, activities that produce vessel, aircraft, and weapons noise during testing activities may affect, but are not likely to adversely affect, sei whales. The use of sonars and explosives during testing activities may affect, and are likely to adversely affect, sei whales. Noise produced by air guns would have no effect on sei whales. Pile diving activities are not conducted during testing.

Table 2.4-15: Estimated Effects to the Eastern North Pacific Stock of Sei Whales over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Explosive	Navy Training	5	1	0	-	-
Explosive	Navy Testing	2	2	(1)	-	-
Sonar	Navy Training	38	151	1	-	-
Sonar	Navy Testing	37	65	(1)	-	-
Sonar	USCG Training	1	-	-	-	-
Maximum Annual Total		**83**	**219**	**3**	**-**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
864	0.35	0.00

	Percent of Total Effects			
Season	**SOCAL**	**PMSR**	**NOCAL**	**High Seas**
Warm	30%	5%	5%	2%
Cold	42%	8%	7%	1%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Medium Coordinated Anti-Submarine Warfare	Navy Training	17%
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	13%
Acoustic and Oceanographic Research (ONR)	Navy Testing	12%
Small Joint Coordinated Anti-Submarine Warfare	Navy Training	9%
Composite Training Unit Exercise (Strike Group)	Navy Training	7%
Intelligence, Surveillance, Reconnaissance (NAVWAR)	Navy Testing	6%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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Table 2.4-16: Estimated Effects to the Hawaii Stock of Sei Whales over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Explosive	Navy Training	1	(1)	0	-	-
Explosive	Navy Testing	0	0	-	-	-
Explosive	USCG Training	-	0	-	-	-
Sonar	Navy Training	25	173	(1)	-	-
Sonar	Navy Testing	11	41	(1)	-	-
Sonar	USCG Training	1	-	-	-	-
Maximum Annual Total		**38**	**215**	**2**	**-**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
452	0.56	0.00

Season	Percent of Total Effects	
	HRC	High Seas
Warm	30%	1%
Cold	65%	4%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Medium Coordinated Anti-Submarine Warfare	Navy Training	37%
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	18%
Acoustic and Oceanographic Research (ONR)	Navy Testing	9%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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2.4.2 Impacts on Odontocetes

The odontocetes are divided into the HF and VHF cetacean hearing groups. In addition to proposing more hours of hull-mounted sonars in this Proposed Action, the updated HF cetacean criteria reflect greater susceptibility to auditory effects at low and mid-frequencies than previously analyzed. Consequently, the predicted auditory effects due to sources under 10 kHz, including but not limited to MF1 hull-mounted sonar and other anti-submarine warfare sonars, are substantially higher for this auditory group than in prior analyses of the same activities. Thus, for activities with sonars, some modeled exposures that would previously have been categorized as significant behavioral responses may now instead be counted as auditory effects (TTS and AINJ). Similarly, the updated HF cetacean criteria reflect greater susceptibility to auditory effects at low and mid-frequencies in impulsive sounds. For VHF cetaceans, susceptibility to auditory effects has not changed substantially since the prior analysis.

The methods to model sonar avoidance have also been revised to base a species' probability of an avoidance responses on the behavioral response functions as described in Section 2.2.2 (Quantifying Impacts on Hearing). The combined behavioral response function for Sensitive Species replaces the two prior distinct behavioral response functions for beaked whales and porpoises. Due to their greater susceptibility to disturbance, HF and VHF cetaceans in the Sensitive behavioral group are predicted to avoid many auditory injuries. All other odontocetes remain in the Odontocete behavioral group, including VHF cetaceans that are not behaviorally sensitive (e.g., Dall's porpoise and Kogia whales). Because the probability of behavioral response has decreased for the Odontocete behavioral group while the estimated susceptibility to auditory effects has increased for the HF hearing group (susceptibility to auditory effects has not notably changed for the VHF cetaceans), this analysis predicts more auditory impacts than the prior analysis for these species. The cut-off conditions for predicting significant behavioral responses have also been revised for both the Sensitive Species and Odontocete behavioral groups as shown in Section 2.2.3 (Quantifying Behavioral Responses to Sonars). These factors interact in complex ways that make comparing the results of this analysis to prior analyses challenging.

Impacts due to non-modeled acoustic stressors are discussed above in Section 2.1.4 (Impacts from Vessel Noise), Section 2.1.5 (Impacts from Aircraft Noise), and Section 2.1.6 (Impacts from Weapons Noise).

2.4.2.1 Sperm Whale (*Physeter macrocephalus*)*

Sperm whales are in the HF cetacean auditory group and the Odontocete behavioral group. Two stocks are in the Study Area – the California, Oregon, and Washington stock and the Hawaii stock. Sperm whales are listed as endangered throughout their range with no designated DPSs. Model-predicted impacts are presented in Table 2.4-17 and Table 2.4-18.

Sperm whales generally have higher abundances in deep water and areas of high productivity. The California, Oregon, and Washington stock of sperm whales are somewhat migratory. While some individuals leaving warm waters in summer to travel to their arctic feeding grounds and returning south in the fall and winter, an annual density estimate was applied to the California portion of the Study Area since seasonally specific values are not currently available. A portion of this stock found year-round in California waters over the continental shelf break, over the continental slope, and into deeper waters. Most impacts on this stock are due to antisubmarine warfare activities in the Southern California portion of the study area, which could overlap areas with higher sperm whale densities in deep waters. The number of impacts due to explosives are limited and there are no predicted impacts due to air guns.

The Hawaii stock of sperm whales is more residential and are one of the more abundant large whales found in that region. Sperm whales occur in Hawaiian waters year-round, overlapping areas where Anti-Submarine Warfare activities would occur. Most impacts on this stock are due to these activities. Most impacts are auditory effects because mysticetes are relatively less sensitive to disturbance. Impacts due to explosives and air guns would be limited.

On average, individuals from either stock would be impacted less than once per year. The annual average individual risk of injury is negligible, although a few auditory injuries are predicted. The risk of any auditory injury due to training explosives, testing explosives, and training sonar is low (less than one) in any year for the California, Oregon, and Washington stock, but auditory injuries are shown in the maximum year of impacts due to summing risk across seven years and following the rounding approach discussed in Section 2.4 (Species Impact Assessments). Likewise, the risk of a single auditory injury from training explosives is low (less than one) in any year for the Hawaii stock, but an auditory injury is shown in the maximum year of impacts due to summing risk across seven years and following the rounding approach. The risk of injury may be reduced through visual observation mitigation.

The risk of repeated impacts on individuals and consequences to populations from disturbances of individuals can be mediated by certain life history traits of a species. As large odontocetes with a slow pace of life, sperm whales are likely more resilient to missed foraging opportunities due to acoustic disturbance than smaller odontocetes. Still, sperm whales are income breeders and may be more susceptible to impacts due to lost foraging opportunities during reproduction, especially if they occur during lactation (Farmer et al., 2018). Sperm whales are somewhat migratory, but their movement ecology is demographically dependent. Nursery groups of females, claves and non-adult males are more residential, staying near warm equatorial breeding grounds throughout the year. Groups of adult males are more migratory, traveling from warm waters in the summer to feeding grounds as far north as the

Arctic. Migratory whales may be less susceptible to repeated impacts than residential whales near range complexes. Because of their longer generation times, this population would require more time to recover if significantly impacted. In addition, both stocks of sperm whales are endangered and depleted with unknown population trends, although it is possible that sperm whales in California, Oregon, and Washington have a stable population.

The limited instances of predicted behavioral and non-injurious auditory impacts are unlikely to result in any long-term impacts on individuals, although individuals who suffer an auditory injury may experience minor energetic costs. Long-term consequences to the stock are unlikely.

Based on the analysis presented above, activities that produce vessel, aircraft, and weapons noise during training activities may affect, but are not likely to adversely affect, sperm whales. The use of sonars and explosives during training activities may affect, and are likely to adversely affect, sperm whales. Activities that involve the use of pile driving are not applicable to sperm whales because there is no geographic overlap of this stressor with species occurrence. Air gun activities are not conducted during training.

Based on the analysis presented above, activities that produce vessel, aircraft, and weapons noise during testing activities may affect, but are not likely to adversely affect, sperm whales. The use of sonars, explosives, and air guns during testing activities may affect, and are likely to adversely affect, sperm whales. Pile diving activities are not conducted during testing.

Table 2.4-17: Estimated Effects to the California, Oregon, and Washington Stock of Sperm Whales over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Explosive	Navy Training	2	4	(1)	-	-
Explosive	Navy Testing	2	1	(1)	-	-
Explosive	USCG Training	0	-	-	-	-
Sonar	Navy Training	2,133	758	(1)	-	-
Sonar	Navy Testing	834	129	-	-	-
Sonar	USCG Training	28	-	-	-	-
Maximum Annual Total		**2,999**	**892**	**3**	**-**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
4,549	0.86	0.00

Season	Percent of Total Effects			
	SOCAL	PMSR	NOCAL	High Seas
Warm	32%	6%	5%	2%
Cold	38%	9%	5%	2%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	20%
Medium Coordinated Anti-Submarine Warfare	Navy Training	18%
Small Joint Coordinated Anti-Submarine Warfare	Navy Training	7%
Composite Training Unit Exercise (Strike Group)	Navy Training	6%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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Table 2.4-18: Estimated Effects to the Hawaii Stock of Sperm Whales over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Air gun	Navy Testing	(1)	-	-	-	-
Explosive	Navy Training	2	1	(1)	-	-
Explosive	Navy Testing	0	(1)	-	-	-
Sonar	Navy Training	939	354	0	-	-
Sonar	Navy Testing	288	56	0	-	-
Sonar	USCG Training	7	-	-	-	-
Maximum Annual Total		**1,237**	**412**	**1**	**-**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
6,062	0.27	0.00

Season	Percent of Total Effects	
	HRC	High Seas
Warm	43%	2%
Cold	51%	4%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Medium Coordinated Anti-Submarine Warfare	Navy Training	29%
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	10%
Submarine Sonar Maintenance and Systems Checks	Navy Training	9%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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2.4.2.2 Dwarf and Pygmy Sperm Whale (*Kogia sima* and *Kogia breviceps*)

Dwarf and pygmy sperm whales are analyzed together, as these species are difficult to distinguish during wildlife surveys and as a result are frequently classified together as Kogia species. Kogia species are in the VHF cetacean auditory group and the Odontocete behavioral group. Two stocks are in the Study Area – the California, Oregon, and Washington stock and the Hawaii stock. Model-predicted impacts are presented in Table 2.4-19 and Table 2.4-20 for dwarf sperm whales, and Table 2.4-21 and Table 2.4-22 for pygmy sperm whales.

Kogia density values for the Study Area are presented differently for Hawaii and California. In Hawaii there is enough data on dwarf and pygmy sperm whales to provide density estimates for each species separately, but fewer live sightings have occurred off the U.S. west coast, so density values are provided for Kogia as a genus. Additionally, density data are insufficient to identify any seasonal patterns in the distribution of Kogia, so these estimates are considered to represent year-round densities. Kogia's higher densities in deep waters along California, especially Southern California, overlap areas where Anti-Submarine Warfare activities would occur. Most sonar impacts on the California, Oregon, and Washington stocks of dwarf and pygmy sperm whales are due to these activities. The number of impacts due to explosives and air guns in this portion of the Study Area are limited. There would be no impacts due to pile driving because there is no geographic overlap of this stressor with species occurrence.

There are hierarchical small and resident population BIAs for dwarf sperm whales on the west coast of the island of Hawaii. Dwarf sperm whales may be minimally impacted while in the nearshore designated BIAs. Both stocks of Kogia are present year-round in Hawaii with higher densities on the Hawaii Range Complex, which overlaps areas where Anti-Submarine Warfare activities would occur. Most sonar impacts on the Hawaii stocks of dwarf and pygmy sperm whales are due to these activities. Dwarf sperm whales appear to prefer tropical waters more than pygmy sperm whales, which are rarely reported, and may contribute to the higher impacts on dwarf sperm whales in Hawaii. Impacts from explosives would occur from a variety of activities, including Amphibious Breaching Operations, Missile and Gunnery Exercises, and Mine Countermeasure activities that have specific on-site mitigations that may reduce the number of impacts on marine mammals in the area (see the *Mitigation* section for details). The number of impacts due to air guns are limited.

On average, individuals in the Hawaii stocks could be impacted about once per year, and individuals in the California, Oregon, and Washington stocks would be impacted a couple times per year. The average risk of injury is low, although a few auditory and non-auditory injuries are predicted. The risk of any air gun auditory injury is negligible (less than one) in any year for the Hawaii stock of dwarf sperm whales, but an auditory injury is shown in the maximum year of impacts due to summing risk across seven years and following the rounding approach discussed in Section 2.4 (Species Impact Assessments). Likewise, the risk of a non-auditory injury from explosives is also incredibly low (less than one) in any year for either stock, but an auditory injury is shown in the maximum year of impacts due to summing risk across seven years and following the rounding approach. These auditory and non-auditory injuries are shown in the maximum year of impacts per the summation and rounding approach discussed above. The risk of injury may be reduced through visual observation mitigation, although Kogia are cryptic and have low sightability.

The risk of repeated exposures to individuals and consequences to populations from disturbances of individuals can be mediated by certain life history traits of a species. As small-medium odontocetes that are income breeders with a fast pace of life, dwarf and pygmy sperm whales are likely less resilient to missed foraging opportunities, especially during lactation. Little is known about the movement ecology of these stocks, other than a small resident population of dwarf sperm whales off the west coast of the Island of Hawaii, which will likely increase the risk of repeated impacts on individual dwarf sperm whales in that portion of the Study Area. Although reproduction in populations with a fast pace of life are more sensitive to foraging disruption, these populations would be quick to recover.

The limited instances of predicted behavioral and non-injurious auditory impacts are unlikely to result in any long-term impacts on individuals, although individuals who suffer an auditory or non-auditory injury may experience minor energetic costs. Most predicted impacts are temporary auditory effects that are unlikely to contribute to any long-term impacts on individuals. Long-term consequences to these stocks are unlikely.

Table 2.4-19: Estimated Effects to the California, Oregon, and Washington Stock of Dwarf Sperm Whales over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Air gun	Navy Testing	1	1	-	-	-
Explosive	Navy Training	12	35	13	-	-
Explosive	Navy Testing	20	33	17	-	0
Explosive	USCG Training	(1)	(1)	(1)	-	-
Sonar	Navy Training	936	3,346	37	-	-
Sonar	Navy Testing	519	709	26	-	-
Sonar	USCG Training	16	34	-	-	-
Maximum Annual Total		**1,505**	**4,159**	**94**	**-**	**0**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
2,462	2.34	0.04

Season	Percent of Total Effects			
	SOCAL	PMSR	NOCAL	High Seas
Warm	32%	4%	6%	1%
Cold	43%	6%	7%	1%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	24%
Medium Coordinated Anti-Submarine Warfare	Navy Training	17%
Small Joint Coordinated Anti-Submarine Warfare	Navy Training	8%
Composite Training Unit Exercise (Strike Group)	Navy Training	7%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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Table 2.4-20: Estimated Effects to the Hawaii Stock of Dwarf Sperm Whales over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Air gun	Navy Testing	8	5	(1)	-	-
Explosive	Navy Training	272	407	171	(1)	0
Explosive	Navy Testing	86	107	27	0	0
Explosive	USCG Training	1	1	(1)	-	-
Explosive	Army Training	51	46	12	-	-
Sonar	Navy Training	8,114	27,505	329	-	-
Sonar	Navy Testing	2,189	6,048	371	-	-
Sonar	USCG Training	159	225	2	-	-
Maximum Annual Total		**10,880**	**34,344**	**914**	**1**	**0**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
43,246	1.07	0.02

Season	Percent of Total Effects	
	HRC	High Seas
Warm	43%	3%
Cold	50%	4%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Medium Coordinated Anti-Submarine Warfare	Navy Training	32%
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	13%
Submarine Sonar Maintenance and Systems Checks	Navy Training	7%
Vehicle Testing	Navy Testing	7%

Area Type	Area Name (Active Months)	BEH	TTS	AINJ	INJ	MORT
S-BIA-C	Hawaii Island (All)	0	3	0	-	-
S-BIA-P	Hawaii Island (All)	1	14	2	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
BIA Types: S - Small/Resident population, M - Migratory, F - Feeding, R - Reproductive, P - Parent, C - Child/Core
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Table 2.4-21: Estimated Effects to the California, Oregon, and Washington Stock of Pygmy Sperm Whales over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Air gun	Navy Testing	(1)	1	-	-	-
Explosive	Navy Training	19	41	23	0	-
Explosive	Navy Testing	22	33	18	-	-
Explosive	USCG Training	(1)	(1)	0	-	-
Sonar	Navy Training	964	3,216	43	-	-
Sonar	Navy Testing	525	743	23	-	-
Sonar	USCG Training	17	31	-	-	-
Maximum Annual Total		**1,549**	**4,066**	**107**	**0**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
4,111	1.39	0.03

	Percent of Total Effects			
Season	SOCAL	PMSR	NOCAL	High Seas
Warm	30%	4%	6%	1%
Cold	44%	6%	7%	1%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	22%
Medium Coordinated Anti-Submarine Warfare	Navy Training	18%
Small Joint Coordinated Anti-Submarine Warfare	Navy Training	8%
Composite Training Unit Exercise (Strike Group)	Navy Training	7%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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Table 2.4-22: Estimated Effects to the Hawaii Stock of Pygmy Sperm Whales over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Air gun	Navy Testing	6	6	1	-	-
Explosive	Navy Training	259	414	167	(1)	0
Explosive	Navy Testing	97	114	28	0	-
Explosive	USCG Training	1	(1)	(1)	-	-
Explosive	Army Training	57	51	15	-	-
Sonar	Navy Training	8,131	27,918	350	-	-
Sonar	Navy Testing	2,243	6,137	373	-	-
Sonar	USCG Training	160	192	-	-	-
Maximum Annual Total		**10,954**	**34,833**	**935**	**1**	**0**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
48,589	0.96	0.02

Season	Percent of Total Effects	
	HRC	High Seas
Warm	43%	3%
Cold	50%	4%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Medium Coordinated Anti-Submarine Warfare	Navy Training	32%
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	13%
Submarine Sonar Maintenance and Systems Checks	Navy Training	7%
Vehicle Testing	Navy Testing	7%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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2.4.2.3 Baird's Beaked Whale (*Berardius bairdii)*

Baird's beaked whales are in the HF cetacean auditory group and the Sensitive behavioral group. The California, Oregon, and Washington stock is the only stock in the Study Area. Model-predicted impacts are presented in Table 2.4-23.

Baird's beaked whales range from Mexico to Alaska and are typically found in deep waters over the continental slope, near oceanic seamounts, and areas with submarine escarpments, although they may be seen close to shore where deep water approaches the coast. While the California, Oregon, and Washington stock is primarily located along the continental slope during the warm season and are presumed to be farther offshore during part of the cold season, the lack of quantitative seasonal information on this species resulted in these density estimates being applied year-round. Overall, this stock seems to have a higher density in the cold waters of northern California, however there is still a concentration of Baird's beaked whales in deep waters offshore southern California which overlaps areas where a relatively high concentration of Anti-Submarine Warfare activities would occur. Most sonar impacts on this stock are due to these activities. Most impacts are behavioral effects because beaked whales are in the Sensitive behavioral group and are relatively more avoidant to noise sources. The number of impacts due to explosives is extremely limited and there would be no impacts due to air guns.

On average, individuals from the California, Oregon, and Washington stock would be impacted several times per year. Most of these impacts would be behavioral responses. There is no predicted risk of auditory or non-auditory injury to this stock.

The risk of repeated impacts on individuals and consequences to populations from disturbances of individuals can be mediated by certain life history traits of a species. While beaked whales are mixed breeders (i.e., behaviorally income breeders), they demonstrate capital breeding strategies during gestation and lactation (Keen et al., 2021), so they may be more vulnerable to prolonged loss of foraging opportunities during gestation. However, as large odontocetes with a slow pace of life, Baird's beaked whales are more resilient to missed foraging opportunities due to acoustic disturbance compared to other beaked whale species. Because Baird's beaked whales have a nomadic-resident movement ecology, the risk of repeated impacts on individuals is likely similar within the population as animals move throughout their range. However, since this species has longer generation times, this population would require more time to recover if significantly impacted.

Several instances of behavioral disturbance over a year are unlikely to have any long-term consequences for individuals. Based on the above analysis, long-term consequences for the California, Oregon, and Washington stock of Baird's beaked whales are unlikely. Most predicted impacts are behavioral responses in an open ocean basin that are unlikely to contribute to any long-term impacts on individuals. Long-term consequences to these stocks are unlikely.

Table 2.4-23: Estimated Effects to the California, Oregon, and Washington Stock of Baird's Beaked Whales over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Explosive	Navy Training	-	1	-	-	-
Explosive	Navy Testing	1	(1)	0	-	-
Sonar	Navy Training	7,234	55	-	-	-
Sonar	Navy Testing	2,823	5	-	-	-
Sonar	USCG Training	54	-	-	-	-
Maximum Annual Total		**10,112**	**62**	**0**	**-**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
1,363	7.46	0.00

Season	Percent of Total Effects		
	SOCAL	PMSR	NOCAL
Warm	27%	8%	11%
Cold	31%	9%	13%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	22%
Medium Coordinated Anti-Submarine Warfare	Navy Training	16%
Acoustic and Oceanographic Research (ONR)	Navy Testing	15%
Surface Ship Sonar Maintenance and Systems Checks	Navy Training	8%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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2.4.2.4 Blainville's Beaked Whale (*Mesoplodon densirostris*)

Blainville's beaked whales are in the HF cetacean auditory group and the Sensitive behavioral group. Two Blainville's beaked whale stocks are in the Study Area – the combined California, Oregon, and Washington Mesoplodont stock and the Hawaii stock. Model-predicted impacts on the Hawaii stock are presented in Table 2.4-24. Impacts on the California, Oregon, and Washington combined Mesoplodont stock are discussed in Section 2.4.2.7 (Mesoplodont Beaked Whales).

There are hierarchical small and resident population BIAs designated for Blainville's beaked whales in the waters around the island of Hawaii to Oahu, with a concentration of use off the west coast and North Kohala portion of the Island of Hawaii. Blainville's beaked whale behavior may be impacted within these BIAs, particularly the larger parent BIA. The Hawaii stock of Blainville's beaked whales is residential and their year-round higher densities on the Hawaii Range Complex overlap areas where Sonar Maintenance and Anti-Submarine Warfare activities would occur. Most sonar impacts on the Hawaii stocks of Blainville's beaked whales are due to these activities. The number of impacts due to explosives is extremely limited, and there would be no impacts due to air guns.

On average, individuals in the Hawaii stock of Blainville's beaked whales could be impacted several times per year, primarily due to behavioral responses.

The risk of repeated impacts on individuals and consequences to populations from disturbances of individuals can be mediated by certain life history traits of a species. As medium-sized odontocetes with a medium pace of life, Blainville's beaked whales are likely moderately resilient to missed foraging opportunities due to acoustic disturbance. While beaked whales are mixed breeders (i.e., behaviorally income breeders), they demonstrate capital breeding strategies during gestation and lactation (Keen et al., 2021), so they may be more vulnerable to prolonged loss of foraging opportunities during gestation. Because Blainville's beaked whales have a nomadic-resident movement ecology, the risk of repeated impacts on individuals is likely similar within the population as animals move throughout their range. However, since this species has longer generation times, this population would require more time to recover if significantly impacted.

Limited instances of disturbance over a year are unlikely to have any long-term consequences for individuals, although individuals who suffer an auditory injury may experience minor energetic costs. Based on the above analysis, long-term consequences for the Hawaii stock of Blainville's beaked whales are unlikely.

Table 2.4-24: Estimated Effects to the Hawaii Stock of Blainville's Beaked Whales over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Explosive	Navy Training	(1)	-	-	-	-
Explosive	Navy Testing	0	-	-	-	-
Explosive	Army Training	-	(1)	-	-	-
Sonar	Navy Training	5,780	31	-	-	-
Sonar	Navy Testing	1,702	2	-	-	-
Sonar	USCG Training	25	-	-	-	-
Maximum Annual Total		**7,508**	**34**	**-**	**-**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
1,300	5.80	0.00

Season	Percent of Total Effects	
	HRC	High Seas
Warm	42%	3%
Cold	52%	3%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Submarine Sonar Maintenance and Systems Checks	Navy Training	21%
Medium Coordinated Anti-Submarine Warfare	Navy Training	11%
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	11%
Anti-Submarine Warfare Tracking Exercise - Submarine	Navy Training	10%
Surface Ship Sonar Maintenance and Systems Checks	Navy Training	6%

Area Type	Area Name (Active Months)	BEH	TTS	AINJ	INJ	MORT
S-BIA-C	Oahu-Maui Nui-Hawaii Island - Hawaii Island (All)	6	-	-	-	-
S-BIA-P	Oahu-Maui Nui-Hawaii Island (All)	778	1	-	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
BIA Types: S - Small/Resident population, M - Migratory, F - Feeding, R - Reproductive, P - Parent, C - Child/Core
version.20241107

2.4.2.5 Goose-beaked Whale (*Ziphius cavirostris*)

Goose-beaked whales (also known as Cuvier's beaked whales) are in the HF cetacean auditory group and the Sensitive behavioral group. Two goose-beaked whale stocks are in the Study Area – the California, Oregon, and Washington stock and the Hawaii stock. Model-predicted impacts are presented in Table 2.4-25 and Table 2.4-26.

This species is the more commonly encountered beaked whale species off the U.S. west coast. The California, Oregon, and Washington stock of goose-beaked whales generally congregate in deep offshore waters of California, with repeated sightings of the same individuals off San Clemente Island in Southern California, indicating some level of site fidelity. Density estimates from the goose-beaked whale model were applied year-round to the portion of the Navy's acoustic modeling study area. Their year-round higher densities in deep waters off Southern California overlap areas where Anti-Submarine Warfare activities would occur. Most sonar impacts on this stock are due to these activities. There would be no impacts due to air guns.

The Hawaii stock of goose-beaked whales is relatively common off the Hawaiian Islands of Lanai, Maui, Hawaii, Niihau, and Kauai, which provide strong evidence for both insular and offshore populations of goose-beaked whales in waters of the Hawaiian Islands EEZ. Hierarchical small and resident population BIAs were redefined for a year-round resident population of goose-beaked whales in Hawaiian waters, particularly between the 2,000- and 3,500-meter isobaths off the leeward side of the Island of Hawaii, where they spend most of their time. Goose-beaked whale behavior may be impacted within these BIAs, particularly the larger parent BIA. Their year-round higher densities in Hawaiian waters overlap areas where Anti-Submarine Warfare activities would occur. Most sonar impacts on this stock are due to these activities. Impacts due to air guns are extremely limited.

On average, individuals in the California, Oregon, and Washington stock could be impacted over a dozen times per year, primarily due to behavioral responses. Beaked whales are a behaviorally sensitive species, and their high density in Southern California and the offshore portions of central and northern California overlaps areas where Anti-Submarine Warfare activities typically occur. The revised cut-off conditions for significant behavioral responses result in predicting significant responses farther than observed in studies of beaked whale responses to sonar (see Section 2.3.3 [Behavioral Responses by Distance and Sound Pressure Level]). On average, individuals in the Hawaii stock would be impacted several times per year, primarily due to behavioral responses. The average risk of injury for either stock is negligible, although a few auditory injuries are predicted. The risk of auditory injury from explosive training is low (less than one) in any year for either stock of goose-beaked whales, but a couple auditory injuries are shown in the maximum year of impacts due to summing risk across seven years and following the rounding approach discussed in Section 2.4 (Species Impact Assessments). These auditory injuries are shown in the maximum year of impacts per the summation and rounding approach discussed above. The risk of injury may be reduced through visual observation mitigation, although beaked whales have low sightability.

The risk of repeated exposures to individuals and consequences to populations from disturbances of individuals can be mediated by certain life history traits of a species. As medium-sized odontocetes with a medium pace of life, goose-beaked whales are likely moderately resilient to missed foraging opportunities due to acoustic disturbance. While beaked whales are mixed breeders (i.e., behaviorally income breeders), they demonstrate capital breeding strategies during gestation and lactation (Keen et al., 2021), so they may be more vulnerable to prolonged loss of foraging opportunities during gestation. Since about 40 percent of the goose-beaked whales that were assessed in photo-identification studies in the SOCAL Range Complex have been seen in one or more prior years, with re-sightings up to seven years apart, there is likely a resident population on the range (Falcone & Schorr, 2014; Falcone et al., 2009). Because goose-beaked whales have a nomadic-resident movement ecology, the risk of repeated impacts on individuals is likely similar within the population as animals move throughout their range. The individuals that are more residential to areas on the SOCAL Range Complex or Hawaii Range Complex may be at higher risk for repeated exposure and long-term consequences from repeated displacement (Hin et al., 2023). Since this species has longer generation times, this population would require more time to recover if significantly impacted.

Several instances of behavioral disturbance over a year are unlikely to have any long-term consequences for most individuals, although individuals who suffer an auditory injury or repeated displacement may experience minor energetic costs. Most predicted impacts are behavioral responses in an open ocean basin that are unlikely to contribute to any long-term impacts on individuals. Long-term consequences to these stocks are unlikely.

Table 2.4-25: Estimated Effects to the California, Oregon, and Washington Stock of Goose-beaked Whales over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Explosive	Navy Training	6	13	(1)	-	-
Explosive	Navy Testing	8	3	1	0	-
Explosive	USCG Training	0	-	-	-	-
Sonar	Navy Training	110,330	504	-	-	-
Sonar	Navy Testing	55,207	92	-	-	-
Sonar	USCG Training	653	-	-	-	-
Maximum Annual Total		**166,204**	**612**	**2**	**0**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
13,531	12.33	0.00

	Percent of Total Effects			
Season	**SOCAL**	**PMSR**	**NOCAL**	**High Seas**
Warm	37%	4%	2%	3%
Cold	45%	4%	2%	3%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	25%
Surface Ship Sonar Maintenance and Systems Checks	Navy Training	9%
Acoustic and Oceanographic Research (ONR)	Navy Testing	7%
Medium Coordinated Anti-Submarine Warfare	Navy Training	6%
Vehicle Testing	Navy Testing	5%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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Table 2.4-26: Estimated Effects to the Hawaii Stock of Goose-beaked Whales over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Air gun	Navy Testing	(1)	-	-	-	-
Explosive	Navy Training	2	1	0	-	-
Explosive	Navy Testing	1	(1)	0	-	-
Explosive	Army Training	(1)	(1)	0	-	-
Sonar	Navy Training	23,137	118	-	-	-
Sonar	Navy Testing	6,945	8	-	-	-
Sonar	USCG Training	143	-	-	-	-
Maximum Annual Total		**30,230**	**129**	**0**	**-**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
5,116	5.93	0.00

Season	Percent of Total Effects: HRC	Percent of Total Effects: High Seas
Warm	42%	3%
Cold	52%	3%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Submarine Sonar Maintenance and Systems Checks	Navy Training	21%
Medium Coordinated Anti-Submarine Warfare	Navy Training	12%
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	11%
Anti-Submarine Warfare Tracking Exercise - Submarine	Navy Training	9%
Surface Ship Sonar Maintenance and Systems Checks	Navy Training	6%
Acoustic and Oceanographic Research (ONR)	Navy Testing	5%

Area Type	Area Name (Active Months)	BEH	TTS	AINJ	INJ	MORT
S-BIA-C	Hawaii Island (All)	77	0	-	-	-
S-BIA-P	Hawaii Island (All)	710	2	-	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
BIA Types: S - Small/Resident population, M - Migratory, F - Feeding, R - Reproductive, P - Parent, C - Child/Core
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2.4.2.6 Longman's Beaked Whale (*Indopacetus pacificus)*

Longman's beaked whales are in the HF cetacean auditory group and the Sensitive behavioral group. The Hawaii stock is the only stock in the Study Area. Model-predicted impacts are presented in Table 2.4-27.

While the full extent of the Longman's beaked whale distribution is not fully understood, there have been many sightings in tropical waters throughout the Pacific and Indian Oceans in waters over deep bathymetric slopes from 200 to 2,000 m. The Hawaii stock of Longman's beaked whales generally congregate in warm deep waters. The lack of quantitative seasonal information on this species resulted in these density estimates being applied year-round. In addition, the Hawaii stock of Longman's beaked whales has a uniform density value which was applied throughout the Hawaii Range Complex portion of the Study Area and the western portion of the transit corridor. Their higher densities in the Hawaii Range Complex overlap areas where Sonar Maintenance and Anti-Submarine Warfare activities would occur. Most sonar impacts on this stock are due to these activities. Impacts due to explosives would be limited, and there would be no impacts due to air guns.

On average, individuals in the Hawaii stock could be impacted several times per year, primarily due to behavioral responses. Beaked whales are a behaviorally sensitive species, and their high density in Hawaii overlaps areas where Anti-Submarine Warfare activities typically occur. The revised cut-off conditions for significant behavioral responses result in predicting significant responses farther than observed in studies of beaked whale responses to sonar (see Section 2.3.3 [Behavioral Responses by Distance and Sound Pressure Level]). The average risk of injury is negligible, although one auditory injury is predicted. The risk of injury may be reduced through visual observation mitigation, although beaked whales have low sightability.

The risk of repeated exposures to individuals and consequences to populations from disturbances of individuals can be mediated by certain life history traits of a species. As medium-sized odontocetes with a medium pace of life, Longman's beaked whales are likely moderately resilient to missed foraging opportunities due to acoustic disturbance. While beaked whales are mixed breeders (i.e., behaviorally income breeders), they demonstrate capital breeding strategies during gestation and lactation (Keen et al., 2021), so they may be more vulnerable to prolonged loss of foraging opportunities during gestation. Because Longman's beaked whales have a nomadic-resident movement ecology, the risk of repeated impacts on individuals is likely similar within the population as animals move throughout their range.

Several instances of disturbance over a year are unlikely to have any long-term consequences for individuals, although individuals who suffer an auditory injury may experience minor energetic costs. Most predicted impacts are behavioral responses in an open ocean basin that are unlikely to contribute to any long-term impacts on individuals. Long-term consequences to these stocks are unlikely.

Table 2.4-27: Estimated Effects to the Hawaii Stock of Longman's Beaked Whales over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Explosive	Navy Training	(1)	(1)	1	-	-
Explosive	Navy Testing	0	0	-	-	-
Explosive	Army Training	(1)	(1)	-	-	-
Sonar	Navy Training	13,966	83	-	-	-
Sonar	Navy Testing	4,106	12	-	-	-
Sonar	USCG Training	145	-	-	-	-
Maximum Annual Total		**18,219**	**97**	**1**	**-**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
2,940	6.23	0.00

Season	Percent of Total Effects	
	HRC	High Seas
Warm	41%	3%
Cold	53%	3%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Submarine Sonar Maintenance and Systems Checks	Navy Training	22%
Medium Coordinated Anti-Submarine Warfare	Navy Training	11%
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	11%
Anti-Submarine Warfare Tracking Exercise - Submarine	Navy Training	9%
Surface Ship Sonar Maintenance and Systems Checks	Navy Training	6%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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2.4.2.7 Mesoplodont Beaked Whales

Mesoplodont beaked whales are in the HF cetacean auditory group and the Sensitive behavioral group. Due to the difficulty in distinguishing species during visual surveys, Mesoplodont beaked whales off the U.S. west coast are managed as a single California/Oregon/Washington stock. This stock includes

Blainville's (*M. densirostris*), Perrin's (*M. perrini*), lesser (pygmy) (*M. peruvianus*), Stejneger's (*M. stejnegeri*), gingko-toothed (*M. gingkodens*), and Hubbs' (*M. carlhubbsi*) beaked whales. Model-predicted impacts on this stock are presented in Table 2.4-28.

Most mesoplodont beaked whale species have a wide distribution and are not residential to any location within the California portion of the Study Area. Even Blainville's beaked whales, which are one of the most widely distributed deep-diving beaked whale species, are not common in the California portion of the Study Area. Stejneger's beaked whales are much more common in Alaskan waters compared to the California portion of the Study Area. Pygmy beaked whale's distribution extends from central California to Chile, so their abundance is likely much higher outside the U.S. Exclusive Economic Zone. A possible exception may be Perrin's beaked whale. Although little is known about Perrin's beaked whale distribution, they have stranded several times in the California portion of the Study Area, so it is possible that their population may be more localized.

Mesoplodont beaked whales are typically found in offshore oceanic waters greater than 200 meters deep along the California coast and are only occasionally reported in waters over the continental shelf. A year-round density is applied due to the lack of quantitative seasonal information. Their higher densities in deep waters off Southern California overlaps areas where Anti-Submarine Warfare activities would occur. Most sonar impacts on this stock are due to these activities. Most impacts are behavioral effects because beaked whales are in the Sensitive behavioral group and are likely to avoid noise sources. The number of impacts due to explosives is limited, and the risk of impacts due to air guns is negligible.

The abundance predicted for this population using the NMSDD includes the west coast extent of this stock as well as areas off the Baja California peninsula of Mexico. Most of these beaked whale species have wide distributions and are not residential to any location within the California Study Area (except possibly Perrin's beaked whales). Given that, individual Mesoplodont beaked whales from the California, Oregon, and Washington stock are estimated to be impacted over a dozen times per year on average. Most of these impacts would be behavioral responses. The risk of auditory injury from explosive testing or training is very low (less than one) in any year, but a couple auditory injuries are shown in the maximum year of impacts due to summing risk across seven years and following the rounding approach discussed in Section 2.4 (Species Impact Assessments). The risk of injury may be reduced through visual observation mitigation, although beaked whales have low sightability. There is no predicted risk of non-auditory injury or mortality in any year.

The risk of repeated impacts on individuals and consequences to populations from disturbances of individuals can be mediated by certain life history traits of a species. As medium-sized odontocetes with a medium pace of life, Mesoplodont beaked whales are likely moderately resilient to missed foraging opportunities due to acoustic disturbance. While beaked whales are mixed breeders (i.e., behaviorally income breeders), they demonstrate capital breeding strategies during gestation and lactation (Keen et al., 2021), so they may be more vulnerable to prolonged loss of foraging opportunities during gestation. Because Mesoplodont beaked whales have a nomadic movement ecology, the risk of repeated impacts on individuals is likely similar within the population as animals move throughout their range.

Several instances of predicted behavioral and non-injurious auditory impacts are unlikely to result in any long-term impacts on individuals, although individuals who suffer an auditory injury may experience minor energetic costs. Based on the above analysis, long-term consequences for the California, Oregon, and Washington stock of Mesoplodont beaked whales are unlikely.

Table 2.4-28: Estimated Effects to the California/Oregon/Washington Stock of Mesoplodont Beaked Whales over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Air gun	Navy Testing	0	-	-	-	-
Explosive	Navy Training	2	5	(1)	-	-
Explosive	Navy Testing	6	3	1	0	0
Explosive	USCG Training	(1)	-	0	-	-
Sonar	Navy Training	64,298	350	0	-	-
Sonar	Navy Testing	27,697	62	-	-	-
Sonar	USCG Training	415	-	-	-	-
Maximum Annual Total		**92,419**	**420**	**2**	**0**	**0**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
7,534	12.32	0.00

Season	Percent of Total Effects			
	SOCAL	PMSR	NOCAL	High Seas
Warm	34%	6%	2%	3%
Cold	42%	6%	2%	4%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	25%
Surface Ship Sonar Maintenance and Systems Checks	Navy Training	10%
Acoustic and Oceanographic Research (ONR)	Navy Testing	7%
Medium Coordinated Anti-Submarine Warfare	Navy Training	7%
Vehicle Testing	Navy Testing	5%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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2.4.2.8 Killer Whale (*Orcinus orca*)*

Killer whales are in the HF cetacean auditory group and the Odontocete behavioral group. Four killer whale stocks are in the Study Area – the Southern Resident stock (the Southern Resident DPS – endangered), the Eastern North Pacific Offshore stock, the Eastern North Pacific West Coast Transient stock, and the Hawaii stock.

2.4.2.8.1 ESA-listed Killer Whales (Southern Resident DPS)

There are no predicted impacts on the endangered Southern Resident stock of killer whales. This stock is largely residential to the Salish Sea, north of the California Study Area. While a sub-set of Southern Resident killer whales (K and L pods) may travel into the NOCAL Range Complex from January to May, where they could be exposed to noise in the designated small and resident population BIA from a limited number of military readiness activities, they typically do not travel south of Monterey, California. Since they do not have any modeled impacts in the HCTT Study Area, the impact of acoustic stressors on this stock will not be analyzed further.

The use of sonars, explosives, and activities that produce vessel, aircraft, and weapons noise during training activities may affect, but are not likely to adversely affect, Southern Resident killer whales. Activities that involve the use of pile driving are not applicable to Southern Resident killer whales because there is no geographic overlap of this stressor with species occurrence. Air gun activities are not conducted during training.

The use of sonars, explosives, air guns, and activities that produce vessel, aircraft, and weapons noise during testing activities may affect, but are not likely to adversely affect, Southern Resident killer whales. Pile diving activities are not conducted during testing.

Critical Habitat

The critical habitat designated by NMFS for Southern Resident killer whales (86 *Federal Register* 41668) off California is largely coastal, with waters 6 m to 200 m deep. It is made up of three continuous sections of Californian coast: the Northern CA Coast Area, the North Central CA Coast Area, and the Monterey Bay Area. The critical habitat extends into the NOCAL Range Complex and as far south as Monterey, California. A map of this critical habitat is in *Biological Resources Supplemental Information*. Sound or energy from sonars, vessels, aircrafts, weapons, air guns, and explosives during military readiness activities could overlap this designated critical habitat. The essential features for the conservation of the Southern Resident DPS designated critical habitat include (1) water quality to support growth and development; (2) prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth; and (3) passage conditions to allow for migration, resting, and foraging.

While use of sonar and noise produced by vessels, aircraft, and weapons firing would overlap critical habitat, they would not affect the essential prey feature in the critical habitat that is essential for the reproduction, rest and refuge, health, continued survival, conservation, and recovery of this species. Non-impulsive sound sources, such as sonars, have not been known to cause direct injury or mortality to fish under conditions that would be found in the wild (Halvorsen et al., 2012a; Kane et al., 2010; Popper et al., 2007) and would only be expected to result in behavioral reactions or potential masking in fishes. Most sonar sources proposed for use during training and testing activities overlapping or adjacent to critical habitat in the Study Area would not fall within the frequency range of fish hearing, thereby presenting no plausible route of effect on Southern Resident killer whale prey species. The few sources used within fish hearing range would be limited and typically transient, as shown in Appendix A (Activity Descriptions) and examined in the *Impacts on Fishes from Acoustic and Explosive Stressors* section. Pile driving would only occur in Point Hueneme, thus would not overlap critical habitat for Southern Resident killer whale in northern California. Limited use of air guns could occur in critical habitat. Air guns may affect prey species very close to the source, although the single air guns used during testing are less powerful than those used in seismic surveys. Any impacts would be minimal, localized, and would not overall reduce aggregations of prey species.

Explosives would not be used in Southern Resident critical habitat. The limited use of explosives in the NOCAL Range Complex adjacent to critical habitat may kill or injure nearby prey species, removing a small number of prey that could have been available in the critical habitat. As described in the Fishes section, the median range to fish mortality due to a bin E3 (> 0.5–2.5 lb. NEW) explosive, the largest explosive proposed in the NOCAL Range Complex, is 64 m. A small number of mortalities would not appreciably diminish the conservation value of the habitat as a whole.

Sonars and vessel, aircraft, and weapons noise during training activities would have no effect on designated critical habitats in California for the Southern Resident DPS of killer whales. The use of explosives during training activities may affect, but is not likely to adversely affect, designated critical habitats in California for the Southern Resident DPS of killer whales. Activities that involve the use of pile driving are not applicable to Southern Resident killer whale critical habitats because there is no *geographic overlap of this stressor with those critical habitats. Air gun activities are not conducted during training.*

Sonars and vessel, aircraft, and weapons noise during testing activities would have <u>no effect</u> on designated critical habitats in California for the Southern Resident DPS of killer whales. The use of air guns and explosives during testing activities <u>may affect, but is not likely to adversely affect</u>, designated critical habitats in California for the Southern Resident DPS of killer whales. Pile diving activities are not conducted during testing.

2.4.2.8.2 Non-ESA-listed Killer Whales

Model-predicted impacts are presented in Table 2.4-29, Table 2.4-30, and Table 2.4-31.

Killer whales can occur in coastal zones or deep ocean basins but are most numerous in coastal water at higher latitudes. The Eastern North Pacific Offshore (Offshore) and Eastern North Pacific West Coast Transient (Transient) stocks occur along the west coast of North America, from the Alaskan coast, along the outer coasts of Washington, Oregon, and California.

The Eastern North Pacific Offshore stock of killer whales generally congregate in northern offshore waters but can be found in Southern California as well. The Offshore stock has a larger southern range compared to the Transient stock of killer whales, especially farther offshore. The absence of seasonally specific data on this stock resulted in killer whale density estimates being applied year-round. Within the California Study Area, the Eastern North Pacific Offshore stock of killer whales is most likely to be impacted in Southern California, as more activities overlap this stock presence in this region. Most impacts are due to Mine Warfare activities and related research and training that may employ lower source levels, but for longer activity durations and at frequencies where HF cetaceans are susceptible to auditory impacts. Anti-Submarine Warfare activities also contribute to impacts for the Eastern North Pacific Offshore stock. A small number of auditory injuries are predicted from explosive activities, but no non-auditory injuries are predicted for this stock. There would be no impacts due to air guns.

The Eastern North Pacific West Coast Transient stock generally congregates in cold waters and higher latitudes. The absence of seasonally specific data on this stock resulted in killer whale density estimates being applied year-round. Therefore, the Transient stock of killer whales in the California portion of the Study Area have the highest year-round density in northern California, which is where they are most likely to experience impacts. Most impacts are due to Anti-Submarine Warfare activities. No injuries are predicted, and there would be no impacts due to explosives or air guns for this stock.

Killer whales are not frequently seen in Hawaiian waters. The Hawaii stock of killer whales is typically only seen during winter, suggesting those sighted in Hawaii are seasonal migrants to Hawaii. However, insufficient seasonal information on this species resulted in these density estimates being applied year-round and is likely to artificially increase the impact on this Hawaiian stock. Killer whales have higher density around the Hawaiian Islands compared to the high seas, which is where they are most likely to experience impacts. Most impacts are due to Anti-Submarine Warfare activities. No injuries are predicted, and there would be no impacts due to explosives or air guns for this stock. Fewer impacts are predicted for this stock in Hawaii because fewer killer whales are found in this warm tropical region.

The potential for repeated impacts on individual killer whale in the Study Area is low. On average, Individuals in the Offshore stock would be impacted a few times per year, and individuals in the Transient or Hawaii stocks would be impacted less than once per year. The average individual risk of injurious impacts is negligible, although a few auditory injuries are predicted for the Offshore stock.

However, the risk of an auditory injury from explosive testing is low (less than one) in any year, but a couple auditory injuries from explosive testing is shown in the maximum year of impacts due to summing risk across seven years and following the rounding approach discussed in Section 2.4 (Species Impact Assessments). These auditory injuries are shown in the maximum year of impacts per the summation and rounding approach discussed above. Therefore, the risk of auditory injury is less likely, even for the Offshore stock of killer whales. There is no risk of injury for the Transient or Hawaii stocks of killer whales. The risk of auditory injury for the Offshore stock may be reduced through visual observation mitigation.

The risk of repeated exposures to individuals and consequences to populations from disturbances of individuals can be mediated by certain life history traits of a species. Killer whales are large, income-breeding odontocetes with a slow pace of life, suggesting they are more resilient to missed foraging opportunities due to acoustic disturbance, except during lactation. All four stocks of killer whales move within their range year-round. Because most killer whale stocks in the Study Area are nomadic, the risk of repeated exposures to individuals is likely similar within the population as animals move throughout their range. Although the Southern Resident killer whale population is critically endangered and decreasing, the Proposed Action will have much less impact on this stock of killer whales since they are largely residential to waters outside of the HCTT Study Area. The other three stocks of killer whales in the Study Area are not endangered and either have stable (Eastern North Pacific offshore stock) or unknown population trends. Overall, killer whales would be resilient to missed foraging opportunities but would require more time to recover if significantly impacted.

A few instances of disturbance over a year are unlikely to have any long-term consequences for individuals, although individuals who suffer an auditory injury would experience energetic costs. Based on the above analysis, long-term consequences for the Eastern North Offshore, Eastern North Pacific West Coast Transient, and Hawaii stocks of killer whales are unlikely.

Table 2.4-29: Estimated Effects to the Eastern North Pacific Offshore Stock of Killer Whales over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Explosive	Navy Training	6	7	3	-	-
Explosive	Navy Testing	2	1	(1)	0	-
Sonar	Navy Training	422	110	0	-	-
Sonar	Navy Testing	399	75	0	-	-
Sonar	USCG Training	1	-	-	-	-
Maximum Annual Total		**830**	**193**	**4**	**0**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
300	3.42	0.01

	Percent of Total Effects			
Season	SOCAL	PMSR	NOCAL	High Seas
Warm	34%	2%	2%	1%
Cold	54%	4%	2%	1%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Intelligence, Surveillance, Reconnaissance (NAVWAR)	Navy Testing	26%
Surface Ship Object Detection	Navy Training	21%
Mine Countermeasure Technology Research	Navy Testing	11%
Medium Coordinated Anti-Submarine Warfare	Navy Training	6%
Unmanned Underwater Vehicle Training - Certification and Development	Navy Training	6%
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	6%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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Table 2.4-30: Estimated Effects to the West Coast Transient Stock of Killer Whales over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Sonar	Navy Training	19	27	-	-	-
Sonar	Navy Testing	7	1	-	-	-
Sonar	USCG Training	1	-	-	-	-
Maximum Annual Total		**27**	**28**	**-**	**-**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
349	0.16	0.00

	Percent of Total Effects		
Season	SOCAL	PMSR	NOCAL
Warm	2%	21%	33%
Cold	1%	19%	25%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Medium Coordinated Anti-Submarine Warfare	Navy Training	53%
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	15%
Acoustic and Oceanographic Research (ONR)	Navy Testing	11%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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Table 2.4-31: Estimated Effects to the Hawaii Stock of Killer Whales over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Explosive	Navy Training	-	0	0	-	-
Sonar	Navy Training	41	62	-	-	-
Sonar	Navy Testing	14	8	-	-	-
Sonar	USCG Training	2	-	-	-	-
Maximum Annual Total		**57**	**70**	**0**	**-**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
198	0.64	0.00

Season	Percent of Total Effects: HRC	Percent of Total Effects: High Seas
Warm	47%	2%
Cold	48%	3%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Medium Coordinated Anti-Submarine Warfare	Navy Training	45%
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	7%
Surface Ship Sonar Maintenance and Systems Checks	Navy Training	6%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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2.4.2.9 False Killer Whale (*Pseudorca crassidens*)*

False killer whales are in the HF cetacean auditory group and the Odontocete behavioral group. Four false killer whale populations are in the Study Area –the Main Hawaiian Islands Insular stock (Main Hawaiian Islands Insular DPS – endangered), the Hawaii Pelagic stock, the Northwestern Hawaiian Islands stock, and the Eastern Tropical Pacific population (not a designated stock).

2.4.2.9.1 ESA-listed False Killer Whales (Main Hawaiian Islands Insular DPS)

Model-predicted impacts are presented in Table 2.4-33.

The Main Hawaiian Islands Insular stock (Main Hawaiian Islands Insular DPS) of false killer whales is resident to the main Hawaiian Islands consisting of Kauai, Oahu, Molokai, Lanai, Kahoolawe, Maui, and Hawaii. This stock has two hierarchical (parent and child) small and resident population BIAs. The child BIA represents high use areas, specifically between Oahu and Molokai, to the west of Lanai, and to the northwest of the Island of Hawaii, encompassing the waters around the Hawaiian Islands. The series of areas that compose the child BIA are geographically located within the larger parent BIA. Although they have been tracked up to 115 km from the Hawaiian Islands, they generally stay within 72 km from shore. The Main Hawaiian Islands Insular stock of false killer whale may be impacted in the designated BIAs, particularly the larger parent BIA. This stock of false killer whales has year-round density estimates on the Hawaii Range Complex, which overlaps areas where Anti-Submarine Warfare activities would occur. Most sonar impacts on this stock are due to these activities. Most impacts would be behavioral responses. Impacts from explosives are limited, and there would be no impacts due to air guns. There are no auditory or non-auditory injuries predicted for this stock.

The potential for repeated impacts on individual false killer whales in the Main Hawaiian Islands Insular stock (Main Hawaiian Islands Insular DPS) in the Study Area is very low. On average, Individuals in this stock would be impacted once per year, and no risk of injury is predicted.

The risk of repeated exposures to individuals and consequences to populations from disturbances of individuals can be mediated by certain life history traits of a species. As medium-sized odontocetes that are income breeders, false killer whales are likely somewhat resilient to missed foraging opportunities due to acoustic disturbance but may be vulnerable to impacts during lactation. In addition, because of their longer generation times, false killer whales would require more time to recover if significantly impacted. Since the Main Hawaiian Islands stock of false killer whales are resident-nomadic, the risk of repeated exposures to individuals in this stock is likely similar within the population as animals move throughout their range.

The limited instances of predicted behavioral and non-injurious auditory impacts are unlikely to result in any long-term impacts on individuals. Long-term consequences to the Main Hawaiian Islands Insular stock of false killer whales are unlikely.

Based on the analysis presented above, explosives and activities that produce vessel, aircraft, and weapons noise during training activities <u>may affect, but are not likely to adversely affect,</u> the Main Hawaiian Islands Insular DPS of false killer whales. The use of sonars during training activities <u>may affect, and are likely to adversely affect,</u> the Main Hawaiian Islands Insular DPS of false killer whales. Activities that involve the use of pile driving are <u>not applicable</u> to the Main Hawaiian Islands Insular DPS of false killer whales because there is no geographic overlap of this stressor with species occurrence. Air gun activities are not conducted during training.

Based on the analysis presented above, activities that produce vessel, aircraft, and weapons noise during testing activities <u>may affect, but are not likely to adversely affect,</u> the Main Hawaiian Islands Insular DPS of false killer whales. The use of sonars and explosives during testing activities <u>may affect, and are likely to adversely affect,</u> the Main Hawaiian Islands Insular DPS of false killer whales. Noise produced by air guns would have <u>no effect</u> on the Main Hawaiian Islands Insular DPS of false killer whales. Pile diving activities are not conducted during testing.

<u>Critical Habitat</u>

The critical habitat designated by NMFS for the main Hawaiian Islands insular false killer whales (83 *Federal Register* 35062) surrounds the islands of Niihau east to Hawaii from the 45-m to the 3,200-m depth contours. The main Hawaiian Islands insular DPS critical habitat is located entirely in the Hawaii Range Complex. A map of this critical habitat is in the *Biological Resources Supplemental Information*. Sound or energy from sonars, vessels, aircrafts, weapons, air guns, and explosives during military readiness activities could overlap this designated critical habitat. Pile driving would not occur in the Hawaii Range Complex, thus no overlap with pile driving noise would occur.

The essential feature for the conservation of the main Hawaiian Islands insular false killer whale is the following: *Island-associated marine habitat for main Hawaiian Islands insular false killer whales.* The critical habitat has four characteristics. Characteristics (1), *adequate space for movement and use within shelf and slope habitat,* and (3), *waters free of pollutants of a type and amount harmful to main Hawaiian Islands insular false killer whales,* would not be affected by sound or energy produced during military readiness activities and are not discussed further. The remaining characteristics may be affected by sound or energy produced during military readiness activities, as follows:

Characteristic (2) - *prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth*:

False killer whales are top predators that feed on a variety of large pelagic fish and squid. While use of sonar and noise produced by vessels, aircraft, and weapons firing would overlap critical habitat, they would not affect the second characteristic. Non-impulsive sound sources, such as sonars, have not been known to cause direct injury or mortality to fish under conditions that would be found in the wild (Halvorsen et al., 2012a; Kane et al., 2010; Popper et al., 2007) and would only be expected to result in behavioral reactions or potential masking in fishes (see the *Fishes Background* section). Most sonar sources proposed for use during military readiness activities that would overlap or be adjacent to critical habitat would not fall within the frequency range of fish or squid hearing, thereby presenting no plausible route of effect on prey species; however, low frequency sources comprise approximately 18% of the bin hours and 30% of the bin counts in these areas. Squids, like most fish species, can detect low frequency sounds and would not perceive most mid- and all high frequency sonars. The few sources used within fish hearing range would be limited and typically transient (see Section 4 [*Impacts on Fishes from Acoustic and Explosive Stressors*]).

Limited use of air guns could occur in critical habitat. Air guns may affect prey species very close to the source, although the air guns used during testing are less powerful than those used in seismic surveys. Any impacts would be minimal, localized, and would not reduce overall aggregations of prey species.

Use of explosives may kill or injure nearby prey species. Explosives would not be used in the Hawaii Island Mitigation Area and the 4-Islands Mitigation area. These areas encompass nearly all critical habitat around Hawaii Island and a portion of critical habitat in the 4-islands region (see maps of the areas in *Mitigation*). Explosives would typically not occur within 12 NM of shore except in designated areas described in Appendix H (Description of Systems and Ranges) in the HCTT EIS/OEIS. Fish not killed or injured by an explosion might change their behavior, feeding pattern, or distribution. Stunning from pressure waves could also temporarily immobilize fish, making them more susceptible to predation. Most explosives would detonate at the water surface, including large gun projectiles, bombs, and missiles. As described in Section 4 [*Impacts on Fishes from Acoustic and Explosive Stressors*], the average range to fish mortality due to a bin E12 (> 675–1,000 lb. NEW) explosive, the largest explosive proposed in the false killer whale critical habitat, is up to 760 m. Ranges to effect for surface explosions are over-estimated as described in Section 2.5.4 (Ranges to Effects for Explosives). Although approximately 6,000 bin-counts of explosives are proposed in the Hawaii Range Complex, critical habitat overlaps only six percent of the area. Higher explosive weight bins (≥ E8 [i.e., ≥ 60 lb. NEW]) comprise less than five percent of the explosives in the Hawaii Range Complex and would typically be used in scheduled offshore subareas in the Hawaii Range Complex outside of critical habitat. Just under half of the explosives used in the area would have very low explosive weight bins (E1-E2 [i.e., ≤ 0.5 lb. NEW]) and over 90 percent of the explosives used in the area would be in explosive weight bin E5 or lower (i.e., ≤ 10 lb. NEW). Considering the mitigation areas and the limited overlap with locations in the Hawaii Range Complex where explosives could be used, effects on critical habitat are unlikely to affect prey of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth.

Characteristic (4) - sound levels that will not significantly impair false killer whales' use or occupancy:

False killer whales rely on their ability to receive and interpret sound in their environment to forage, travel and communicate with one another. Per the final rule designating critical habitat, *noises that would significantly impair use or occupancy are those that inhibit false killer whales' ability to receive and interpret sound for the purposes of navigation, communication, and detection of predators and prey. Such noises are likely to be long-lasting, continuous, and/or persistent in the marine environment and, either alone or added to other ambient noises, significantly raise local sound levels over a significant portion of an area*.

Sounds attributable to military readiness activities like sonar and explosives can be widely dispersed or concentrated in small areas for varying periods. See the section titled *Anthropogenic Noise* in the *Marine Mammal Acoustic Background* for additional information on the sound properties produced from military sonar and explosives. During military readiness activities, sound can cause masking in false killer whales, particularly from high-duty sonar sources, as described in the Impacts from Sonars and Other Transducers section. Masking occurs when a noise interferes with an animal's ability to perceive or discriminate sounds and signals that are biologically relevant.

The sonar bins in the proposed action include sources with a range of source levels, frequencies, and duty cycles. Sonars used during military readiness activities would not be "long-lasting" or "persistent," as their use in any event would be limited to the activity durations described in *Activity Descriptions*. Sonars used during military readiness activities, however, can be "continuous" and can "raise local sound levels." Characteristics of sources that may affect critical habitat are high duty cycles and high source levels in the frequencies most relevant for false killer whale communication and foraging. Hearing measurements of a false killer whale showed a hearing range between 4-50 kHz with best sensitivity between 16 and 24 kHz (Yuen et al., 2007). False killer whales produce echolocation clicks, whistles, and burst pulses. Whistle frequencies are between 4 and 8 kHz and echolocation clicks are between 17 and 32 kHz (Thode et al., 2016). Mid-frequency sonars (1 – 10 kHz) and high frequency sonars (10-100 kHz) overlap these frequency ranges.

While signals relevant to false killer whales may be masked by low (e.g. sounds of prey), mid- (e.g. communication calls), and high (e.g. foraging echolocation clicks) frequency sonars, the duty cycle of most active sonars is low enough that the sounds would be masked by only a small percentage of the time. Active sonar is duty-cycled such that it emits sound for a short period of time and then stops, usually for a much longer period for any return echoes to be received and interpreted. The typical duty cycle with most tactical anti-submarine warfare is about once per minute with most active sonar pulses lasting no more than a few seconds. Large scale training events (e.g., RIMPAC, USWEX, etc.) using the more powerful hull-mounted sonars would generally occur outside of critical habitat. High frequency sonars are generally lower powered than mid-frequency sonars, have shorter propagation ranges due to greater signal attenuation in the ocean, and are often used in directional sources rather than omni-directional sources. They are typically used for mine hunting, navigation, and object detection. Thus, while they can contribute to a reduction in communication space and detection space for foraging, the affected area would be both temporally and spatially limited. High frequency sonars associated with mine warfare activities would be more common in or near main Hawaiian Islands false killer whale critical habitat due to the shallow water needed in searching for mine shapes. he transitory nature of most training and testing activities ensures that any masking occurring within an area is of short duration.

Although any bin category could be used in critical habitat, a Navy review of classified data for typical sources (MF1, MF4, MF5) from 2012-2017 demonstrated that most use was outside of critical habitat. To assess the potential for sonars to affect main Hawaiian Islands false killer whale critical habitat under this proposed action, the portion of high duty-to-continuous duty cycle sonar use that is proposed in the Hawaii Range Complex that may occur in critical habitat is estimated. The main Hawaiian Island false killer whale critical habitat overlaps approximately 6 percent of the Hawaii Range Complex. Approximately 22,600 sonar bin-hours and 13,000 sonar bin-counts are proposed in the Hawaii Range Complex in a maximum year of activity in areas that completely or partially overlap[4] the critical habitat. These quantities do not include sonar use proposed in areas that were excluded from the designation of critical habitat[5] and areas subject to the Joint Base Pearl Harbor-Hickam Integrated Natural Resource Management Plan[6]. It is likely that a large portion of these sonar hours and counts would be used outside of critical habitat, since 94 percent of the Hawaii Range Complex does not overlap the critical habitat. Sonar bins are accounted for as both hours and counts. Sonars that are quantified as counts are typically those with a limited and relatively defined duration, such as dipping sonar or torpedoes. Approximately 2 percent of sonar bin-counts and a small portion bin-hours (see Table 2.4-32) employ high-to-continuous duty cycle sources, particularly in mid- and high frequencies that are relevant to false killer whale communication, foraging, and hearing.

[4] Areas of partial overlap with main Hawaiian Islands false killer whale critical habitat include the navigation track out of Pearl Harbor (south of the Naval Defense Area), W-186, and W-189.

[5] The national security exclusions include PMRF Offshore ranges (including the Shallow Water Training Range, the Barking Sands Tactical Underwater Range (BARSTUR), and the Barking Sands Underwater Range Extension (BSURE; west of Kauai), the Navy Kingfisher Range (northeast of Niihau), Warning Area 188 (west of Kauai), Kaula Island and Warning Area 187 (surrounding Kaula Island), the Navy Fleet Operational Readiness Accuracy Check Site (FORACS) (west of Oahu), the Navy Shipboard Electronic Systems Evaluation Facility (SESEF) (west of Oahu), Warning Areas 196 and 191 (south of Oahu), Warning Areas 193 and 194 (south of Oahu), the Kaulakahi Channel portion of Warning area 186 (the channel between Niihau and Kauai and extending east), the area north of Molokai (found offshore at the outer edge of the designation), the Alenuihaha Channel, the Hawaii Area Tracking System, and the Kahoolawe Training Minefield.

[6] Includes Ewa Training Minefield and the Naval Defensive Sea Area.

Table 2.4-32: Portion of Overall Sonar Use in in the Hawaii Range Complex with High to Continuous Duty Cycles

Source Class Category[1]	*Description*	*Duty Cycle*	*Percent*
Broadband Sources[2]			
LF	<205 dB	High	-
LF to HF		Continuous	2%
		High	3%
LF to MF		High	0%
MF to HF		High	18%
Low-Frequency Acoustic Sources			
LFL	160 dB to 185 dB	High	0%
LFM	185 dB to 205 dB	Continuous	0%
		High	12%
LFH	>205 dB	Continuous	0%
		High	2%
Mid-Frequency Acoustic Sources Other Than Hull-Mounted			
MFL	160 dB to 185 dB	High	2%
MFM	185 dB to 205 dB	Continuous	0%
		High	2%
MFH	>205 dB	Continuous	0%
		High	0%
Hull-Mounted Surface Ship Sonar			
MF1C	Hull-mounted surface ship sonar (previously MF11) with duty cycle >80%	High	2%
High-Frequency Acoustic Sources			
HFL	160 dB to 185 dB	High	0%
HFM	185 dB to 205 dB	Continuous	0%
		High	2%
HFH	>205 dB	Continuous	0%
		High	0%
Very High-Frequency Acoustic Sources			
VHFL	160 dB to 185 dB	High	-
VHFM	185 dB to 205 dB	High	-
VHFH	>205 dB	Continuous	0%
		High	0%

(-) means no hours or counts are proposed in this category in these areas.
[1] Bin MF1 and MF1K (hull-mounted sonar) are not included because they have a low duty cycle.
[2] Broadband sources have a range of duty cycles. For this analysis, they are all assumed to be high-to-continuous, which is an over-estimate.

Explosions could also mask hearing thresholds in marine mammals that are nearby, since explosions introduce low-frequency, broadband sounds into the environment. Sounds from explosions could also mask biologically relevant sounds. Certain activities with multiple detonations such as some naval gunfire exercises may create brief periods of broadband masking of biologically relevant sounds. However, the likelihood of substantial auditory masking from explosives is unlikely since the duration of individual explosive sounds is very short and behavioral impacts from explosives (e.g., mine countermeasure testing) on the critical habitat are negligible. See the sections titled *Masking* in the *Marine Mammal Acoustic Background* for additional information.

Mitigation areas in Hawaii limit the use of sonar and explosives nearshore. The geographic mitigation related to the use of active sonar off Hawaii Island states that Action Proponents will not use more than 300 hours of MF1 surface ship hull-mounted mid-frequency active sonar or 20 hours of helicopter dipping sonar (a mid-frequency active sonar source) annually within the Hawaii Island Marine Mammal Mitigation Area. MF1 surface ship hull-mounted mid-frequency active sonar will not be used within the Hawaii 4-Islands Marine Mammal Mitigation Area between mid-November to mid-April. Action Proponents will also not detonate in-water explosives (including underwater explosives and explosives deployed against surface targets) within the Hawaii Island Marine Mammal Mitigation Area and the Hawaii 4-Islands Marine Mammal Mitigation Area (see *Mitigation* for more details). These areas encompass nearly all critical habitat around Hawaii Island and a portion of critical habitat in the 4-islands region (see maps of the areas in *Mitigation*). Explosives would typically not occur within 12 NM of shore except in designated areas described in Appendix H (Description of Systems and Ranges) in the HCTT EIS/OEIS.

Vessel, aircraft, and weapons noise during training activities would have <u>no effect</u> on designated critical habitats in Hawaii for the Hawaiian Islands Insular DPS false killer whales. The use of sonars and explosives during training activities <u>may affect, but are not likely to adversely affect</u>, designated critical habitats for the Hawaiian Islands Insular DPS false killer whales. Activities that involve the use of pile driving are <u>not applicable</u> to false killer whale critical habitats because there is no geographic overlap of this stressor with those critical habitats. Air gun activities are not conducted during training.

Vessel, aircraft, and weapons noise during testing activities would have <u>no effect</u> on designated critical habitats in Hawaii for the Hawaiian Islands Insular DPS false killer whales. The use of sonars, air guns, and explosives during testing activities <u>may affect, but are not likely to adversely affect</u>, designated critical habitats for the Hawaiian Islands Insular DPS false killer whales. Pile diving activities are not conducted during testing.

Table 2.4-33: Estimated Effects to the Main Hawaiian Islands Insular Stock of False Killer Whales over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Explosive	Navy Training	-	0	-	-	-
Explosive	Navy Testing	(1)	(1)	-	-	-
Sonar	Navy Training	68	54	-	-	-
Sonar	Navy Testing	32	9	-	-	-
Sonar	USCG Training	4	-	-	-	-
Maximum Annual Total		**105**	**64**	**-**	**-**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
138	1.22	0.00

Season	Percent of Total Effects HRC
Warm	53%
Cold	47%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Medium Coordinated Anti-Submarine Warfare	Navy Training	32%
Anti-Submarine Warfare Torpedo Exercise - Ship	Navy Training	7%
Anti-Submarine Warfare Torpedo Exercise - Submarine	Navy Training	6%

Area Type	Area Name (Active Months)	BEH	TTS	AINJ	INJ	MORT
Critical Habitat	Critical Habitat (All)	31	1	-	-	-
S-BIA-C	Main Hawaiian Islands (All)	8	-	-	-	-
S-BIA-P	Main Hawaiian Islands (All)	54	12	-	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
BIA Types: S - Small/Resident population, M - Migratory, F - Feeding, R - Reproductive, P - Parent, C - Child/Core
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2.4.2.9.2 Non-ESA-listed False Killer Whales

Model-predicted impacts are presented in Table 2.4-34, Table-2.4-35, and Table 2.4-36.

Although false killer whales have stranded in Southern California, they are not included by NMFS as a managed species in California waters and are not expected to be present in California unless an El Niño event occurs. However, this species does have a density estimate in warmer waters off the Baja California Peninsula, Mexico within the HCTT Study Area. The lack of quantitative seasonal information on this Eastern Tropical Pacific population resulted in false killer whale density estimates being applied year-round. The estimated density for the California-Mexico population of false killer whales in the SOCAL Range Complex overlap areas where Anti-Submarine Warfare activities would occur. Most sonar impacts on this population are due to these activities. Impacts from explosives would be limited, and there would be no impacts due to air guns.

False killer whales congregate in deep oceanic waters off Hawaii and throughout the Pacific. They are commonly found in Hawaii in groups of up to 100 individuals in various depths and distances from shore. The Hawaii Pelagic stock of false killer whales has year-round density estimates on the Hawaii Range Complex, which overlaps areas where Anti-Submarine Warfare activities would occur. Most sonar impacts on this stock are due to these activities. Impacts from explosives would be limited, and there would be no impacts due to air guns.

The Northwestern Hawaiian Islands stock of false killer whales have been seen as far as 93-km from Kauai, Niihau, and the Northwestern Hawaiian Islands, and do not have density estimates near the eastern Hawaiian Islands. There is a year-round. non-hierarchical small and resident population BIA designated for the Northwestern Hawaiian Islands stock of false killer whales that surrounds the northwest islands of Kauai and Niihau and extends farther northwest offshore. False killer whales may be impacted while in this designated BIA. This stock of false killer whales has year-round density estimates on the Hawaii Range Complex, which overlaps areas where Anti-Submarine Warfare activities would occur. Most sonar impacts on this stock are due to these activities. Most impacts would be behavioral responses. There are no auditory or non-auditory injuries from sonar or impacts from explosives predicted for this stock. There would be no impacts due to air guns.

On average, individuals in the Hawaii Pelagic stock and the Northwestern Hawaiian Islands stock would be impacted less than once per year, and individuals in the California-Mexico population would be impacted about once per year. The average individual risk of injurious impacts in these three populations is negligible. The modeled risk of an auditory injury in the Hawaii Pelagic stock from sonar testing is low (less than one) in any year, and the modeled risk of auditory injury in the Eastern Tropical Pacific population from sonar training and USCG explosive training is low (less than one) in any year. Single auditory injuries are shown in the maximum year of impacts for these stressors per the summation and rounding approach discussed in Section 2.4 (Species Impact Assessments). The risk of auditory injury may also be reduced through visual observation mitigation.

The risk of repeated exposures to individuals and consequences to populations from disturbances of individuals can be mediated by certain life history traits of a species. As medium-sized odontocetes that are income breeders, false killer whales are likely somewhat resilient to missed foraging opportunities due to acoustic disturbance but may be vulnerable to impacts during lactation. In addition, because of their longer generation times, false killer whales would require more time to recover if significantly impacted. Since the Northwestern Hawaiian Islands stock of false killer whales are resident-nomadic, this could contribute to their slightly higher risk of repeated exposure compared to the Hawaii pelagic stock of false killer whales that are strictly nomadic and have less site fidelity within the Hawaii portion of the Study Area. As a result, the risk of repeated exposures to individuals in the Hawaii pelagic stock is likely similar within the population as animals move throughout their range.

A couple instances of disturbance over a year are unlikely to have any long-term consequences for individuals, although individuals that experience auditory injury may incur energetic costs. Based on the above analysis, long-term consequences for the Eastern Tropical Pacific population and the Hawaii Pelagic, and Northwestern Hawaiian Islands stocks of false killer whales are unlikely.

Table 2.4-34: Estimated Effects to the Eastern Tropical Pacific Population of False Killer Whales over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Explosive	Navy Training	0	1	-	-	-
Explosive	Navy Testing	0	(1)	0	0	-
Explosive	USCG Training	(1)	-	(1)	-	-
Sonar	Navy Training	1,361	765	(1)	-	-
Sonar	Navy Testing	332	60	0	-	-
Sonar	USCG Training	16	-	-	-	-
Maximum Annual Total		**1,710**	**827**	**2**	**0**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
1,990	1.28	0.00

Season	Percent of Total Effects
	SOCAL
Warm	42%
Cold	58%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	35%
Small Joint Coordinated Anti-Submarine Warfare	Navy Training	11%
Composite Training Unit Exercise (Strike Group)	Navy Training	9%
Medium Coordinated Anti-Submarine Warfare	Navy Training	7%
Surface Ship Sonar Maintenance and Systems Checks	Navy Training	6%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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Table-2.4-35: Estimated Effects to the Hawaii Pelagic Stock of False Killer Whales over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Explosive	Navy Training	(1)	(1)	-	-	-
Explosive	Navy Testing	0	0	0	-	-
Sonar	Navy Training	731	638	0	-	-
Sonar	Navy Testing	192	95	(1)	-	-
Sonar	USCG Training	12	-	-	-	-
Maximum Annual Total		**936**	**734**	**1**	**-**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
5,528	0.30	0.00

Season	Percent of Total Effects	
	HRC	High Seas
Warm	45%	2%
Cold	50%	2%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Medium Coordinated Anti-Submarine Warfare	Navy Training	33%
Submarine Sonar Maintenance and Systems Checks	Navy Training	11%
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	9%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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Table 2.4-36: Estimated Effects to the Northwestern Hawaiian Islands Stock of False Killer Whales over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Sonar	Navy Training	96	55	-	-	-
Sonar	Navy Testing	30	8	-	-	-
Sonar	USCG Training	2	-	-	-	-
Maximum Annual Total		**128**	**63**	**-**	**-**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
477	0.40	0.00

Season	Percent of Total Effects HRC
Warm	32%
Cold	68%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Anti-Submarine Warfare Torpedo Exercise - Ship	Navy Training	24%
Medium Coordinated Anti-Submarine Warfare	Navy Training	20%
Anti-Submarine Warfare Torpedo Exercise - Submarine	Navy Training	14%

Area Type	Area Name (Active Months)	BEH	TTS	AINJ	INJ	MORT
S-BIA	Northwestern Hawaiian Islands (All)	83	25	-	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
BIA Types: S - Small/Resident population, M - Migratory, F - Feeding, R - Reproductive, P - Parent, C - Child/Core
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2.4.2.10 Pygmy Killer Whale (*Feresa attenuata*)

Pygmy killer whales are in the HF cetacean auditory group and the Odontocete behavioral group. Two pygmy killer whale populations are in the Study Area – the Hawaii stock and the California population (not a designated stock). Model-predicted impacts are presented in Table 2.4-37 and Table 2.4-38.

Throughout the North and West Pacific, pygmy killer whales are generally an open ocean deepwater species. However, two year-round, non-hierarchical small and resident population BIAs have been delineated for pygmy killer whales in Hawaii. One pygmy killer whale BIA surrounds Oahu and Maui Nui, and the second BIA surrounds the southwestern portion of the Island of Hawaii. Although they the Hawaii stock of pygmy killer whales likely congregates in these two areas within the Hawaii portion of the HCTT Study Area, this stock has a uniform density value which was applied throughout the Hawaii Range Complex. Pygmy killer whale behavior may be impacted within these BIAs, particularly the Oahu-Maui Nui BIA. The Hawaii stock's year-round density in Hawaiian waters overlaps areas where Anti-Submarine Warfare activities would occur. Most sonar impacts on this stock are due to these activities. Impacts from explosives would be limited, and no impacts are predicted due to air guns.

Although pygmy killer whales have been sighted in offshore waters of Southern California, they are not included by NMFS as a managed species in California waters and are not expected to regularly occur in the area. However, this species does have a conservative density estimate in Southern California for summer and fall. The estimated density for the California population of pygmy killer whales in the SOCAL Range Complex overlap areas where Anti-Submarine Warfare activities would occur. Most sonar impacts on this population are due to these activities. Impacts from explosives and air guns would be negligible. No impacts are predicted during colder months (winter and spring) when the California population of pygmy killer whales would not be in the Study Area.

On average, individuals in the Hawaii stock and the California population would be impacted less than once per year. The average individual risk of injurious impacts in both populations is negligible. No auditory injuries are predicted for the California population, but a small number of auditory injuries could occur to individuals in Hawaii. However, the risk of auditory injuries in Hawaii from explosive training or sonar testing is low (less than one) in any year, but for each stressor, a single auditory injury is shown in the maximum year of impacts due to summing risk across seven years and following the rounding approach discussed in Section 2.4 (Species Impact Assessments). The risk of injury may be reduced through visual observation mitigation.

The risk of repeated exposures to individuals and consequences to populations from disturbances of individuals can be mediated by certain life history traits of a species. Little is known about pygmy killer whale demographics, but they are income breeders with a small body and medium pace of life, suggesting they are less resilient to missed foraging opportunities due to acoustic disturbance, especially during lactation. Since they have a nomadic-resident movement ecology, both stocks of pygmy killer whales move within their range year-round.

A few instances of disturbance over a year are unlikely to have any long-term consequences for individuals, although individuals that experience auditory injury may incur energetic costs. Based on the above analysis, long-term consequences for the Hawaii stock and California population of pygmy killer whales are unlikely.

Table 2.4-37: Estimated Effects to the California Population of Pygmy Killer Whales over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Air gun	Navy Testing	(1)	-	-	-	-
Explosive	Navy Training	(1)	(1)	-	-	-
Explosive	Navy Testing	-	(1)	0	0	-
Sonar	Navy Training	357	118	-	-	-
Sonar	Navy Testing	260	53	-	-	-
Sonar	USCG Training	3	-	-	-	-
Maximum Annual Total		**622**	**173**	**0**	**0**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
874	0.91	0.00

Season	Percent of Total Effects		
	SOCAL	PMSR	High Seas
Warm	84%	8%	7%
Cold	0%	0%	0%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	15%
Intelligence, Surveillance, Reconnaissance (NAVWAR)	Navy Testing	9%
Medium Coordinated Anti-Submarine Warfare	Navy Training	8%
Vehicle Testing	Navy Testing	8%
Surface Ship Sonar Maintenance and Systems Checks	Navy Training	7%
Small Joint Coordinated Anti-Submarine Warfare	Navy Training	6%
At-Sea Sonar Testing	Navy Testing	5%
Composite Training Unit Exercise (Strike Group)	Navy Training	5%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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Table 2.4-38: Estimated Effects to the Hawaii Stock of Pygmy Killer Whales over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Explosive	Navy Training	2	2	(1)	0	-
Explosive	Navy Testing	(1)	0	0	0	-
Explosive	Army Training	(1)	-	-	-	-
Sonar	Navy Training	3,666	3,758	1	-	-
Sonar	Navy Testing	928	481	(1)	-	-
Sonar	USCG Training	56	-	-	-	-
Maximum Annual Total		**4,654**	**4,241**	**3**	**0**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
11,928	0.75	0.00

Season	Percent of Total Effects: HRC	Percent of Total Effects: High Seas
Warm	47%	2%
Cold	48%	2%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Medium Coordinated Anti-Submarine Warfare	Navy Training	35%
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	11%
Submarine Sonar Maintenance and Systems Checks	Navy Training	10%

Area Type	Area Name (Active Months)	BEH	TTS	AINJ	INJ	MORT
S-BIA	Hawaii Island (All)	1	0	-	-	-
S-BIA	Oahu-Maui Nui (All)	185	1	-	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
BIA Types: S - Small/Resident population, M - Migratory, F - Feeding, R - Reproductive, P - Parent, C - Child/Core
version.20241107

2.4.2.11 Fraser's Dolphin (*Lagenodelphis hosei*)

Fraser's dolphins are in the HF cetacean auditory group and the Odontocete behavioral group. The Hawaii stock of Fraser's dolphin is the only stock in the Study Area. Model-predicted impacts are presented in Table 2.4-39.

Fraser's dolphins are one of the most abundant species within the Hawaiian Islands Exclusive Economic Zone. The Hawaii stock of Fraser's dolphins generally congregate in deep tropical waters with occurrence likely related to upwelling modified waters in the eastern tropical Pacific. The lack of quantitative seasonal information on this species resulted in Fraser's dolphin density estimates being applied year-round. In addition, the Hawaii stock of Fraser's dolphins has a uniform density value which was applied throughout this portion of the Study Area and the western portion of the transit corridor. Their estimated year-round density in Hawaiian waters overlap areas where Anti-Submarine Warfare activities would occur. Most sonar impacts on this stock are due to these activities. There would be no impacts due to air guns.

On average, individuals in the Hawaii stock would be impacted less than once per year, primarily due to behavioral responses. The average risk of injury is negligible, although a few auditory injuries and a single non-auditory injury are predicted. The risk of a non-auditory injury from either Navy explosive training or Army explosive training is low (less than one) in any year, but a non-auditory injuries are shown in the maximum year of impacts due to summing risk across seven years and following the rounding approach discussed in Section 2.4 (Species Impact Assessments). The risk of injury may be reduced through visual observation mitigation, since this stock of Fraser's dolphins travel in large groups and have high sightability.

The risk of repeated exposures to individuals and consequences to populations from disturbances of individuals can be mediated by certain life history traits of a species. Fraser's dolphins are income breeders with a small body and fast pace of life, suggesting they are less resilient to missed foraging opportunities due to acoustic disturbance, especially during lactation. This nomadic population moves within its range year-round. Therefore, the risk of repeated exposures to individuals is likely similar within the population as animals move throughout their Pacific range. Although reproduction in populations with a fast pace of life are more sensitive to foraging disruption, these populations would be quick to recover.

The limited instances of predicted behavioral and non-injurious auditory impacts are unlikely to result in any long-term consequences for individuals, although individuals who suffer an auditory or non-auditory injury may experience minor energetic costs. Based on the above analysis, long-term consequences for the Hawaii stock of Fraser's dolphins are unlikely.

Table 2.4-39: Estimated Effects to the Hawaii Stock of Fraser's Dolphin over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Explosive	Navy Training	13	10	3	(1)	-
Explosive	Navy Testing	0	0	0	-	-
Explosive	USCG Training	(1)	0	-	-	-
Explosive	Army Training	2	3	1	(1)	-
Sonar	Navy Training	16,259	14,089	1	-	-
Sonar	Navy Testing	3,562	1,524	(1)	-	-
Sonar	USCG Training	17	-	-	-	-
Maximum Annual Total		**19,854**	**15,626**	**6**	**2**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
47,288	0.75	0.00

Season	Percent of Total Effects: HRC	Percent of Total Effects: High Seas
Warm	48%	1%
Cold	49%	2%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Medium Coordinated Anti-Submarine Warfare	Navy Training	32%
Submarine Sonar Maintenance and Systems Checks	Navy Training	17%
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	12%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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2.4.2.12 Short-Finned Pilot Whale (*Globicephala macrorhynchus*)

Short-finned pilot whales are in the HF cetacean auditory group and the Odontocete behavioral group. Two short-finned pilot whale stocks are in the Study Area – the California, Oregon, and Washington stock and the Hawaii stock. Model-predicted impacts on the California, Oregon, and Washington and the Hawaii stocks are presented in Table 2.4-40 and Table 2.4-41.

The California, Oregon, and Washington stock generally congregates in in warm temperate and tropical waters over the continental shelf break, in slope waters, and in areas of high topographic relief. In the absence of seasonally specific data, uniform density estimates for southern, central and northern California were used to represent this stock's density year-round. This is ecologically appropriate for short-finned pilot whales, since this is a nomadic species which follows the movements of their prey (e.g., squid) rather than a migration path. Intelligence, Surveillance, and Reconnaissance testing activities may employ lower source levels, but for longer periods and at frequencies where HF cetaceans are susceptible to auditory impacts. Surface Ship Detection and Anti-Submarine Warfare activities also contribute to impacts for the California, Oregon, and Washington stock. There would be no impacts due to air guns.

Most explosive impacts in California, including the model-predicted mortality, non-auditory injuries, and some of the auditory injuries are from Mine Neutralization Explosive Ordnance Disposal. The mortalities, non-auditory injuries, and auditory injuries associated with this activity may be mitigated, as the Navy conducts pre-event visual observations for mine warfare activities with placed explosives (see the *Mitigation* section). Adherence to these plans increases the likelihood that Lookouts would sight surface-active marine mammals, particularly species that occur in groups, and short-finned pilot whales tend to travel in large groups up to 50 individuals.

Short-finned pilot whales are found close to shore near oceanic islands like Hawaii, where the shelf is narrow and deeper waters are found nearby. A year-round small and resident population parent BIA and three child BIAs have been delineated for short-finned pilot whales in waters of the Main Hawaiian Island. Short-finned pilot whale behavior may be impacted within these BIAs, particularly the larger Main Hawaiian Island parent BIA and Western Community child BIA closer to Kauai, Niihau, and the west coast of Oahu. Short-finned pilot whale's year-round higher densities in nearshore Hawaiian waters overlaps areas where Anti-Submarine Warfare activities would occur. Most sonar impacts on this stock are due to these activities. The number of impacts due to other acoustic stressors (i.e., explosives, air guns) would be limited.

On average, individuals in the California, Oregon, and Washington stock could be impacted several times per year, and individuals in the Hawaii stock could be impacted less than once per year. The average individual risk of injurious impacts in both populations is very low, although a small number of auditory and non-auditory injuries could occur to individuals in either stock and a single mortality could occur to a short-finned pilot whale in Southern California. However, the risk of an auditory injury in California from sonar testing, sonar training, or explosive testing is low (less than one) in any year, but a single injury from sonar testing, sonar training, and explosive testing is shown in the maximum year of impacts due to summing risk across seven years and following the rounding approach discussed in Section 2.4 (Species Impact Assessments). Likewise, the risk of a non-auditory injury in Hawaii from Army explosive training is low (less than one) in any year, but a single non-auditory injury from Army explosive training is shown in the maximum year of impacts due to summing risk across seven years and following the rounding approach. These injuries are shown in the maximum year of impacts per the summation and rounding approach discussed above. The risk of injury or mortality may be reduced through visual observation mitigation.

The risk of repeated exposures to individuals and consequences to populations from disturbances of individuals can be mediated by certain life history traits of a species. Short-finned pilot whales are medium-sized, income breeding odontocetes with a slow pace of life, making them somewhat resilient to missed foraging opportunities due to acoustic disturbance, except for during lactation. Both populations are nomadic and move within their range year-round. Therefore, the risk of repeated exposures to individuals is likely similar within the population. However, because of their longer generation times, this population would require more time to recover if significantly impacted.

A few instances of disturbance over a year are unlikely to have any long-term consequences for individuals, although individuals who experience auditory or non-auditory injury would incur energetic costs. Based on the above analysis, long-term consequences for the California, Oregon, and Washington and Hawaii stocks of short-finned pilot whales are unlikely.

Table 2.4-40: Estimated Effects to the California, Oregon, and Washington Stock of Short-Finned Pilot Whales over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Explosive	Navy Training	6	6	6	2	1
Explosive	Navy Testing	2	2	(1)	-	-
Sonar	Navy Training	1,436	547	(1)	-	-
Sonar	Navy Testing	1,899	371	(1)	-	-
Sonar	USCG Training	10	-	-	-	-
Maximum Annual Total		**3,353**	**926**	**9**	**2**	**1**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
836	5.13	0.01

Season	Percent of Total Effects			
	SOCAL	PMSR	NOCAL	High Seas
Warm	34%	3%	2%	1%
Cold	51%	6%	1%	2%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Intelligence, Surveillance, Reconnaissance (NAVWAR)	Navy Testing	29%
Surface Ship Object Detection	Navy Training	9%
Mine Countermeasure Technology Research	Navy Testing	9%
Medium Coordinated Anti-Submarine Warfare	Navy Training	8%
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	8%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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Table 2.4-41: Estimated Effects to the Hawaii Stock of Short-Finned Pilot Whales over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Air gun	Navy Testing	(1)	-	-	-	-
Explosive	Navy Training	6	9	1	0	0
Explosive	Navy Testing	4	3	1	-	-
Explosive	Army Training	2	1	(1)	(1)	-
Sonar	Navy Training	8,905	4,931	2	-	-
Sonar	Navy Testing	2,625	734	(1)	-	-
Sonar	USCG Training	83	-	-	-	-
Maximum Annual Total		**11,626**	**5,678**	**6**	**1**	**0**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
23,117	0.75	0.00

Season	Percent of Total Effects	
	HRC	High Seas
Warm	46%	1%
Cold	51%	2%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Medium Coordinated Anti-Submarine Warfare	Navy Training	25%
Submarine Sonar Maintenance and Systems Checks	Navy Training	8%
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	6%
Submarine Navigation	Navy Training	6%
Anti-Submarine Warfare Torpedo Exercise - Ship	Navy Training	5%

Area Type	Area Name (Active Months)	BEH	TTS	AINJ	INJ	MORT
S-BIA-C	Main Hawaiian Islands - Central Community (All)	25	2	-	-	-
S-BIA-C	Main Hawaiian Islands - Eastern Community (All)	11	11	-	-	-
S-BIA-C	Main Hawaiian Islands - Western Community (All)	1,682	358	0	-	-
S-BIA-P	Main Hawaiian Islands (All)	4,039	576	0	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
BIA Types: S - Small/Resident population, M - Migratory, F - Feeding, R - Reproductive, P - Parent, C - Child/Core
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2.4.2.13 Melon-Headed Whale (*Peponocephala electra*)

Melon-headed whales are in the HF cetacean auditory group and the Odontocete behavioral group. Two melon-headed whale stocks are in the Study Area – the Hawaiian Islands stock and the Kohala resident stock. Model-predicted impacts are presented in Table 2.4-42 and Table 2.4-43.

Melon-headed whales congregate in deep tropical and subtropical waters, especially when they forage at night. However, they have been known to rest nearshore oceanic islands during the day. Melon-headed whales are regularly found within Hawaiian waters. The Hawaiian Islands stock of melon-headed whales includes melon-headed whales inhabiting waters throughout the Hawaiian Islands. The Hawaiian Islands stock's year-round higher densities in deep waters around the Hawaii Range Complex overlap areas where Anti-Submarine Warfare activities would occur. Most sonar impacts on this stock are due to these activities. Impacts from explosives and air guns would be limited.

The Kohala resident stock of melon-headed whales are present year-round off the Kohala and west coast of Hawaii Island in waters less than 2,500 m deep. A year-round, non-hierarchical small and resident population BIA has been delineated for melon-headed whales off the Island of Hawaii which overlaps a large portion of this stock's range. Melon-headed whales may be impacted in this designated BIA. The Kohala resident stock's presence in the Hawaii Range Complex overlaps areas where Anti-

Submarine Warfare activities would occur. Most sonar impacts on this stock are due to these activities. Because their range is substantially smaller and there are fewer melon-headed whales for this stock compared to the Hawaiian Islands stock, there are relatively fewer impacts on the Kohala resident stock. There would be no impacts due to air guns and impacts from explosives would be negligible.

On average, individuals in the Hawaiian Islands stock and the Kohala resident stock would be impacted less than once per year. The average individual risk of injurious impacts in both populations is negligible. No auditory or non-auditory injuries are predicted for the Kohala resident stock, but a small number of auditory injuries could occur to individuals in the Hawaiian Islands stock. The risk of an auditory injury in Hawaii from explosive testing is low (less than one) in any year, but a single auditory injury is shown in the maximum year of impacts due to summing risk across seven years and following the rounding approach discussed in Section 2.4 (Species Impact Assessments). The risk of injury may be reduced through activity-based mitigation, especially since melon-headed whales tend to travel in large groups.

The risk of repeated exposures to individuals and consequences to populations from disturbances of individuals can be mediated by certain life history traits of a species. As small odontocetes that are income breeders with a medium pace of life, melon-headed whales are likely somewhat resilient to missed foraging opportunities due to acoustic disturbance but could be vulnerable during lactation. Because the Hawaiian Islands stock is nomadic-resident and the Kohala stock is resident, the risk of repeated exposures to individuals is likely similar within the populations as animals move throughout their range. However, because of their longer generation times, these populations would require more time to recover if significantly impacted.

A few instances of disturbance over a year are unlikely to have any long-term consequences for individuals, although individuals who experience auditory injury may incur energetic costs. Based on the above analysis, long-term consequences for the Hawaiian Islands and Kohala resident stocks of melon-headed whales are unlikely.

Table 2.4-42: Estimated Effects to the Hawaiian Islands Stock of Melon-Headed Whales over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Air gun	Navy Testing	(1)	-	-	-	-
Explosive	Navy Training	4	3	1	0	0
Explosive	Navy Testing	1	(1)	(1)	0	-
Explosive	USCG Training	(1)	-	-	-	-
Explosive	Army Training	1	(1)	(1)	-	-
Sonar	Navy Training	12,560	13,553	8	-	-
Sonar	Navy Testing	3,396	1,711	2	-	-
Sonar	USCG Training	223	-	-	-	-
Maximum Annual Total		**16,187**	**15,269**	**13**	**0**	**0**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
46,949	0.67	0.00

Season	Percent of Total Effects	
	HRC	High Seas
Warm	45%	2%
Cold	51%	2%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Medium Coordinated Anti-Submarine Warfare	Navy Training	37%
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	11%
Submarine Sonar Maintenance and Systems Checks	Navy Training	9%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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Table 2.4-43: Estimated Effects to the Kohala Resident Stock of Melon-Headed Whales over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Explosive	Army Training	1	(1)	-	-	-
Sonar	Navy Training	15	8	-	-	-
Sonar	Navy Testing	25	6	-	-	-
Maximum Annual Total		**41**	**15**	**-**	**-**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
447	0.13	0.00

Season	Percent of Total Effects: HRC
Warm	77%
Cold	23%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Medium Coordinated Anti-Submarine Warfare	Navy Training	40%
Vehicle Testing	Navy Testing	18%
Anti-Submarine Warfare Tracking Test (Rotary Wing)	Navy Testing	12%
At-Sea Sonar Testing	Navy Testing	9%
Acoustic and Oceanographic Research (ONR)	Navy Testing	7%
Torpedo (Non-Explosive) Testing	Navy Testing	7%

Area Type	Area Name (Active Months)	BEH	TTS	AINJ	INJ	MORT
S-BIA	Kohala Residents - Hawaii Island (All)	20	5	-	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
BIA Types: S - Small/Resident population, M - Migratory, F - Feeding, R - Reproductive, P - Parent, C - Child/Core
version.20241107

2.4.2.14 Pacific White-Sided Dolphin (*Lagenorhynchus acutus*)

Pacific white-sided dolphins are in the HF cetacean auditory group and the Odontocete behavioral group. One stock of Pacific white-sided dolphin is in the Study Area – the California, Oregon, and Washington stock. Model-predicted impacts are presented in Table 2.4-44.

The California, Oregon, and Washington stock of Pacific white-sided dolphins generally congregate in cold temperate waters over the continental shelf and slope from the southern Bering Sea to the Gulf of California off Mexico, with higher abundances in the northern portion of the HCTT Study Area, closer to Oregon and Washington. To a lesser extent, Pacific white-sided dolphins occur in Southern California year-round which overlap areas where Anti-Submarine Warfare and various testing activities would occur. Most sonar impacts on this stock are due to these activities. Impacts from explosives would occur from a variety of activities. The few mortalities are predicted from these explosive activities are the combined prediction from multiple types of activities, primarily Mine Warfare. They have specific pre-event visual observation mitigations that may reduce the number of impacts on marine mammals in the area (see the *Mitigation* section for details). The risk of impacts due to air guns would be limited.

The potential for repeated impacts on individuals is low. On average, Individuals in the California, Oregon, and Washington stock would be impacted less than once per year. The average individual risk of injurious impacts is negligible, although several injuries and two mortalities are predicted. The modeled risk of a mortality from explosive testing or training is low (less than one) in any year, but a single mortality from both explosive testing and training is shown in the maximum year of impacts due to summing risk across seven years and following the rounding approach discussed in Section 2.4 (Species Impact Assessments). These mortalities are shown in the maximum year of impacts per the summation and rounding approach discussed above. The risk of injury or mortality may be reduced through visual observation mitigation.

The risk of repeated exposures to individuals and consequences to populations from disturbances of individuals can be mediated by certain life history traits of a species. As small odontocetes that are income breeders with a medium pace of life, Pacific white-sided dolphins are likely somewhat resilient to missed foraging opportunities due to acoustic disturbance but could be vulnerable during lactation. This nomadic population moves within their range year-round, including northern habitats outside the Study Area, so the risk of repeated exposures to individuals within the population is likely similar year-round. However, because of their longer generation times, this species would require more time to recover if significantly impacted.

A few instances of disturbance over a year are unlikely to have any long-term consequences for individuals, although individuals who suffer an auditory or non-auditory injury may experience energetic costs. The risk of mortality is extremely unlikely. Based on the above analysis, long-term consequences for the California, Oregon, and Washington stock of Pacific white-sided dolphins are unlikely.

Table 2.4-44: Estimated Effects to the California, Oregon, and Washington Stock of Pacific White-Sided Dolphins over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Air gun	Navy Testing	1	-	-	-	-
Explosive	Navy Training	77	73	16	3	(1)
Explosive	Navy Testing	25	31	6	1	(1)
Explosive	USCG Training	0	0	-	-	-
Sonar	Navy Training	22,095	19,683	14	-	-
Sonar	Navy Testing	23,127	3,851	2	-	-
Sonar	USCG Training	246	1	-	-	-
Maximum Annual Total		**45,571**	**23,639**	**38**	**4**	**2**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
107,775	0.64	0.00

Season	Percent of Total Effects: SOCAL	PMSR	NOCAL
Warm	20%	5%	17%
Cold	33%	12%	14%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Medium Coordinated Anti-Submarine Warfare	Navy Training	29%
Intelligence, Surveillance, Reconnaissance (NAVWAR)	Navy Testing	12%
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	9%
Anti-Submarine Warfare Torpedo Exercise - Ship	Navy Training	6%
Unmanned Underwater Vehicle Testing	Navy Testing	6%
Undersea Warfare Testing	Navy Testing	5%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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2.4.2.15 Pantropical Spotted Dolphin (*Stenella attenuata*)

Pantropical spotted dolphins are in the HF cetacean auditory group and the Odontocete behavioral group. Five Pantropical spotted dolphin populations are in the Study Area –the Maui Nui stock (formerly the 4-Islands stock), the Hawaii Island stock, the Hawaii Pelagic stock, the Oahu stock, and the Baja, California Peninsula Mexico population (not a designated stock). Model-predicted impacts are presented in Table 2.4-45 through Table 2.4-49.

Pantropical spotted dolphins can be found mostly in deep offshore tropical and subtropical waters of the Pacific, but they do approach the coast in some areas like Hawaii. They are one of the most abundant species of cetacean in Hawaiian waters. A year-round small and resident population parent BIA and three child BIAs have been delineated for all stocks of pantropical spotted dolphins around the waters surrounding Oahu, Maui Nui, and the Island of Hawaii. The Maui Nui stock of pantropical spotted dolphins generally congregate in shallow coastal waters with depths from 1,500 to 3,500 m. Most impacts on the Maui Nui stock of pantropical spotted dolphins are predicted to occur within the designated BIAs, particularly the larger parent BIA. Their year-round higher densities in nearshore waters overlap areas where Anti-Submarine Warfare activities would occur. Most sonar impacts on this stock are due to these activities. Impacts from explosives would be limited, and no impacts are predicted due to air guns.

The Hawaii Island stock of pantropical spotted dolphins generally congregate in shallow coastal waters with depths from 1,500 to 3,500 m. This stock of pantropical spotted dolphins may be impacted in the designated BIAs, particularly the larger parent BIA. Their year-round higher densities in nearshore waters overlap areas where Anti-Submarine Warfare activities would occur. Most sonar impacts on this stock are due to these activities. Impacts from explosives and air guns would be limited.

The Hawaii Pelagic stock of pantropical spotted dolphins can be found in tropical offshore waters of the Hawaiian Islands EEZ, with highest densities near all the islands, but particularly around the Main Hawaiian Islands. A new habitat-based density model was used which showed an increase in overall density for this stock compared to the previous analysis. The Hawaii Pelagic stock increased density estimates in the Hawaii Range Complex overlap areas where Anti-Submarine Warfare activities would occur. Most sonar impacts on this stock are due to these activities. Impacts from explosives and air guns would be limited.

The Oahu stock of pantropical spotted dolphins generally congregate in shallow coastal waters with depths from 1,500 to 3,500 m. Most impacts on the Oahu stock of pantropical spotted dolphins are predicted to occur within the designated BIAs. Their year-round higher densities in nearshore waters overlap areas where sonar activities like Submarine Navigation, Surface Ship Object Identification, and Anti-Submarine Warfare activities would occur. Most sonar impacts on this stock are due to these activities. Most impacts would be behavioral. Impacts from explosives would be limited, and no impacts are predicted due to air guns.

The Baja, California Peninsula Mexico population of pantropical spotted dolphins can be found in tropical and subtropical waters deep offshore. They are not expected to occur in waters off California or the eastern portion of the transit corridor but may occur in waters off the BCPM within the HCTT Study Area. The lack of quantitative seasonal information on this population resulted in pantropical spotted dolphins density estimates being applied year-round. This population of pantropical spotted dolphins in the SOCAL Range Complex overlaps areas where Anti-Submarine Warfare activities would occur. Most sonar impacts on this population are due to these activities. Impacts from explosives are limited, although two mortalities are predicted due to the combined risk from offshore explosive activities. Impacts from air guns would be limited.

On average, individuals in the Oahu stock could be impacted several times per year, and individuals in the Maui Nui stock, the Hawaii Island stock, and the Hawaii Pelagic stock would be impacted less than once per year. On average, individuals in the Baja, California Peninsula Mexico population would be impacted less than twice per year. The average individual risk of injury is negligible in all five populations, but a small number of injuries could occur to individuals in any of the five populations of pantropical spotted dolphins. In addition, mortalities are predicted for Baja, California Peninsula Mexico population. The risk of a mortality from explosive testing and training is low (less than one) in any year for this population, but single mortalities are shown in the maximum year of impacts due to summing risk across seven years and following the rounding approach discussed in Section 2.4 (Species Impact Assessments). Similarly, the risk of non-auditory injuries is low (less than one) in any year in most instances for each of the stocks/population, but single non-auditory injuries are shown in the maximum year of impacts due to summing risk across seven years and following the rounding approach discussed above. The risk of injury and mortality may be reduced through visual observation mitigation, especially since Pantropical spotted dolphins tend to travel in large groups.

The risk of repeated exposures to individuals and consequences to populations from disturbances of individuals can be mediated by certain life history traits of a species. As small odontocete income breeders with a medium pace of life, Pantropical spotted dolphins are likely somewhat resilient to missed foraging opportunities due to acoustic disturbance. Because nomadic and offshore populations of pantropical spotted dolphins like the Hawaii Pelagic stock have a larger range farther from shore, they have a lower risk of repeated exposure compared to the other three nearshore residential stocks in the Hawaii portion of the Study Area. The Oahu stock of pantropical spotted dolphins has the smallest range out of the three residential stocks, which combined with more activities occurring there, likely contributed to the higher risk of repeated exposure shown below.

A few instances of disturbance over a year are unlikely to have any long-term consequences for individuals, although individuals who experience auditory or non-auditory injury may incur energetic costs. The risk of mortality is extremely unlikely. Based on the above analysis, long-term consequences for the Maui Nui stock, the Hawaii Island stock, the Hawaii Pelagic stock, the Oahu stock, and the Baja, California Peninsula Mexico population of Pantropical spotted dolphins are unlikely.

Table 2.4-45: Estimated Effects to the Maui Nui (Formerly 4 Islands) Stock of Pantropical Spotted Dolphins over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Explosive	Navy Training	3	2	2	0	-
Explosive	Navy Testing	19	8	1	0	-
Explosive	Army Training	-	(1)	-	-	-
Sonar	Navy Training	811	14	-	-	-
Sonar	Navy Testing	1,358	157	(1)	-	-
Maximum Annual Total		**2,191**	**182**	**4**	**0**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
2,674	0.89	0.00

Season	Percent of Total Effects
	HRC
Warm	50%
Cold	50%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Surface Ship Object Detection	Navy Training	27%
Anti-Submarine Warfare Tracking Test (Rotary Wing)	Navy Testing	21%
Vehicle Testing	Navy Testing	13%
Anti-Submarine Warfare Torpedo Test (Aircraft)	Navy Testing	11%

Area Type	Area Name (Active Months)	BEH	TTS	AINJ	INJ	MORT
S-BIA-C	Oahu-Maui Nui-Hawaii Island - Maui Nui (All)	808	108	2	-	-
S-BIA-P	Oahu-Maui Nui-Hawaii Island (All)	2,170	181	3	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
BIA Types: S - Small/Resident population, M - Migratory, F - Feeding, R - Reproductive, P - Parent, C - Child/Core
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Table 2.4-46: Estimated Effects to the Hawaii Island Stock of Pantropical Spotted Dolphins over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Air gun	Navy Testing	(1)	-	-	-	-
Explosive	Navy Training	1	8	2	(1)	-
Explosive	Navy Testing	(1)	(1)	(1)	-	-
Explosive	USCG Training	0	0	-	-	-
Sonar	Navy Training	2,086	2,879	2	-	-
Sonar	Navy Testing	789	234	(1)	-	-
Sonar	USCG Training	24	-	-	-	-
Maximum Annual Total		**2,902**	**3,122**	**6**	**1**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
8,674	0.70	0.00

Season	Percent of Total Effects
	HRC
Warm	51%
Cold	49%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Medium Coordinated Anti-Submarine Warfare	Navy Training	39%
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	14%
Surface Ship Sonar Maintenance and Systems Checks	Navy Training	9%
Submarine Sonar Maintenance and Systems Checks	Navy Training	6%

Area Type	Area Name (Active Months)	BEH	TTS	AINJ	INJ	MORT
S-BIA-C	Oahu-Maui Nui-Hawaii Island - Hawaii Island (All)	801	1,356	1	-	-
S-BIA-P	Oahu-Maui Nui-Hawaii Island (All)	1,253	1,612	1	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
BIA Types: S - Small/Resident population, M - Migratory, F - Feeding, R - Reproductive, P - Parent, C - Child/Core
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Table 2.4-47: Estimated Effects to the Hawaii Pelagic Stock of Pantropical Spotted Dolphins over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Air gun	Navy Testing	(1)	-	-	-	-
Explosive	Navy Training	11	13	3	(1)	0
Explosive	Navy Testing	12	4	(1)	(1)	0
Explosive	USCG Training	-	(1)	-	-	-
Explosive	Army Training	2	1	(1)	(1)	0
Sonar	Navy Training	18,458	17,816	9	-	-
Sonar	Navy Testing	5,521	2,324	2	-	-
Sonar	USCG Training	226	-	-	-	-
Maximum Annual Total		**24,231**	**20,159**	**16**	**3**	**0**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
67,313	0.66	0.00

Season	Percent of Total Effects	
	HRC	High Seas
Warm	44%	2%
Cold	53%	2%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Medium Coordinated Anti-Submarine Warfare	Navy Training	31%
Submarine Sonar Maintenance and Systems Checks	Navy Training	11%
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	10%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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Table 2.4-48: Estimated Effects to the Oahu Stock of Pantropical Spotted Dolphins over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Explosive	Navy Training	17	15	3	(1)	-
Explosive	Navy Testing	-	(1)	0	-	-
Sonar	Navy Training	5,489	97	(1)	-	-
Sonar	Navy Testing	748	58	(1)	-	-
Sonar	USCG Training	1	-	-	-	-
Maximum Annual Total		**6,255**	**171**	**5**	**1**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
1,491	4.31	0.00

Season	Percent of Total Effects
	HRC
Warm	51%
Cold	49%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Submarine Navigation	Navy Training	48%
Surface Ship Object Detection	Navy Training	19%
Mine Countermeasures - Ship Sonar	Navy Training	17%
Anti-Submarine Warfare Tracking Test (Rotary Wing)	Navy Testing	6%

Area Type	Area Name (Active Months)	BEH	TTS	AINJ	INJ	MORT
S-BIA-C	Oahu-Maui Nui-Hawaii Island - Oahu (All)	5,937	145	3	-	-
S-BIA-P	Oahu-Maui Nui-Hawaii Island (All)	6,196	147	3	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
BIA Types: S - Small/Resident population, M - Migratory, F - Feeding, R - Reproductive, P - Parent, C - Child/Core
version.20241107

Table 2.4-49: Estimated Effects to the Baja, California-Peninsula Mexico Population of Pantropical Spotted Dolphins over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Air gun	Navy Testing	2	-	-	-	-
Explosive	Navy Training	15	11	5	1	(1)
Explosive	Navy Testing	25	19	1	1	(1)
Explosive	USCG Training	-	(1)	-	-	-
Sonar	Navy Training	48,096	34,318	37	-	-
Sonar	Navy Testing	12,181	2,468	2	-	-
Sonar	USCG Training	490	-	-	-	-
Maximum Annual Total		**60,809**	**36,817**	**45**	**2**	**2**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
70,889	1.38	0.00

Season	Percent of Total Effects
	SOCAL
Warm	45%
Cold	55%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	34%
Small Joint Coordinated Anti-Submarine Warfare	Navy Training	12%
Composite Training Unit Exercise (Strike Group)	Navy Training	10%
Medium Coordinated Anti-Submarine Warfare	Navy Training	7%
Surface Ship Sonar Maintenance and Systems Checks	Navy Training	7%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
version.20241107

2.4.2.16 Striped Dolphin (*Stenella coeruleoalba*)

Striped dolphins are in the HF cetacean auditory group and the Odontocete behavioral group. Two striped dolphin stocks are in the Study Area – the California, Oregon, and Washington stock and the Hawaii stock. Model-predicted impacts are presented in Table 2.4-50 and Table 2.4-51.

The California, Oregon, and Washington stock of striped dolphins generally congregates over deep, relatively warmer waters off the U.S. west coast. They appear to have a continuous distribution in offshore waters from California to Mexico, expanding north into PMSR only during warmer months (summer and fall). Their year-round higher densities in deep waters offshore Southern California and Baja California, Mexico, overlap areas where Anti-Submarine Warfare activities would occur. Most sonar impacts on this stock are due to these activities. The number of impacts from air guns and explosives are limited, although a mortality is predicted for the combined training activities.

Striped dolphins regularly occur in the warm tropical waters around the Hawaiian Islands. The Hawaii stock of striped dolphins is present year-round in waters primarily seaward of the 1,000-m depth contour, but they are occasionally sighted closer to shore, from a depth range of 100 to 1,000 m. Their year-round higher densities in warm waters offshore Hawaii overlap areas where Anti-Submarine Warfare activities would occur. Most sonar impacts on this stock are due to these activities. The number of impacts due to explosives and air guns would be limited.

On average, individuals in the California, Oregon, and Washington stock and the Hawaii stock would be impacted less than once per year. A small number of injuries could occur to individuals in either stock, although the average individual risk of injury is negligible. In addition, a single mortality could occur to individuals in the California, Oregon, and Washington stock. However, the risk of a mortality from explosives is low (less than one) in any year, but a mortality is shown in the maximum year of impacts due to summing risk across seven years and following the rounding approach discussed in Section 2.4 (Species Impact Assessments The risk of injury may be reduced through visual observation mitigation, especially since striped dolphins tend to travel in large groups.

The risk of repeated exposures to individuals and consequences to populations from disturbances of individuals can be mediated by certain life history traits of a species. As income breeders with a small body and medium pace of life, striped dolphins are somewhat resilient to missed foraging opportunities due to acoustic disturbance, except for during lactation. Striped dolphins are nomadic, so the risk of repeated exposures to individuals is likely similar within the population as animals move throughout their range year-round. Both stocks of striped dolphins have unknown population trends. Because of their longer generation times, this population would require more time to recover if significantly impacted.

A few instances of disturbance over a year are unlikely to have any long-term consequences for individuals, although individuals who experience an auditory or non-auditory injury may incur energetic costs. The risk of mortality is extremely unlikely. Based on the above analysis, long-term consequences for the California, Oregon, and Washington stock and Hawaii stock of striped dolphins are unlikely.

Table 2.4-50: Estimated Effects to the California, Oregon, and Washington Stock of Striped Dolphins over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Air gun	Navy Testing	1	-	-	-	-
Explosive	Navy Training	12	23	4	1	(1)
Explosive	Navy Testing	16	22	4	1	0
Explosive	USCG Training	-	(1)	-	-	-
Sonar	Navy Training	63,661	46,945	32	-	-
Sonar	Navy Testing	16,581	5,362	2	-	-
Sonar	USCG Training	775	-	-	-	-
Maximum Annual Total		**81,046**	**52,353**	**42**	**2**	**1**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
160,551	0.83	0.00

	Percent of Total Effects		
Season	SOCAL	PMSR	High Seas
Warm	45%	5%	5%
Cold	42%	0%	2%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	31%
Small Joint Coordinated Anti-Submarine Warfare	Navy Training	11%
Medium Coordinated Anti-Submarine Warfare	Navy Training	10%
Composite Training Unit Exercise (Strike Group)	Navy Training	9%
Surface Ship Sonar Maintenance and Systems Checks	Navy Training	7%
Vehicle Testing	Navy Testing	6%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
version.20241107

Table 2.4-51: Estimated Effects to the Hawaii Stock of Striped Dolphins over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Air gun	Navy Testing	-	(1)	-	-	-
Explosive	Navy Training	11	5	1	(1)	-
Explosive	Navy Testing	2	1	(1)	0	-
Explosive	USCG Training	-	0	0	-	-
Explosive	Army Training	1	2	(1)	(1)	-
Sonar	Navy Training	14,566	16,678	6	-	-
Sonar	Navy Testing	3,793	2,473	1	-	-
Sonar	USCG Training	247	2	-	-	-
Maximum Annual Total		**18,620**	**19,162**	**10**	**2**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
68,909	0.55	0.00

Season	Percent of Total Effects	
	HRC	High Seas
Warm	45%	3%
Cold	50%	3%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Medium Coordinated Anti-Submarine Warfare	Navy Training	36%
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	11%
Submarine Sonar Maintenance and Systems Checks	Navy Training	11%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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2.4.2.17 Spinner Dolphin (*Stenella longirostris*)

Spinner dolphins are in the HF cetacean auditory group and the Odontocete behavioral group. Six Spinner dolphin stocks are in the Study Area – the Hawaii Island stock, Hawaii Pelagic stock, the Kauai and Niihau stock, the Oahu/4-Islands stock, the Kure and Midway stock, and the Pearl and Hermes Reef stock. Model-predicted impacts on the Hawaii Island stock, Hawaii Pelagic stock, the Kauai and Niihau stock, and the Oahu/4-Islands stock are presented in Table 2.4-52 through Table 2.4-55. There are no predicted impacts on the Kure and Midway stock or the Pearl and Hermes Reef stock.

The distribution of the Hawaii Island stock of spinner dolphins extends from the coast of Hawaii out to 10 nm from shore. Spinner dolphins in Hawaii have a higher abundance along the leeward coasts of all the major islands and around several of the atolls northwest of the main Hawaiian Islands in water shallower than 4,000 m in depth. They are expected to occur in shallow water resting areas (about 50 m deep or less) throughout the middle of the day, moving into deep waters offshore during the night to feed. Five year-round, non-hierarchical small and resident population BIAs have been delineated for spinner dolphins around several islands including the Island of Hawaii, where this stock is resident. Most impacts on the Hawaii Island stock of spinner dolphins are predicted to occur within the designated Island of Hawaii BIA. Their year-round higher densities in nearshore shallow waters around the Island of Hawaii overlap areas where Anti-Submarine Warfare activities would occur. Most sonar impacts on this stock are due to these activities. Impacts from explosives would be limited, and no impacts are predicted due to air guns.

The Hawaii Pelagic stock of pantropical spotted dolphins is often found in waters with a shallow thermocline (rapid temperature difference with depth) which concentrates open sea organisms in and above it, which spinner dolphins feed on. The Hawaii Pelagic stock density estimates in the Hawaii Range Complex overlap areas where Anti-Submarine Warfare activities would occur. Most sonar impacts on this stock are due to these activities. Impacts from explosives would be limited, and no impacts are predicted due to air guns.

The Kauai and Niihau stock of spinner dolphins generally congregate in shallow coastal waters with depths from 50 to 4,000 m. A year-round, non-hierarchical small and resident population BIAs has been delineated for spinner dolphins around several islands, including Kauai and Niihau where this stock is resident. Most impacts on this stock of spinner dolphins are predicted to occur within the designated Kauai and Niihau BIA. The waters off Kauai are particularly popular for spinner dolphins. They are frequently found resting in Kilauea Bay, Kauai, and monitoring for a Naval exercise in 2006 resulted in daily sightings of spinner dolphins within the offshore area of Kauai, near the PMRF. Their higher densities in nearshore tropical waters overlap areas where Anti-Submarine Warfare activities would occur, particularly in colder months. Most sonar impacts on this stock are due to these activities. Impacts from explosives would be limited, and no impacts are predicted due to air guns.

The Oahu/4-Islands stock of spinner dolphins generally congregates in shallow coastal waters with depths from 50 to 4,000 m. Five year-round, non-hierarchical small and resident population BIAs have been delineated for spinner dolphins around several islands including islands where this stock is resident (e.g., Oahu/Maui Nui). Most impacts on this stock of spinner dolphins are predicted to occur within the designated Oahu and Maui Nui BIA. Their year-round higher densities in nearshore tropical waters overlap areas where submarine navigation activities would occur. Impacts from explosives would be limited, and no impacts are predicted due to air gun.

On average, individuals in the Hawaii Island stock and Hawaii Pelagic stock would be impacted less than once per year, and individuals in the Kauai and Niihau stock and the Oahu/4-Islands stock could be impacted several times per year. The average individual risk of injury is negligible in all four stocks, but a small number of auditory injuries could occur. However, in four out of six instances of auditory injury, the risk of an injury is low (less than one) in any year, but single injuries are shown in the maximum year of impacts due to summing risk across seven years and following the rounding approach discussed in Section 2.4 (Species Impact Assessments). Therefore, the risk of any auditory injury from an explosive activity is unlikely for all stocks of spinner dolphins in the HCTT Study Area, and the risk of an auditory injury from sonar testing is unlikely for spinner dolphins in the Hawaii pelagic stock. The risk of injury may be reduced through visual observation mitigation, as spinner dolphins have relatively higher sightability.

The risk of repeated exposures to individuals and consequences to populations from disturbances of individuals can be mediated by certain life history traits of a species. As income breeders with a small body and a fast pace of life, spinner dolphins are less resilient to missed foraging opportunities due to acoustic disturbance, especially during lactation. Because this stock is nomadic, the risk of repeated exposures to individuals is likely similar within the population as animals move throughout their range. Risk of impacts would also be similar across seasons and critical life functions. The population trend for all stocks of spinner dolphins in the HCTT Study Area are unknown. Although reproduction in populations with a fast pace of life are more sensitive to foraging disruption, these populations are quick to recover.

A few instances of disturbance over a year are unlikely to have any long-term consequences for individuals, although individuals who experience auditory injury may incur energetic costs. Based on the above analysis, long-term consequences for the Hawaii Island stock, Hawaii Pelagic stock, the Kauai and Niihau stock, and the Oahu/4-Islands stock of spinner dolphins are unlikely.

Table 2.4-52: Estimated Effects to the Hawaii Island Stock of Spinner Dolphins over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Explosive	Navy Training	1	(1)	(1)	0	-
Explosive	Navy Testing	0	-	-	-	-
Sonar	Navy Training	46	49	-	-	-
Sonar	Navy Testing	13	0	-	-	-
Maximum Annual Total		**60**	**50**	**1**	**0**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
670	0.17	0.00

Season	Percent of Total Effects: HRC
Warm	60%
Cold	40%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Medium Coordinated Anti-Submarine Warfare	Navy Training	76%
Vehicle Testing	Navy Testing	7%

Area Type	Area Name (Active Months)	BEH	TTS	AINJ	INJ	MORT
S-BIA	Hawaii Island (All)	57	49	0	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
BIA Types: S - Small/Resident population, M - Migratory, F - Feeding, R - Reproductive, P - Parent, C - Child/Core
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Table 2.4-53: Estimated Effects to the Hawaii Pelagic Stock of Spinner Dolphins over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Explosive	Navy Training	(1)	(1)	0	0	-
Explosive	Navy Testing	0	(1)	0	0	-
Sonar	Navy Training	1,679	2,100	1	-	-
Sonar	Navy Testing	473	265	(1)	-	-
Sonar	USCG Training	24	-	-	-	-
Maximum Annual Total		**2,177**	**2,367**	**2**	**0**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
6,807	0.67	0.00

Season	Percent of Total Effects: HRC	Percent of Total Effects: High Seas
Warm	43%	2%
Cold	52%	2%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Medium Coordinated Anti-Submarine Warfare	Navy Training	39%
Submarine Sonar Maintenance and Systems Checks	Navy Training	10%
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	10%
Surface Ship Sonar Maintenance and Systems Checks	Navy Training	5%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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Table 2.4-54: Estimated Effects to the Kauai and Niihau Stock of Spinner Dolphins over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Explosive	Navy Training	0	2	0	0	0
Explosive	Navy Testing	0	(1)	(1)	-	-
Sonar	Navy Training	2,660	866	1	-	-
Sonar	Navy Testing	901	16	-	-	-
Maximum Annual Total		**3,561**	**885**	**2**	**0**	**0**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
606	7.34	0.00

Season	Percent of Total Effects HRC
Warm	35%
Cold	65%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Anti-Submarine Warfare Torpedo Exercise - Submarine	Navy Training	34%
Anti-Submarine Warfare Torpedo Exercise - Ship	Navy Training	32%
Anti-Submarine Warfare Torpedo Exercise - Maritime Patrol Aircraft	Navy Training	11%
Undersea Range System Test	Navy Testing	10%
Long Range Acoustic Communications	Navy Testing	8%

Area Type	Area Name (Active Months)	BEH	TTS	AINJ	INJ	MORT
S-BIA	Kauai and Niihau (All)	3,438	864	1	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
BIA Types: S - Small/Resident population, M - Migratory, F - Feeding, R - Reproductive, P - Parent, C - Child/Core
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Table 2.4-55: Estimated Effects to the Oahu /4 Islands Stock of Spinner Dolphins over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Explosive	Navy Training	4	3	(1)	0	0
Explosive	Navy Testing	1	(1)	-	-	-
Sonar	Navy Training	971	13	-	-	-
Sonar	Navy Testing	180	28	0	-	-
Maximum Annual Total		**1,156**	**45**	**1**	**0**	**0**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
355	3.39	0.00

Season	Percent of Total Effects HRC
Warm	63%
Cold	37%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Submarine Navigation	Navy Training	48%
Surface Ship Object Detection	Navy Training	18%
Mine Countermeasures - Ship Sonar	Navy Training	14%

Area Type	Area Name (Active Months)	BEH	TTS	AINJ	INJ	MORT
S-BIA	Oahu and Maui Nui (All)	1,139	45	0	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
BIA Types: S - Small/Resident population, M - Migratory, F - Feeding, R - Reproductive, P - Parent, C - Child/Core
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2.4.2.18 Rough-Toothed Dolphin (*Steno bredanensis*)

Rough-toothed dolphins are in the HF cetacean auditory group and the Odontocete behavioral group. The Hawaii stock is the only stock in the Study Area. Model-predicted impacts are presented in Table 2.4-56.

Rough-toothed dolphins are one of the most abundant species present in the Study Area and can be found in deep ocean waters off the Hawaiian Islands but are also seen relatively frequently during nearshore surveys. A large portion of the core area for the Hawaii stock of rough-toothed dolphins overlaps the PMRF range and the channel between Kauai and Niihau. A year-round small and resident population parent BIA and child BIA have been delineated for waters off Kauai, Niihau, and the west coast of Oahu for rough-toothed dolphins. In addition, a year-round, non-hierarchical BIA was delineated for rough-toothed dolphins associated with Maui Nui and the Island of Hawaii. Rough-toothed dolphins may be impacted within these BIAs, particularly the Kauai Niihau-Oahu parent BIA. Their year-round higher densities in waters in the Hawaii Range Complex overlap areas where Anti-Submarine Warfare activities would occur. Most sonar impacts on this stock are due to these activities. Impacts from air guns and explosives are limited, although two mortalities are predicted from combined training activities and Mine Warfare testing activities.

On average, individuals in the Hawaii stock would be impacted less than once per year. A small number of auditory and non-auditory injuries could occur to individuals, although the average individual risk of injury is negligible. In addition, a mortality could occur from explosive testing and training activities. However, the risk of a single mortality from either activity is low (less than one) in any year, but a mortality for both explosive activities is shown in the maximum year of impacts due to summing risk across seven years and following the rounding approach discussed in Section 2.4 (Species Impact Assessments). The risk of injury may be reduced through visual observation mitigation, as rough-toothed dolphins are moderately sightable.

The risk of repeated exposures to individuals and consequences to populations from disturbances of individuals can be mediated by certain life history traits of a species. As income breeders with a small body and a medium pace of life, rough-toothed dolphins have some resilience to missed foraging opportunities due to acoustic disturbance, except for during lactation. Because the Hawaii stock is nomadic, the risk of repeated exposures to individuals is likely similar within the population as animals move throughout their range. Risk of impacts would also be similar across seasons and critical life functions. The population trend for this stock is unknown, and because of their longer generation times, this population would require more time to recover if it was further significantly impacted.

A few instances of disturbance over a year are unlikely to have any long-term consequences for individuals, although individuals who experience injury may incur energetic costs. The risk of mortality is extremely unlikely. Based on the above analysis, long-term consequences for the Hawaii stock of rough-toothed dolphins are unlikely.

Table 2.4-56: Estimated Effects to the Hawaii Stock of Rough-Toothed Dolphins over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Air gun	Navy Testing	(1)	-	-	-	-
Explosive	Navy Training	72	63	6	3	(1)
Explosive	Navy Testing	42	23	3	1	(1)
Explosive	USCG Training	0	-	-	-	-
Explosive	Army Training	3	2	(1)	(1)	-
Sonar	Navy Training	45,968	34,070	18	-	-
Sonar	Navy Testing	11,455	4,768	3	-	-
Sonar	USCG Training	406	-	-	-	-
Maximum Annual Total		**57,947**	**38,926**	**31**	**5**	**2**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
106,193	0.91	0.00

Season	Percent of Total Effects	
	HRC	High Seas
Warm	46%	2%
Cold	51%	2%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Medium Coordinated Anti-Submarine Warfare	Navy Training	26%
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	9%
Submarine Sonar Maintenance and Systems Checks	Navy Training	8%
Submarine Navigation	Navy Training	8%

Area Type	Area Name (Active Months)	BEH	TTS	AINJ	INJ	MORT
S-BIA	Maui Nui-Hawaii Island (All)	677	351	0	-	-
S-BIA-C	Kauai Niihau-Oahu - Kauai Niihau (All)	4,996	1,688	2	-	-
S-BIA-P	Kauai Niihau-Oahu (All)	8,242	2,820	3	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
BIA Types: S - Small/Resident population, M - Migratory, F - Feeding, R - Reproductive, P - Parent, C - Child/Core
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2.4.2.19 Northern Right Whale Dolphin (*Steno bredanensis*)

Northern right whale dolphins are in the HF cetacean auditory group and the Odontocete behavioral group. The California, Oregon, and Washington stock is the only stock in the Study Area. Model-predicted impacts are presented in Table 2.4-57.

Northern right whale dolphins generally have higher abundances in cold waters along the outer continental shelf and slope and move nearshore only in areas where the continental shelf is narrow or where productivity on the shelf is especially high. While the California, Oregon, and Washington stock of Northern right whale dolphins can be found off California during colder months, their distribution shifts north towards Oregon and Washington as water temperatures increase during late spring and summer. Their year-round higher densities in the colder waters of northern California, and seasonal abundance in Southern California, overlap areas where Anti-Submarine Warfare activities would occur. Most sonar impacts on this stock are due to these activities. Some of Anti-Submarine Warfare activities use hull-mounted high duty cycle sonars that increase the potential for auditory effects and masking. Impacts from air guns and explosives would be limited, although a single mortality from explosive activities is predicted.

On average, individuals in the California, Oregon, and Washington stock would be impacted less than once per year. A small number of auditory and non-auditory injuries could occur to individuals, although the average individual risk of injury is negligible. The risk of a mortality is low (less than one) in any year for this stock, but a single mortality are shown in the maximum year of testing impacts due to summing risk across seven years and following the rounding approach discussed in Section 2.4 (Species Impact Assessments). The risk of injury may be reduced through visual observation mitigation, as rough-toothed dolphins are moderately sightable.

The risk of repeated exposures to individuals and consequences to populations from disturbances of individuals can be mediated by certain life history traits of a species. As income breeders with a small body and a medium pace of life, northern right whale dolphins have some resilience to missed foraging opportunities due to acoustic disturbance, except for during lactation. Because the California, Oregon, and Washington stock is nomadic, the risk of repeated exposures to individuals is likely similar within the population as animals move throughout their range. Risk of impacts would also be similar across seasons and critical life functions. The population trend for this stock is unknown, and because of their longer generation times, this population would require more time to recover if it was further significantly impacted.

A few instances of disturbance over a year are unlikely to have any long-term consequences for individuals, although individuals who experience injury may incur energetic costs. The risk of mortality is extremely unlikely. Based on the above analysis, long-term consequences for the California, Oregon, and Washington stock of northern right whale dolphins are unlikely.

Table 2.4-57: Estimated Effects to the California, Oregon, and Washington Stock of Northern Right Whale Dolphins over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Air gun	Navy Testing	(1)	-	-	-	-
Explosive	Navy Training	2	4	(1)	(1)	0
Explosive	Navy Testing	9	9	3	1	(1)
Explosive	USCG Training	0	0	-	-	-
Sonar	Navy Training	15,672	19,635	13	-	-
Sonar	Navy Testing	7,934	1,997	2	-	-
Sonar	USCG Training	249	2	-	-	-
Maximum Annual Total		**23,867**	**21,647**	**19**	**2**	**1**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
68,935	0.66	0.00

Season	Percent of Total Effects SOCAL	Percent of Total Effects PMSR	Percent of Total Effects NOCAL
Warm	6%	4%	16%
Cold	30%	20%	25%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Medium Coordinated Anti-Submarine Warfare	Navy Training	39%
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	13%
Acoustic and Oceanographic Research (ONR)	Navy Testing	7%
Anti-Submarine Warfare Torpedo Exercise - Ship	Navy Training	5%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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2.4.2.20 Common Bottlenose Dolphin (*Tursiops truncatus*)

Bottlenose dolphins are in the HF cetacean auditory group and the Odontocete behavioral group. There are seven stocks in the Study Area – the California coastal stock, the California, Oregon, and Washington Offshore stock, the Hawaii Pelagic stock, the Kauai Niihau stock, the Oahu stock, the 4-Islands stock, and the Hawaii Island stock. Model-predicted impacts are presented in Table 2.4-58 through Table 2.4-64. After the two California stock tables, the five Hawaii stock tables are listed.

Bottlenose dolphins occur in coastal and continental shelf waters of tropical and temperate regions of the Pacific Ocean. The California, Oregon, and Washington Offshore stock of bottlenose dolphins generally congregate at distances greater than 1.9 miles from the coast and throughout the waters of Southern California and Baja California, Mexico. Most impacts on the California, Oregon, and Washington Offshore Stock are due to Anti-Submarine Warfare activities in Southern California. Impacts from explosives and air guns would be limited.

The California coastal stock of bottlenose dolphins can be found up to 1 km from the coast primarily from Monterey, California to Ensenada, Baja Mexico, and typically congregates within 500 m of shore in Southern California. While this stock typically stays nearshore, individuals are highly mobile and this nomadic population travels widely within their range. Their year-round higher densities in warm coastal waters of Southern California overlaps areas where unmanned systems are tested. Most sonar impacts on this stock are due to these activities. These activities may employ lower source levels, but for longer periods and at frequencies where HF cetaceans are susceptible to auditory impacts. A small number of auditory and non-auditory injuries are predicted from explosive activities. There would be no impacts due to air guns.

The potential for an individual to be repeatedly impacted by sonar or explosives is low for either of these wide-ranging, nomadic stocks of bottlenose dolphins in California, and even less so for the large California, Oregon, and Washington stock. On average, individuals in the California, Oregon, and Washington stock would be impacted less than once per year, and individuals in the California Coastal stock could be impacted a few times per year. The average risk of injurious impacts on individuals is negligible for either stock. A small number of auditory and non-auditory injuries could occur to individuals in California, although the risk of a non-auditory injury from this activity is low (less than one) in any year for either stock. A non-auditory injury is shown in the maximum year of impacts due to summing risk across seven years and following the rounding approach discussed in Section 2.4 (Species Impact Assessments). The risk of injuries may be reduced through visual observation mitigation, as bottlenose dolphins tend to travel in groups of several animals to over a hundred.

Five common bottlenose dolphin stocks occur in both shallow coastal waters and deep offshore waters throughout the Hawaiian Islands, especially throughout the main islands and from the Island of Hawaii to Kure Atoll. Five year-round small and resident population BIAs have been delineated in the main Hawaiian Islands for the populations of common bottlenose dolphins which encompasses the Island of Hawaii (non-hierarchal Island of Hawaii BIA), as well as waters surrounding Niihau to the west and extending east to surround the island of Maui (Kauai Niihau, Oahu, and Maui Nui hierarchal parent BIA). The three hierarchal child BIAs encompass waters around Kauai/Niihau, Oahu, and Maui Nui.

The Oahu stock is residential to nearshore waters around the island of Oahu, where one of the year-round Child BIAs have been delineated for Hawaiian bottlenose dolphins. Most impacts on the Oahu stock of bottlenose dolphins are predicted to occur within the designated small and resident population BIAs, specifically the larger parent BIA and the Kauai Niihau, Oahu, and Maui Nui – Oahu child BIA. Their year-round higher densities in warm coastal waters of Oahu overlaps areas where Submarine Navigation activities would regularly occur along the navigation track into and out of Pearl Harbor. Most sonar impacts on this stock are due to these activities. Impacts due to explosives would be limited, although a single mortality from Obstacle Loading activities is predicted. There would be no impacts due to air guns. On average, individuals in the Oahu stock would be impacted over 60 times per year, although most of these impacts would be behavioral. A small number of auditory and non-auditory injuries could occur to individuals in Oahu, although the average risk of injurious impacts on individuals is negligible. The risk of a non-auditory injury or mortality from this activity is low (less than one) in any year for this stock, but a single non-auditory injury and mortality are shown in the maximum year of impacts due to summing risk across seven years and following the rounding approach discussed in Section 2.4 (Species Impact Assessments). The risk of injury or mortality may be reduced through visual observation mitigation.

The Maui Nui (formerly the 4-Islands) stock of bottlenose dolphins is residential to nearshore waters around the islands of Maui, Kahoolawe, Lanai, and Molokai, which is near the center of the year-round parent BIA that has been delineated for Hawaiian bottlenose dolphins. Most impacts on the Maui Nui stock of bottlenose dolphins are predicted to occur within the designated small and resident population BIAs, specifically the larger parent BIA and the Kauai Niihau, Oahu, and Maui Nui – Maui Nui child BIA. Their year-round higher densities in warm coastal waters of these four Hawaiian islands overlaps areas where Surface Ship Object Detection activities would occur. Most sonar impacts on this stock are due to these activities. Impacts due to explosives would be limited, and there would be no impacts due to air guns. No injuries are predicted for this stock.

The Kauai Niihau stock of bottlenose dolphins is residential to nearshore waters around the islands of Kauai and Niihau, which does not overlap the BIAs that have been delineated for Hawaiian bottlenose dolphins. Most impacts on the Kauai Niihau stock of bottlenose dolphins are predicted to occur within the designated small and resident population BIAs, specifically the larger parent BIA and to a lesser extent the Kauai Niihau, Oahu, and Maui Nui – Kauai Niihau child BIA. Their year-round higher densities in warm coastal waters of these two Hawaiian islands overlap areas where Anti-Submarine Warfare activities would occur. Most sonar impacts on this stock are due to these activities. The number of impacts due to explosives would be limited, and there would be no impacts due to air guns. No injuries are predicted for this stock.

The Hawaii Island stock of bottlenose dolphins is residential to nearshore waters around the islands of Hawaii, where one of the year-round BIAs have been delineated for Hawaiian bottlenose dolphins. Most impacts on the Hawaii Island stock of bottlenose dolphins are predicted to occur within the non-hierarchal Island of Hawaii small and resident population BIA. Their year-round higher densities in the warm coastal waters around the Island of Hawaii overlaps areas where Anti-Submarine Warfare activities would occur. Most sonar impacts on this stock are due to these activities. The number of impacts due to explosives would be limited, and there would be no impacts due to air guns. No injuries are predicted for this stock.

The Hawaii Pelagic stock of bottlenose dolphins is residential to the warm tropical waters around Hawaii. However, this stock has the largest range out of the other bottlenose dolphin stock in the Hawaii portion of the HCTT Study Area, as it extends throughout the Hawaii Range Complex. Submarine Navigation near Pearl Harbor would contribute a large portion of impacts. Impacts due to explosives and air guns would be limited, although a single mortality that is mostly attributable to Obstacle Loading activities is predicted.

On average, individuals in the Maui Nui stock and Kauai Niihau stock could be impacted several times per year, individuals in the Hawaii Pelagic stock would be impacted less than twice per year, and individuals in the Hawaii Island stock could be impacted less than once per year. There are no annual injuries predicted in the Maui Nui stock, Kauai Niihau stock, or the Hawaii Island stock. The average individual risk of injury is negligible in all four stocks, but a small number of injuries and one mortality could occur in the Hawaii Pelagic stock. For the Hawaii Pelagic stock, the risk of mortality is low (less than one) in any year, but a single mortality is shown in the maximum year of impacts due to summing risk across seven years and following the rounding approach discussed in Section 2.4 (Species Impact Assessments). The risk of injury or mortality may be reduced through visual observation mitigation, as bottlenose dolphins have relatively higher sightability.

The risk of repeated exposures to individuals and consequences to populations from disturbances of individuals can be mediated by certain life history traits of a species. Bottlenose dolphins are income breeders with a small-medium body size and a medium pace of life, suggesting they are moderately resilient to foraging disruption due to acoustic disturbance, except for during lactation. Because these stocks are nomadic, the risk of repeated exposures to individuals is likely similar within these populations as animals move throughout their range. Risk of impacts would also be similar across seasons and critical life functions. While the California Coastal stock of bottlenose dolphins has a stable and potentially increasing population, the other bottlenose dolphin stocks in the Hawaii Study Area have unknown population trends. Since this species has longer generation times, they would require more time to recover if significantly impacted.

Several instances of disturbance over a year are unlikely to have any long-term consequences for individuals, although individuals who suffer a slight recoverable injury or an auditory injury may experience minor energetic costs. Because bottlenose dolphins are resilient to limited instances of disturbance, long-term consequences are unlikely for any stock in the Study Area.

Table 2.4-58: Estimated Effects to the California, Oregon, and Washington Stock of Bottlenose Dolphins over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Air gun	Navy Testing	(1)	-	-	-	-
Explosive	Navy Training	38	40	9	(1)	0
Explosive	Navy Testing	6	7	1	0	-
Explosive	USCG Training	(1)	(1)	-	-	-
Sonar	Navy Training	11,368	5,492	3	-	-
Sonar	Navy Testing	9,699	1,286	(1)	-	-
Sonar	USCG Training	119	-	-	-	-
Maximum Annual Total		**21,232**	**6,826**	**14**	**1**	**0**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
42,395	0.66	0.00

	Percent of Total Effects		
Season	SOCAL	PMSR	High Seas
Warm	59%	5%	1%
Cold	34%	0%	0%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	19%
Intelligence, Surveillance, Reconnaissance (NAVWAR)	Navy Testing	14%
Small Joint Coordinated Anti-Submarine Warfare	Navy Training	7%
Medium Coordinated Anti-Submarine Warfare	Navy Training	6%
Composite Training Unit Exercise (Strike Group)	Navy Training	5%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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Table 2.4-59: Estimated Effects to the California Coastal Stock of Bottlenose Dolphins over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Explosive	Navy Training	9	15	6	(1)	-
Explosive	Navy Testing	-	(1)	0	0	-
Sonar	Navy Training	484	8	-	-	-
Sonar	Navy Testing	811	20	-	-	-
Sonar	USCG Training	2	-	-	-	-
Maximum Annual Total		**1,306**	**44**	**6**	**1**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
453	3.00	0.02

Season	Percent of Total Effects SOCAL	PMSR
Warm	39%	1%
Cold	59%	1%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Intelligence, Surveillance, Reconnaissance (NAVWAR)	Navy Testing	30%
Surface Ship Object Detection	Navy Training	26%
Unmanned Underwater Vehicle Testing	Navy Testing	22%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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Table 2.4-60: Estimated Effects to the Oahu Stock of Bottlenose Dolphins over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Explosive	Navy Training	29	21	4	(1)	(1)
Explosive	Navy Testing	-	(1)	0	0	-
Sonar	Navy Training	6,672	67	0	-	-
Sonar	Navy Testing	407	35	(1)	-	-
Maximum Annual Total		**7,108**	**124**	**5**	**1**	**1**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
113	64.06	0.06

Season	Percent of Total Effects HRC
Warm	46%
Cold	54%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Submarine Navigation	Navy Training	58%
Mine Countermeasures - Ship Sonar	Navy Training	20%
Surface Ship Object Detection	Navy Training	14%

Area Type	Area Name (Active Months)	BEH	TTS	AINJ	INJ	MORT
S-BIA-C	Kauai Niihau, Oahu, and Maui Nui - Oahu (All)	7,060	119	4	-	-
S-BIA-P	Kauai Niihau, Oahu, and Maui Nui (All)	7,086	121	4	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
BIA Types: S - Small/Resident population, M - Migratory, F - Feeding, R - Reproductive, P - Parent, C - Child/Core
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Table 2.4-61: Estimated Effects to the Maui Nui Stock of Bottlenose Dolphins over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Explosive	Navy Training	0	1	-	-	-
Explosive	Navy Testing	2	2	-	-	-
Sonar	Navy Training	186	2	-	-	-
Sonar	Navy Testing	121	12	0	-	-
Maximum Annual Total		**309**	**17**	**0**	**-**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
65	5.02	0.00

	Percent of Total Effects
Season	**HRC**
Warm	50%
Cold	50%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Surface Ship Object Detection	Navy Training	45%
Vehicle Testing	Navy Testing	13%
Anti-Submarine Warfare Tracking Test (Rotary Wing)	Navy Testing	8%
Submarine Navigation	Navy Training	7%
Anti-Submarine Warfare Torpedo Test (Aircraft)	Navy Testing	6%

Area Type	Area Name (Active Months)	BEH	TTS	AINJ	INJ	MORT
S-BIA-C	Kauai Niihau, Oahu, and Maui Nui - Maui Nui (All)	291	16	-	-	-
S-BIA-P	Kauai Niihau, Oahu, and Maui Nui (All)	307	17	-	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
BIA Types: S - Small/Resident population, M - Migratory, F - Feeding, R - Reproductive, P - Parent, C - Child/Core
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Table 2.4-62: Estimated Effects to the Hawaii Island Stock of Bottlenose Dolphins over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Explosive	Navy Training	0	(1)	-	-	-
Sonar	Navy Training	2	3	-	-	-
Sonar	Navy Testing	3	-	-	-	-
Maximum Annual Total		**5**	**4**	**-**	**-**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
138	0.07	0.00

Season	Percent of Total Effects
	HRC
Warm	20%
Cold	80%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Medium Coordinated Anti-Submarine Warfare	Navy Training	34%
Vehicle Testing	Navy Testing	27%
Unmanned Underwater Vehicle Training - Certification and Development	Navy Training	11%
Small Joint Coordinated Anti-Submarine Warfare	Navy Training	9%
Acoustic and Oceanographic Research (ONR)	Navy Testing	6%
Gunnery Exercise Surface-to-Surface Ship Medium-Caliber	Navy Training	6%

Area Type	Area Name (Active Months)	BEH	TTS	AINJ	INJ	MORT
S-BIA	Hawaii Island (All)	4	3	-	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
BIA Types: S - Small/Resident population, M - Migratory, F - Feeding, R - Reproductive, P - Parent, C - Child/Core
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Table 2.4-63: Estimated Effects to the Hawaii Pelagic Stock of Bottlenose Dolphins over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Air gun	Navy Testing	(1)	-	-	-	-
Explosive	Navy Training	134	114	14	1	(1)
Explosive	Navy Testing	51	32	4	1	-
Explosive	Army Training	2	1	(1)	0	-
Sonar	Navy Training	32,258	5,040	3	-	-
Sonar	Navy Testing	4,805	842	1	-	-
Sonar	USCG Training	33	-	-	-	-
Maximum Annual Total		**37,284**	**6,029**	**23**	**2**	**1**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
25,120	1.73	0.00

Season	Percent of Total Effects HRC
Warm	47%
Cold	52%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Submarine Navigation	Navy Training	27%
Surface Ship Object Detection	Navy Training	21%
Mine Countermeasures - Ship Sonar	Navy Training	9%
Medium Coordinated Anti-Submarine Warfare	Navy Training	7%
Anti-Submarine Warfare Torpedo Exercise - Submarine	Navy Training	6%
Anti-Submarine Warfare Torpedo Exercise - Ship	Navy Training	5%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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Table 2.4-64: Estimated Effects to the Kauai and Niihau Stock of Bottlenose Dolphins over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Explosive	Navy Training	-	(1)	0	0	-
Explosive	Navy Testing	0	0	0	-	-
Sonar	Navy Training	945	233	-	-	-
Sonar	Navy Testing	276	5	-	-	-
Maximum Annual Total		**1,221**	**239**	**0**	**0**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
113	12.92	0.00

Season	Percent of Total Effects HRC
Warm	41%
Cold	59%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Anti-Submarine Warfare Torpedo Exercise - Submarine	Navy Training	35%
Anti-Submarine Warfare Torpedo Exercise - Ship	Navy Training	32%
Anti-Submarine Warfare Torpedo Exercise - Maritime Patrol Aircraft	Navy Training	11%
Undersea Range System Test	Navy Testing	10%
Long Range Acoustic Communications	Navy Testing	7%

Area Type	Area Name (Active Months)	BEH	TTS	AINJ	INJ	MORT
S-BIA-C	Kauai Niihau, Oahu, and Maui Nui - Kauai Niihau (All)	969	184	0	-	-
S-BIA-P	Kauai Niihau, Oahu, and Maui Nui (All)	1,202	239	0	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
BIA Types: S - Small/Resident population, M - Migratory, F - Feeding, R - Reproductive, P - Parent, C - Child/Core
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2.4.2.21 Short-Beaked Common Dolphin (*Delphinus delphis*)

Short-beaked common dolphins are in the HF cetacean auditory group and the Odontocete behavioral group. One short-beaked common dolphin stock is in the Study Area – the California, Oregon, and Washington stock. Model-predicted impacts are presented in Table 2.4-65.

Short-beaked common dolphins exhibit substantial seasonal and annual variability due to changes in oceanographic conditions, resulting in shifts both north-south and inshore-offshore. The California, Oregon, and Washington stock of short-beaked common dolphins has a widespread distribution off California. They generally congregate in the California portion of the HCTT Study Area throughout the year, distributed between the coast and at least 345 miles from shore. Their higher densities in nearshore waters of Baja California, Mexico and offshore waters of Southern California overlap areas where Anti-Submarine Warfare activities would occur. While most auditory injuries would be due to Acoustic and Oceanographic Research activities, most impacts overall to this stock are due to Anti-Submarine Warfare activities. Some of Anti-Submarine Warfare activities use hull-mounted high duty cycle sonars that increase the potential for auditory effects and masking. Impacts from explosives would occur from a variety of activities, including Ship Shock Trials, Mine Neutralization Explosive Ordnance Disposal, Underwater Demolition, and Amphibious Breaching activities. Impacts from air guns would be limited.

Most of the model-predicted mortalities and some of the non-auditory and auditory injuries for testing explosives are due to Small Ship Shock Trials. Most of the model-predicted mortalities, non-auditory and auditory injuries for training explosives are due to Mine Neutralization Explosive Ordnance Disposal, Amphibious Breaching, and other Mine Warfare activities. The mortalities, non-auditory injuries, and auditory injuries associated with these activities could be mitigated, as the Navy conducts mitigation in the form of pre-event visual observations for these specific training activities (see the *Mitigation* section). Navy conducts much more extensive visual observations for Ship Shock Trials in accordance with NMFS-reviewed event-specific mitigation and monitoring plans (see the *Mitigation* section). Adherence to these plans increases the likelihood that Lookouts would sight surface-active marine mammals within the explosive activity's mitigation zone, particularly species that occur in groups. Short-beaked common dolphins tend to travel in large groups averaging hundreds, and occasionally thousands, of individuals. No marine mammal mortalities have been identified during multi-day post-event observations following previous Ship Shock Trials.

On average, individuals in this stock would be impacted a couple times per year. Some injuries and mortalities could occur to individuals in the California, Oregon, and Washington stock, although the average individual risk of injury is negligible. In addition, the risk of a single auditory injury from U.S. Coast Guard explosives is low (less than one) in any year for this stock, but an auditory injury is shown in the maximum year of impacts due to summing risk across seven years and following the rounding approach discussed in Section 2.4 (Species Impact Assessments). The risk of injury and mortality may be reduced through visual observation mitigation.

The risk of repeated exposures to individuals and consequences to populations from disturbances of individuals can be mediated by certain life history traits of a species. As income breeders with a small body and a medium pace of life, short-beaked dolphins have some resilience to missed foraging opportunities due to acoustic disturbance, except for during lactation. Because this stock is nomadic, the risk of repeated exposures to individuals is likely similar within the population as animals move throughout their range. Risk of impacts would also be similar across seasons and critical life functions. The population trend for the California, Oregon, and Washington stock of short-beaked common dolphins is unknown. However, there seems to be a recent increase in the population within the HCTT Study Area which is likely due to distribution shifts north from Mexico. Due to this species' longer generation times, this population would require more time to recover if significantly impacted.

A few instances of predicted behavioral and non-injurious auditory impacts are unlikely to result in any long-term impacts on individuals, although individuals who suffer an injury may experience minor energetic costs. Long-term consequences to the stock are unlikely.

Table 2.4-65: Estimated Effects to the California, Oregon, and Washington Stock of Short-Beaked Common Dolphins over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Air gun	Navy Testing	17	-	-	-	-
Explosive	Navy Training	1,413	1,078	255	50	13
Explosive	Navy Testing	428	492	103	21	5
Explosive	USCG Training	3	2	(1)	-	-
Sonar	Navy Training	876,990	548,702	389	-	-
Sonar	Navy Testing	611,376	119,400	58	-	-
Sonar	USCG Training	9,634	19	-	-	-
Maximum Annual Total		**1,499,861**	**669,693**	**806**	**71**	**18**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
1,056,308	2.05	0.00

Season	Percent of Total Effects			
	SOCAL	PMSR	NOCAL	High Seas
Warm	44%	6%	2%	1%
Cold	38%	4%	1%	3%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	21%
Medium Coordinated Anti-Submarine Warfare	Navy Training	10%
Intelligence, Surveillance, Reconnaissance (NAVWAR)	Navy Testing	9%
Small Joint Coordinated Anti-Submarine Warfare	Navy Training	6%
Anti-Submarine Warfare Torpedo Exercise - Ship	Navy Training	5%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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2.4.2.22 Long-Beaked Common Dolphin (*Delphinus capensis*)

Long-beaked common dolphins are in the HF cetacean auditory group and the Odontocete behavioral group. One long-beaked common dolphin stock is in the Study Area – the California stock. Model-predicted impacts are presented in Table 2.4-66.

The California stock of long-beaked common dolphins generally have higher abundances nearshore in Southern California year-round, although Southern California waters represent the northern limit to this species' range. The seasonal and inter-annual changes in abundance off California are assumed to reflect the shifts in the movements of long-beaked common dolphins between U.S. and Mexican waters. Impacts would be slightly higher in the warm season when they have higher densities in Southern California. Their higher densities in nearshore waters in Southern California overlap areas where Unmanned Underwater Vehicle Testing would occur. Most impacts would be due to this sonar activity, which may employ lower source levels, but for longer periods and at frequencies where HF cetaceans are susceptible to auditory impacts. Impacts from explosives would occur from a variety of activities, including Ship Shock Trials, EOD Mine Neutralization, Underwater Demolition, and Amphibious Breaching activities. Impacts from air guns would be limited.

The model-predicted mortality and some of the injuries for testing explosives are due to Small Ship Shock Trials. The mortality and injuries associated with this activity could be mitigated, as the Navy conducts extensive visual observations for Ship Shock Trials in accordance with NMFS-reviewed event-specific mitigation and monitoring plans (see the *Mitigation* section). Training explosive activities (e.g., EOD Mine Neutralization, Amphibious Breaching activities) are also predicted to result in a few mortalities but have specific on-site mitigations, including visual observations, that may reduce the number of impacts on marine mammals in the area (see the *Mitigation* section for details). Adherence to these plans increases the likelihood that Lookouts would sight surface-active marine mammals within the explosive activity's mitigation zone, particularly species that occur in groups. Long-beaked common dolphins tend to travel in large groups of up to 500 individuals. No marine mammal mortalities have been identified during multi-day post-event observations following previous Ship Shock Trials.

On average, individuals in this stock would be impacted less than twice per year. A small number of injuries and mortalities could occur to individuals in the California stock, although the average individual risk of injury is negligible. The risk of injury and mortality may be reduced through visual observation mitigation.

The risk of repeated exposures to individuals and consequences to populations from disturbances of individuals can be mediated by certain life history traits of a species. As income breeders with a small body and a medium pace of life, long-beaked common dolphins have some resilience to missed foraging opportunities due to acoustic disturbance, except for during lactation. Because this stock is nomadic, the risk of repeated exposures to individuals is likely similar within the population as animals move throughout their range. Risk of impacts would also be similar across seasons and critical life functions. The population trend for the California stock of long-beaked common dolphins is unknown. However, there seems to be a recent increase in the population within the HCTT Study Area which is likely due to distribution shifts north from Mexico. Due to this species' longer generation times, this population would require more time to recover if significantly impacted.

A few instances of predicted behavioral and non-injurious auditory impacts are unlikely to result in any long-term impacts on individuals, although individuals who suffer an injury may experience minor energetic costs. A few mortalities are anticipated but long-term consequences to the stock are unlikely.

Table 2.4-66: Estimated Effects to the California Stock of Long-Beaked Common Dolphins over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Air gun	Navy Testing	3	-	-	-	-
Explosive	Navy Training	273	306	75	18	3
Explosive	Navy Testing	72	83	27	6	1
Explosive	USCG Training	(1)	(1)	0	-	-
Sonar	Navy Training	70,884	30,889	20	-	-
Sonar	Navy Testing	181,795	11,646	6	-	-
Sonar	USCG Training	924	1	-	-	-
Maximum Annual Total		**253,952**	**42,926**	**128**	**24**	**4**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
209,100	1.42	0.00

Season	Percent of Total Effects	
	SOCAL	PMSR
Warm	45%	9%
Cold	37%	8%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Unmanned Underwater Vehicle Testing	Navy Testing	31%
Intelligence, Surveillance, Reconnaissance (NAVWAR)	Navy Testing	19%
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	8%
Medium Coordinated Anti-Submarine Warfare	Navy Training	5%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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2.4.2.23 Risso's Dolphin (*Grampus griseus*)

Risso's dolphins are in the HF cetacean auditory group and the Odontocete behavioral group. Two Risso's dolphin stocks are in the Study Area – the California, Oregon, and Washington stock and the Hawaii stock. Model-predicted impacts are presented in Table 2.4-67 and Table 2.4-68.

The California, Oregon, and Washington stock of Risso's dolphins can be found year-round in Southern California but is more abundant in the area during the cold-water months, consistent with their seasonal shifts north to Oregon and Washington waters during warmer months. While they are commonly seen over the slope and in offshore waters, they also frequent coastal waters around islands in Southern California. Their higher densities in Southern California, especially in winter and spring, overlap areas where Anti-Submarine Warfare activities would occur. Most impacts on this stock are due to these activities. Most impacts are behavioral responses. The number of impacts due to explosives and air guns would be limited.

The Hawaii stock of Risso's dolphins have the highest densities offshore of the Hawaiian Islands in waters approximately 2,500 m to 4,500 m depth, and mid-range densities farther offshore. This stock would be relatively less impacted, with very few predicted injuries. Most impacts on this stock are due to Anti-Submarine Warfare activities. The number of impacts due to explosives would be limited. There would be no impacts due to air guns.

On average, individuals in the California, Oregon, and Washington stock would be impacted a couple times per year. On average, individuals in the Hawaii stock would be impacted less than once per year. The average risk of injury is negligible, although a few non-auditory injuries could occur to individuals in California and a small number of auditory injuries could occur to individuals in either stock. The risk of any auditory injury is low (less than one) in any year for the Hawaii stock, but a couple injuries are shown in the maximum year of impacts due to summing risk across seven years and following the rounding approach discussed in Section 2.4 (Species Impact Assessments). The risk of injury may be reduced through visual observation mitigation, as Risso's dolphins are relatively sightable.

The risk of repeated exposures to individuals and consequences to populations from disturbances of individuals can be mediated by certain life history traits of a species. As income breeders with a small-medium body and a medium pace of life, Risso's dolphins are moderately resilient to foraging disruption due to acoustic disturbance, except for during lactation. Because both stocks in the HCTT Study Area are nomadic, the risk of repeated exposures to individuals is likely similar within the population as animals move throughout their range. Risk of impacts would also be similar across seasons and critical life functions. Both stocks have unknown population trends. Due to this species' longer generation times, this population would require more time to recover if significantly impacted.

A few instances of disturbance over a year are unlikely to have any long-term consequences for individuals, although individuals who experience injury may incur energetic costs. Based on the above analysis, long-term consequences for the California, Oregon, and Washington stock and Hawaii stock of Risso's dolphins are unlikely.

Table 2.4-67: Estimated Effects to the California, Oregon, and Washington Stock of Risso's Dolphins over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Air gun	Navy Testing	1	-	-	-	-
Explosive	Navy Training	23	38	9	3	-
Explosive	Navy Testing	11	10	4	(1)	0
Explosive	USCG Training	0	(1)	-	-	-
Sonar	Navy Training	17,117	7,907	3	-	-
Sonar	Navy Testing	15,852	2,686	1	-	-
Sonar	USCG Training	187	-	-	-	-
Maximum Annual Total		**33,191**	**10,642**	**17**	**4**	**0**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
19,357	2.27	0.00

	Percent of Total Effects			
Season	**SOCAL**	**PMSR**	**NOCAL**	**High Seas**
Warm	39%	4%	2%	1%
Cold	48%	5%	1%	0%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	17%
Intelligence, Surveillance, Reconnaissance (NAVWAR)	Navy Testing	13%
Medium Coordinated Anti-Submarine Warfare	Navy Training	8%
Anti-Submarine Warfare Torpedo Exercise - Ship	Navy Training	7%
Undersea Warfare Testing	Navy Testing	7%
At-Sea Sonar Testing	Navy Testing	6%
Unmanned Underwater Vehicle Testing	Navy Testing	6%
Small Joint Coordinated Anti-Submarine Warfare	Navy Training	5%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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Table 2.4-68: Estimated Effects to the Hawaii Stock of Risso's Dolphins over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Explosive	Navy Training	2	2	0	0	-
Explosive	Navy Testing	(1)	(1)	(1)	-	-
Explosive	Army Training	-	-	(1)	0	-
Sonar	Navy Training	2,781	2,595	(1)	-	-
Sonar	Navy Testing	745	396	(1)	-	-
Sonar	USCG Training	35	-	-	-	-
Maximum Annual Total		**3,564**	**2,994**	**4**	**0**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
8,649	0.76	0.00

Season	Percent of Total Effects	
	HRC	High Seas
Warm	47%	3%
Cold	48%	2%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Medium Coordinated Anti-Submarine Warfare	Navy Training	33%
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	12%
Submarine Sonar Maintenance and Systems Checks	Navy Training	12%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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2.4.2.24 Dall's Porpoise (*Phocoenoides dalli*)

Dall's porpoises are in the VHF cetacean auditory group and the Odontocete behavioral group. The California, Oregon, and Washington stock is the only stock in the Study Area. Model-predicted impacts are presented in Table 2.4-69.

The California, Oregon, and Washington stock of Dall's porpoises can be found from Baja California, Mexico to the northern Bering Sea. They shift their distribution southward during cooler-water periods on both interannual and seasonal time scales. They primarily congregate in shelf and slope waters, and decrease substantially in waters warmer than 63°F. Their higher densities in Southern California during the cold season overlaps areas where Anti-Submarine Warfare activities would occur. Most impacts on this stock are due to these activities.

As VHF cetaceans, Dall's porpoises are more susceptible to auditory impacts in mid- to high frequencies than other species. Auditory impacts from sonars are attributable to a variety of activities, with most auditory injuries attributable to Anti-Submarine Warfare activities. As VHF cetaceans, Dall's porpoises are also more susceptible than other species to auditory impacts from explosives. Auditory injuries are attributable to a variety of activities. Most auditory injuries due to explosives are attributable to Missile and Rocket testing activities and Air-to-Surface Missile activities in PMSR, and EOD Mine Neutralization activities in Southern California. The number of impacts due to air guns would be limited.

On average, individuals in this stock would be impacted about once per year. The average risk of injury is negligible, although auditory and non-auditory injuries are predicted. The risk of a single auditory injury from U.S. Coast Guard explosives is low (less than one) in any year for this stock, but a auditory injury is shown in the maximum year of impacts due to summing risk across seven years and following the rounding approach discussed in Section 2.4 (Species Impact Assessments). Similarly, the risk of a single non-auditory injury from Navy training explosives is low (less than one) in any year for this stock, but a non-auditory injury is shown in the maximum year of impacts due to summing risk across seven years and following the rounding approach discussed above. The risk of auditory or non-auditory injury may be reduced through visual observation mitigation.

The risk of repeated exposures to individuals and consequences to populations from disturbances of individuals can be mediated by certain life history traits of a species. As small odontocetes and income breeders with a fast pace of life, Dall's porpoises are less resilient to missed foraging opportunities than larger odontocetes. Because the California, Oregon, and Washington stock of Dall's porpoise is nomadic, the risk of repeated exposures to individuals is likely similar within the population as animals move throughout their range. Risk of impacts would also be similar across seasons and critical life functions. Although reproduction in populations with a fast pace of life are more sensitive to foraging disruption, these populations are quick to recover. Additionally, this stock of Dall's porpoise is unknown but likely stable.

A few instances of disturbance over a year are unlikely to have any long-term consequences for individuals, although individuals who experience injury may incur energetic costs. Based on the above analysis, long-term consequences for the California, Oregon, and Washington stock of Dall's porpoise are unlikely.

Table 2.4-69: Estimated Effects to the California, Oregon, and Washington Stock of Dall's Porpoise over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Air gun	Navy Testing	9	8	1	-	-
Explosive	Navy Training	155	433	185	(1)	-
Explosive	Navy Testing	438	631	304	1	0
Explosive	USCG Training	2	2	(1)	-	-
Sonar	Navy Training	6,430	36,826	522	-	-
Sonar	Navy Testing	6,191	8,086	222	-	-
Sonar	USCG Training	169	239	-	-	-
Maximum Annual Total		**13,394**	**46,225**	**1,235**	**2**	**0**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
61,840	0.98	0.02

	Percent of Total Effects		
Season	SOCAL	PMSR	NOCAL
Warm	7%	2%	8%
Cold	41%	26%	15%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Medium Coordinated Anti-Submarine Warfare	Navy Training	29%
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	16%
Intelligence, Surveillance, Reconnaissance (NAVWAR)	Navy Testing	6%
Small Joint Coordinated Anti-Submarine Warfare	Navy Training	5%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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2.4.2.25 Harbor Porpoise (*Phocoena phocoena*)

Harbor porpoises are in the VHF cetacean auditory group and the Sensitive behavioral group. Four harbor porpoise stocks are in the Study Area – the Northern California/Southern Oregon stock, the San Francisco Russian River stock, the Monterey Bay stock, and the Morro Bay stock. Model-predicted impacts on the Northern California/Southern Oregon stock, the San Francisco Russian River stock, the Monterey Bay stock, and the Morro Bay stock are presented in Table 2.4-70 through Table 2.4-73.

Harbor porpoises generally have higher abundances in shallow waters (less than 200 m) and near shore, but they sometimes move into deeper offshore waters. However, this species has no overlap with nearshore or offshore areas in the SOCAL Range Complex (e.g., San Diego, SOAR) or the southern nearshore portions of PMSR (e.g., Port Hueneme).

The Northern California/Southern Oregon stock of harbor porpoises congregates in shallow coastal waters of northern California and southern Oregon, occasionally moving offshore. Their higher densities in northern California during the cold season overlaps areas where Anti-Submarine Warfare activities would occur. Most impacts on this stock are due to these activities. All impacts on this stock are behavioral. Impacts from explosives are negligible, and no impacts are predicted due to air guns.

The Monterey Bay stock of harbor porpoises generally congregate in shallow coastal waters near Monterey Bay, California. A non-hierarchical small and resident population BIA for the Monterey Bay stock of harbor porpoise off California encompasses waters from land to the 200-meter isobath within the defined range. The abundance of individuals in this stock increased after when gillnet bycatch was reduced in their habitat. Harbor porpoise behavior may be impacted within the designated Monterey Bay BIA. Their higher densities in northern California during the cold season overlaps areas where Anti-Submarine Warfare activities would occur. Most impacts on this stock are due to these activities. All impacts on this stock are behavioral. Impacts from explosives are negligible, and no impacts are predicted due to air guns.

The San Francisco Russian River stock of harbor porpoises generally congregate in shallow coastal waters near San Francisco, California. Their higher densities in northern California during the cold season overlaps areas where Anti-Submarine Warfare activities would occur. Most impacts on this stock are due to these activities. Most impacts on this stock are behavioral. Impacts from explosives and air guns are limited. However, most auditory injuries for this stock of harbor porpoises would be due to Submarine and Unmanned Underwater Vehicle Subsea and Seabed Explosive activities.

The Morro Bay stock of harbor porpoises generally congregate in shallow coastal waters near Morro Bay in central California. A non-hierarchical small and resident population BIA for the Morro Bay stock of harbor porpoise off California encompasses waters from land to the 200-meter isobath within the defined range. The abundance of individuals in this stock increased after when gillnet bycatch was reduced in their habitat. Most of the impacts on the Morro Bay stock of harbor porpoises are predicted to occur within the Morro Bay BIA. Their higher densities in central California during the cold season overlaps areas where Submarine Mobile Mine activities and Anti-Submarine Warfare activities would occur on PMSR. Most impacts on this stock are due to these activities. Most predicted auditory injuries from explosives would occur from Air-to-Surface and Surface-to-Air Missile Testing activities. There are no impacts predicted due to air guns.

As VHF cetaceans, harbor porpoises are more susceptible to auditory impacts in mid- to high frequencies compared to other species. Auditory impacts from sonars are attributable to a variety of activities, with most behavioral impacts attributable to Anti-Submarine Warfare activities. Harbor porpoises are more susceptible to behavioral disturbance than other species. Harbor porpoises are highly sensitive to many sound sources and generally demonstrate strong avoidance of most types of acoustic stressors.

As VHF cetaceans, harbor porpoises are also more susceptible than other species to auditory impacts from explosives. Auditory injuries are attributable to a variety of activities, with most auditory injuries attributable to explosive activities. Most training auditory injuries are associated with submarine and UUV subsea and seabed warfare activities in the NOCAL Range Complex. Most testing auditory injuries area associated with Air-to-Surface and Surface-to-Air Missile Testing activities in PMSR.

On average, individuals in the San Francisco Russian River stock and the Morro Bay stock would be impacted about once per year. On average, individuals in the Northern California/Southern Oregon stock and the Monterey Bay stock would be impacted less than once per year. The average risk of injury is negligible for all four stocks, although injuries are predicted for the San Francisco Russian River stock and the Morro Bay stock. The risk of a single auditory injury from air guns is low (less than one) in any year for San Francisco Russian River stock, but an auditory injury is shown in the maximum year of impacts due to summing risk across seven years and following the rounding approach discussed in Section 2.4 (Species Impact Assessments). Similarly, the risk of a single non-auditory injury from explosive testing is low (less than one) in any year for the Morro Bay stock, but a non-auditory injury is shown in the maximum year of impacts due to summing risk across seven years and following the rounding approach discussed above. The risk of auditory or non-auditory injury may be reduced through visual observation mitigation.

The risk of repeated exposures to individuals and consequences to populations from disturbances of individuals can be mediated by certain life history traits of a species. As small odontocetes and income breeders with a fast pace of life, harbor porpoises are less resilient to missed foraging opportunities than larger odontocetes. Because all four stocks of harbor porpoise on the U.S. west coast portion of the Study Area are residential, the risk of repeated exposure would be higher for stocks that have high site fidelity in locations that overlap with the Proposed Action. However, most of these stocks inhabit coastal near-shore areas with minimal geographical overlap with the Proposed Action. Additionally, the populations of harbor porpoises in Morro Bay and Monterey Bay are likely increasing, and the Northern California/Southern Oregon and the San Francisco Russian River stocks of harbor porpoises are relatively stable. Although reproduction in populations with a fast pace of life are more sensitive to foraging disruption, these populations are quick to recover.

The limited instances of predicted behavioral and non-injurious auditory impacts are unlikely to result in any long-term impacts on individuals, although individuals who suffer an auditory injury in the San Francisco Russian River may experience minor energetic costs. Long-term consequences to the stock are unlikely.

Table 2.4-70: Estimated Effects to the Northern California/Southern Oregon Stock of Harbor Porpoise over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Sonar	Navy Training	357	0	-	-	-
Sonar	Navy Testing	124	-	-	-	-
Maximum Annual Total		**481**	**0**	**-**	**-**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
15,303	0.03	0.00

Season	Percent of Total Effects: NOCAL
Warm	32%
Cold	68%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Medium Coordinated Anti-Submarine Warfare	Navy Training	62%
Acoustic and Oceanographic Research (ONR)	Navy Testing	26%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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Table 2.4-71: Estimated Effects to the Monterey Bay Stock of Harbor Porpoise over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Explosive	Navy Testing	0	-	-	-	-
Sonar	Navy Training	1,314	0	-	-	-
Sonar	Navy Testing	865	-	-	-	-
Maximum Annual Total		**2,179**	**0**	**-**	**-**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
4,530	0.48	0.00

Season	Percent of Total Effects: NOCAL
Warm	29%
Cold	71%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Medium Coordinated Anti-Submarine Warfare	Navy Training	49%
Acoustic and Oceanographic Research (ONR)	Navy Testing	40%

Area Type	Area Name (Active Months)	BEH	TTS	AINJ	INJ	MORT
S-BIA	Monterey Bay (All)	1,178	-	-	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
BIA Types: S - Small/Resident population, M - Migratory, F - Feeding, R - Reproductive, P - Parent, C - Child/Core
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Table 2.4-72: Estimated Effects to the San Francisco Russian River Stock of Harbor Porpoise over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Air gun	Navy Testing	1	2	(1)	-	-
Explosive	Navy Training	-	22	24	-	-
Explosive	Navy Testing	3	3	1	-	-
Explosive	USCG Training	0	0	0	-	-
Sonar	Navy Training	6,869	29	0	-	-
Sonar	Navy Testing	3,023	6	0	-	-
Sonar	USCG Training	2	-	-	-	-
Maximum Annual Total		**9,898**	**62**	**26**	**-**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
9,974	1.00	0.00

Season	Percent of Total Effects
	NOCAL
Warm	39%
Cold	61%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Medium Coordinated Anti-Submarine Warfare	Navy Training	52%
Acoustic and Oceanographic Research (ONR)	Navy Testing	30%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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Table 2.4-73: Estimated Effects to the Morro Bay Stock of Harbor Porpoise over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Explosive	Navy Training	-	13	11	0	-
Explosive	Navy Testing	74	159	75	(1)	0
Sonar	Navy Training	3,824	46	0	-	-
Sonar	Navy Testing	254	3	(1)	-	-
Maximum Annual Total		**4,152**	**221**	**87**	**1**	**0**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
4,191	1.06	0.02

Season	Percent of Total Effects	
	PMSR	NOCAL
Warm	26%	0%
Cold	73%	1%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Submarine Mobile Mine and Mine Laying Exercise	Navy Training	46%
Medium Coordinated Anti-Submarine Warfare	Navy Training	20%
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	13%
Acoustic and Oceanographic Research (ONR)	Navy Testing	5%

Area Type	Area Name (Active Months)	BEH	TTS	AINJ	INJ	MORT
S-BIA	Morro Bay (All)	3,815	186	73	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
BIA Types: S - Small/Resident population, M - Migratory, F - Feeding, R - Reproductive, P - Parent, C - Child/Core
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2.4.3 Impacts on Pinnipeds

The pinnipeds analyzed below are either in the Phocid Carnivores in Water (PCW) or the Otariids and other non-phocid marine carnivores in Water (OCW) auditory groups. The updated PCW criteria reflect greater susceptibility to auditory effects at low and mid-frequencies than previously analyzed. The updated OCW criteria reflects substantially greater susceptibility to auditory effects across their hearing range compared to previous analyses (Figure 2.2-1). For sonar exposures, the updated Pinniped in-water behavioral response function indicates greater sensitivity to behavioral disturbance compared to the prior analysis. As described in Section 2.2.2 (Quantifying Impacts on Hearing), the methods to model avoidance of sonars have been revised to base a species' probability of an avoidance responses on the behavioral response function. In addition, the cut-off conditions for predicting significant behavioral responses have been revised as shown in Section 2.2.3 (Quantifying Behavioral Responses to Sonars). These factors interact in complex ways that the results of this analysis challenging to compare to prior analyses. Overall impacts due to sonar have increased for pinnipeds compared to the prior analysis, which is primarily due to the changes in auditory and behavioral criteria mentioned above, and changes to species densities (see the *Density TR*). There has also been an increase in hull-mounted sonar use (see Section 2.1.1 Impacts from Sonars and Other Transducers)

Some species of pinnipeds would be exposed to pile driving activities conducted within Port Hueneme, as detailed in Section 2.1.3 (Impacts from Pile Driving). Impacts from pile driving are estimated as if all affects would occur underwater, which is conservative as pinnipeds spend a substantial portion of time hauled out on land or with their heads out of the water. Furthermore, the quantitative analysis of pile driving did not account for avoidance. Estimated ranges to effect are shown in Section 2.5.3 (Ranges to Effects for Pile Driving).

Impacts on pinnipeds due to land-based launches at San Nicolas Island in PMSR and at the PMRF on Kauai in the Hawaii Study Area were analyzed separately from the impacts due to activities conducted within and over the sea space of the Study Area analyzed here.

Impacts due to non-modeled acoustic stressors are discussed above in Section 2.1.4 (Impacts from Vessel Noise), Section 2.1.5 (Impacts from Aircraft Noise), and Section 2.1.6 (Impacts from Weapons Noise).

2.4.3.1 Hawaiian Monk Seal (*Neomonachus schauinslandi*)*

The only stock of Hawaiian monk seals in the Study Area is the Hawaiian stock which is endangered throughout its range. Hawaiian monk seals are in the PCW hearing group and Pinniped behavioral group. Model-predicted impacts are presented in Table 2.4-74. Although Hawaiian monk seals are analyzed using the same criteria and thresholds as other pinnipeds, the best available scientific information suggests that their hearing is less sensitive than other pinnipeds (Ruscher et al., 2021; Sills et al., 2021). Therefore, the quantitative analysis presented below is likely to be conservative.

Hawaiian monk seals are residents of the main Hawaiian Islands and Northwest Hawaiian Islands where they breed, but sightings have been reported south of the Hawaiian island chain. They mostly inhabit nearshore or shallow water but have been observed traveling between islands, atolls, and submerged reefs, and even on occasion making pelagic foraging trips. Hawaiian monk seals are generally solitary, and while some individuals adhere to a single island, others regularly travel between islands within their range year-round.

Most auditory impacts would be attributable to sonar used in Anti-Submarine Warfare activities. It is more likely that Hawaiian monk seals would experience short-term behavioral impacts, which are mostly attributable to Anti-Submarine Warfare and Surface Ship Object Detection activities. The average risk of injurious impacts per individual is negligible although four AINJ and one non-auditory injury is predicted. The single predicted non-auditory injury due to explosives during Mine Warfare and Expeditionary Warfare (Obstacle Loading) conducted at Puuloa Underwater Range and is a result of summing risk across seven years and following the approach discussed in Section 2.4 (Species Impact Assessments). The pre-event activity-based mitigation prescribed for these activities in the *Mitigation* may reduce the potential for injurious impacts. No effects are predicted from noise produced by air guns, which may be used in testing activities at least 3 NM from shore in the Hawaii Range Complex. No effects are possible from pile driving because there is no geographic overlap of this stressor.

The risk of repeated impacts on individuals and consequences to populations from disturbances of individuals can be mediated by certain life history traits of a species. Hawaiian monk seals have a fast pace of life and capital breeding strategy which makes them more resilient to short-term foraging disruptions. Their primary habitat in the Northwestern Hawaiian Islands is within the Hawaii Study Area, and their main Hawaiian Islands habitat is within the Hawaii Range Complex. Because Hawaiian monk seals are residential, and the population is located entirely within the Hawaii Study Area, the risk of repeated exposure is higher for this species compared to other pinnipeds with nomadic or migratory movement ecology.

Although Hawaiian monk seals are endangered and depleted, they have a stable and possibly increasing population trend. The greatest threats to the species include reduced prey availability, shark predation, anthropogenic disturbance, and loss of habitat due to climate change. One to a few instances of disturbance over a year are unlikely to have any long-term consequences for individuals, although individuals who experience injury may incur energetic costs. Based on the above analysis, long-term consequences for the Hawaiian stock of Hawaiian monk seals are unlikely.

Based on the analysis presented above, vessel, aircraft, and weapons noise produced during training activities <u>may affect, but are not likely to adversely affect,</u> Hawaiian monk seals. The use of sonar and explosives during training activities <u>may affect, and are likely to adversely affect,</u> Hawaiian monk seals. Activities that involve the use of pile driving are <u>not applicable</u> to Hawaiian monk seals because there is no geographic overlap of this stressor with species occurrence. Air gun activities are not conducted during training.

Based on the analysis presented above, air guns and activities that produce vessel, aircraft, and weapons noise during testing activities <u>may affect, but are not likely to adversely affect,</u> Hawaiian monk seals. The use of sonar and explosives during testing activities <u>may affect, and are likely to adversely affect,</u> Hawaiian monk seals. Pile diving activities are not conducted during testing.

<u>Critical Habitat</u>

Critical habitat for the Hawaiian monk seal is designated in much of the coastal areas of the Hawaiian Islands (National Oceanic and Atmospheric Administration, 2015). A map of this critical habitat is in *Biological Resources Supplemental Information*. Hawaiian monk seal critical habitat is located entirely within the Hawaii Study Area. A portion of the critical habitat is located within the Hawaii Range Complex and sound from sonar used during anti-submarine warfare, mine countermeasures, and surface ship object detection activities may occur. There are also military readiness activities involving explosives, air guns, aircraft, weapons, and vessel noise for which sound or energy might overlap this designated critical habitat. The essential features of designated critical habitat are: (1) Terrestrial areas and adjacent shallow, sheltered aquatic areas with characteristics preferred by monk seals for pupping and nursing; (2) Marine areas from 0 to 200 m in depth that support adequate prey quality and quantity for juvenile and adult monk seal foraging; and 3) Significant areas used by monk seals for hauling out, resting, or molting. These features are primarily geographical and would not be altered by sound or sound energy from military readiness activities. Terrestrial areas preferred by monk seals for pupping and hauling out have been identified from over 30 years of data (National Oceanic and Atmospheric Administration, 2015).

The biological feature of adequate prey quality and quantity may be affected by the Proposed Action. Hawaiian monk seals prey on fishes and invertebrates in shallow water. Air guns would be used at least 3 NM from shore in the Hawaii Range Complex. Sound from air guns would have no plausible route of effect for impacts on prey quality or quantity within the 200 m depth contour, as ranges to injury or mortality for fishes would be within five meters for this source (see *Impacts on Fishes from Acoustic and Explosive Stressors*). Any sound from air guns would likely not be detectable above ambient noise at distances of a few hundred meters or more. The use of explosives could affect prey quality or quantity in Hawaiian monk seal critical habitat. Most activities involving in-water and surface explosives are conducted more than 12 NM from shore, beyond monk seal critical habitat. Ranges to injury and mortality of fishes due to explosives are on the order of hundreds of meters for the largest explosives (Table 4.4-5), so it is unlikely that sound or energy from explosives would be sufficient to affect prey in designated critical habitat. Explosives close to shore would be used in areas described in Appendix A (Activity Descriptions) and Appendix H (Description of Systems and Ranges). Most of these areas were excluded from the critical habitat designation[7]. Non-impulsive sound sources, such as sonars, have not been known to cause direct injury or mortality to fish under conditions that would be found in the wild (Halvorsen et al., 2012a; Kane et al., 2010; Popper et al., 2007) and would only be expected to result in behavioral reactions or potential masking in fishes and marine invertebrates. Most sonar sources proposed for use during training and testing activities overlapping or adjacent to critical habitat in the Hawaii Study Area would not fall within the frequency range of fish and invertebrate hearing, thereby presenting no plausible route of effect on Hawaiian monk seal prey species. Vessel and aircraft noise may be present in critical habitat but would not cause injury or mortality to fishes or invertebrates and are unlikely to affect prey quality or quantity.

Sonar and activities that produce vessel, aircraft, and weapons noise during training activities would have <u>no effect</u> on designated Hawaiian monk seal critical habitat. The use of explosives during training activities <u>may affect, but is not likely to adversely affect,</u> designated Hawaiian monk seal critical habitat. Activities that involve the use of pile driving are <u>not applicable</u> to designated Hawaiian monk seal critical habitat because there is no geographic overlap of this stressor with critical habitat. Air gun activities are not conducted during training.

[7] These exclusion areas include (1) all areas subject to the Marine Corps Base Hawaii, the Joint Base Pearl Harbor-Hickam, and the Pacific Missile Range Facility Integrated Natural Resource Management Plans; and (2) areas excluded due to national security: the Kingfisher Underwater Training area in marine areas off the northeast coast of Niihau; PMRF Offshore Areas in marine areas off the western coast of Kauai; the Puuloa Underwater Training Range in marine areas outside Pearl Harbor, Oahu; and the Shallow Water Minefield Sonar Training Range off the western coast of Kahoolawe in the Maui Nui area.

Sonar, air guns, and activities that produce vessel, aircraft, and weapons noise during testing activities would have no effect on designated Hawaiian monk seal critical habitat. The use of explosives during testing activities may affect, but is not likely to adversely affect, designated Hawaiian monk seal critical habitat. Pile diving activities are not conducted during testing.

Table 2.4-74: Estimated Effects to the Hawaiian Monk Seal over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Explosive	Navy Training	11	16	2	(1)	0
Explosive	Navy Testing	8	9	1	-	-
Explosive	Army Training	(1)	-	-	-	-
Sonar	Navy Training	457	95	0	-	-
Sonar	Navy Testing	58	33	(1)	-	-
Sonar	USCG Training	1	-	-	-	-
Maximum Annual Total		**536**	**153**	**4**	**1**	**0**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
1,564	0.44	0.00

Season	Percent of Total Effects: HRC	Percent of Total Effects: High Seas
Warm	45%	1%
Cold	54%	1%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Surface Ship Object Detection	Navy Training	28%
Anti-Submarine Warfare Torpedo Exercise - Ship	Navy Training	13%
Anti-Submarine Warfare Torpedo Exercise - Submarine	Navy Training	9%
Submarine Navigation	Navy Training	8%
Mine Countermeasures - Ship Sonar	Navy Training	5%

Area Type	Area Name (Active Months)	BEH	TTS	AINJ	INJ	MORT
Critical Habitat	Critical Habitat (All)	356	53	2	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
BIA Types: S - Small/Resident population, M - Migratory, F - Feeding, R - Reproductive, P - Parent, C - Child/Core
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2.4.3.2 Harbor Seal (*Phoca vitulina*)

The only stock of harbor seals in the Study Area is the California stock. Harbor seals are in the PCW hearing group and Pinniped behavioral group. Model-predicted impacts on the California stock are presented in Table 2.4-75.

The California stock of harbor seals is widely distributed along the costal nearshore waters in the California Study Area and PMSR, primarily within 20 km of shore. Harbor seals frequently occupy bays, estuaries, and inlets and prefer waters near haul out locations like the Channel Islands and the mainland coast.

Most auditory impacts would be due to sonar from Intelligence, Surveillance, and Reconnaissance activities in the Southern California Study Area. It is likely that harbor seals would experience short-term behavioral impacts and TTS due to sonar. The majority of predicted AINJ is due to impulsive sources used in Navy training activities including explosives and pile driving. The implementation of pile driving ‘soft start’ procedures may warn harbor seals to avoid the area, or to haul out, prior to receiving sound levels that could produce these effects. Furthermore, the risk of AINJ or TTS from pile driving may be reduced further through visual observation mitigation. It is more likely that harbor seals may experience short-term behavioral impacts from this activity.

The potential for repeated effects to individuals is low. On average, individuals in this stock would be impacted twice per year. The average risk of injurious impacts on individuals is low although injury could occur. A single mortality is predicted due to summing risk across seven years and following the rounding approach discussed in Section 2.4 (Species Impact Assessments). Therefore, the risk of any mortality is unlikely for harbor seals. The risk of injury or mortality could be further reduced with visual observation mitigation.

The risk of repeated impacts on individuals and consequences to populations from disturbances of individuals can be mediated by certain life history traits of a species. Harbor seals have a fast pace of life, but pinnipeds have a relatively lower energy requirement for their body size, which may moderate any impact due to foraging disruption. The California stock of harbor seals is residential, so the risk of repeated effects is likely higher for individuals within the population that inhabit areas overlapping with or adjacent to locations such as Port Hueneme and San Nicholas Island as compared with individuals that reside elsewhere. Because of their shorter generation times, this population would require less time to recover if significantly impacted.

A few instances of disturbance over a year are unlikely to have any long-term consequences for individuals, although individuals who experience injury may incur energetic costs. Based on the above analysis, long-term consequences for the California stock of harbor seals are unlikely.

Table 2.4-75: Estimated Effects to the California Stock of Harbor Seals over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Explosive	Navy Training	1,510	2,050	214	6	1
Explosive	Navy Testing	170	158	14	(1)	0
Explosive	USCG Training	(1)	0	-	-	-
Pile Driving	Navy Training	952	183	20	-	-
Sonar	Navy Training	10,510	1,457	3	-	-
Sonar	Navy Testing	38,391	15,461	3	-	-
Sonar	USCG Training	140	-	-	-	-
Maximum Annual Total		**51,674**	**19,309**	**254**	**7**	**1**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
30,968	2.30	0.01

	Percent of Total Effects	
Season	SOCAL	PMSR
Warm	42%	4%
Cold	50%	4%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Intelligence, Surveillance, Reconnaissance (NAVWAR)	Navy Testing	55%
Multi-Domain Unmanned Autonomous Systems	Navy Training	9%
Undersea Warfare Testing	Navy Testing	7%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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2.4.3.3 Northern Fur Seal (*Callorhinus ursinus*)

Two Northern fur seal stocks are in the Study Area – the California stock and the Eastern Pacific stock. Fur seals are in the OCW hearing group and the Pinniped behavioral group. Model-predicted impacts on the California stock are presented in Table 2.4-76 and model-predicted impacts on the Eastern Pacific stock are presented in Table 2.4-77.

Northern fur seals are found primarily over the edge of the continental shelf and slope in the north Pacific. The California stock is found on San Miguel Island and a nearby offshore island primarily in summer and up to 40 km to the south of San Miguel Island but may be present there year-round. A small percentage of juvenile and adult female individuals from the Eastern Pacific stock migrate seasonally into the northernmost portion of the Study Area as far south as San Miguel Island.

Most estimated effects for both the California and Eastern Pacific stocks of northern fur seals are behavioral responses due to sonar used in Anti-Submarine Warfare training activities, but TTS is also likely to occur. Although some AINJ is predicted, the overall risk of injurious impacts on individuals is negligible. One non-auditory injury due to explosives is predicted for each stock, however this result is due to summing risk across seven years and following the rounding approach discussed in Section 2.4 (Species Impact Assessments). The risk of repeated impacts for the California stock is low, with individuals estimated to be impacted twice per year. The risk of repeated impacts for the Eastern Pacific stock is very low, with individuals estimated to be impacted less than once per year.

The risk of repeated impacts on individuals and consequences to populations from disturbances of individuals can be mediated by certain life history traits of a species. Northern fur seals have a fast pace of life, but pinnipeds have a relatively lower energy requirement for their body size, which may moderate any impact due to foraging disruption. The California stock of northern fur seals is residential, so the risk of repeated impacts on individuals is likely higher for individuals within the population that inhabit areas overlapping with or adjacent to locations in the Study Area. This population of northern fur seals may also be increasing. Although the Eastern Pacific stock of Northern fur seals is depleted and in decline, they are migratory and therefore less susceptible to repeated impacts as they travel seasonally through their range. Northern fur seals have shorter generation times, so these two stocks would require less time to recover if significantly impacted.

A few instances of disturbance over a year are unlikely to have any long-term consequences for individuals, although individuals who experience injury may incur energetic costs. Based on the above analysis, long-term consequences for the California and Eastern Pacific stocks of northern fur seals are unlikely.

Table 2.4-76: Estimated Effects to the California Stock of Northern Fur Seals over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Air gun	Navy Testing	(1)	-	-	-	-
Explosive	Navy Training	(1)	2	(1)	0	-
Explosive	Navy Testing	15	22	6	(1)	0
Explosive	USCG Training	0	0	-	-	-
Sonar	Navy Training	13,512	6,134	2	-	-
Sonar	Navy Testing	1,769	87	0	-	-
Sonar	USCG Training	555	-	-	-	-
Maximum Annual Total		**15,853**	**6,245**	**9**	**1**	**0**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
14,115	1.57	0.00

Season	Percent of Total Effects: PMSR	Percent of Total Effects: NOCAL
Warm	35%	7%
Cold	36%	22%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Medium Coordinated Anti-Submarine Warfare	Navy Training	48%
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	21%
Acoustic and Oceanographic Research (ONR)	Navy Testing	7%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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Table 2.4-77: Estimated Effects to the Eastern Pacific Stock of Northern Fur Seals over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Air gun	Navy Testing	(1)	-	-	-	-
Explosive	Navy Training	(1)	2	(1)	0	-
Explosive	Navy Testing	19	28	7	(1)	0
Explosive	USCG Training	0	(1)	-	-	-
Sonar	Navy Training	19,371	9,876	2	-	-
Sonar	Navy Testing	3,080	183	(1)	-	-
Sonar	USCG Training	633	-	-	-	-
Maximum Annual Total		**23,105**	**10,090**	**11**	**1**	**0**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
626,618	0.05	0.00

Season	Percent of Total Effects: PMSR	Percent of Total Effects: NOCAL
Warm	11%	3%
Cold	42%	44%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Medium Coordinated Anti-Submarine Warfare	Navy Training	52%
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	16%
Acoustic and Oceanographic Research (ONR)	Navy Testing	9%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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2.4.3.4 Northern Elephant Seal (*Mirounga angustirostris*)

The only stock of Northern elephant seals in the Study Area is the California breeding stock. However, 80 percent of elephant seals from the breeding population in Mexico migrate into the Study Area seasonally and were included in density estimates that were used to model impacts on this species (see the *Density TR*). Elephant seals are in the PCW hearing group and the Pinniped behavioral group. Model-predicted impacts on the California breeding stock are presented in Table 2.4-78.

The California breeding stock of Northern elephant seals is found in California and is not expected to be present in the Hawaii Study Area. Elephant seals spend approximately 80 percent of their time in the open ocean migrating and foraging, but they can be found in coastal waters seasonally when breeding in their mainland rookeries. Small colonies of northern elephant seals breed and haul-out on Santa Barbara Island, Santa Rosa Island, and San Clemente Island with large colonies on San Nicolas and San Miguel Islands. Northern elephant seals breed on these islands from late December to February and molt primarily from April to July.

Most auditory impacts would be attributable to sonar used in Anti-Submarine Warfare training, UUV testing, Intelligence, Surveillance, and Reconnaissance testing, and other activities. The average risk of injurious impacts on individuals is negligible, although AINJ due to explosives and sonar is predicted. Two non-auditory injuries are predicted to occur as a result of explosives, however this result is due to summing risk across seven years and following the rounding approach discussed in Section 2.4 (Species Impact Assessments). It is more likely that Northern elephant seals would experience TTS and short-term behavioral impacts. The risk of repeated impacts on individuals is low. On average, individuals would experience impacts less than once per year. This risk estimate is conservative because it was calculated using the SAR abundance of 187,386 elephant seals for the California Stock (see Table 2.4-1), however the density used in modeling also accounted for elephant seals from the Mexico population that likely overlap the California stock during migration. The modeling assumes 80 percent of the Mexico population (conservatively estimated at 22,000) may overlap the California stock, for total species abundance of 204,986 in the Study Area.

The risk of repeated impacts on individuals and consequences to populations from disturbances of individuals can be mediated by certain life history traits of a species. Despite being the largest species of pinniped in the HCTT Study Area, Northern elephant seals have a fast pace of life. However, pinnipeds have a relatively lower energy requirement for their body size, which may moderate any impact due to foraging disruption. The California stock of Northern elephant seals spend most of their time at sea, migrating long distances to offshore foraging areas to build up the blubber stores required to support them during breeding and molting haulouts. Therefore, the risk of repeated impacts is likely lower for individuals in this population. Because of their shorter generation times, this population would require less time to recover if significantly impacted.

A few instances of disturbance over a year are unlikely to have any long-term consequences for individuals, although individuals who experience injury may incur energetic costs. Based on the above analysis, long-term consequences for the California stock of northern elephant seals are unlikely.

Table 2.4-78: Estimated Effects to the California Breeding Stock of Northern Elephant Seals over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Air gun	Navy Testing	1	-	-	-	-
Explosive	Navy Training	147	229	31	(1)	-
Explosive	Navy Testing	220	332	55	(1)	0
Explosive	USCG Training	2	2	(1)	-	-
Sonar	Navy Training	28,461	39,790	17	-	-
Sonar	Navy Testing	34,434	13,065	5	-	-
Sonar	USCG Training	1,790	(1)	-	-	-
Maximum Annual Total		**65,055**	**53,419**	**109**	**2**	**0**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
187,386	0.63	0.00

Season	Percent of Total Effects		
	SOCAL	PMSR	NOCAL
Warm	27%	8%	5%
Cold	30%	19%	13%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Medium Coordinated Anti-Submarine Warfare	Navy Training	22%
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	12%
Unmanned Underwater Vehicle Testing	Navy Testing	9%
Intelligence, Surveillance, Reconnaissance (NAVWAR)	Navy Testing	8%
Acoustic and Oceanographic Research (ONR)	Navy Testing	6%
At-Sea Sonar Testing	Navy Testing	6%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
version.20241107

2.4.3.5 Guadalupe Fur Seal (*Arctocephalus townsendi*)*

The only stock of Guadalupe fur seals in the Study Area is the Mexico stock which is threatened throughout its range. Fur seals are in the OCW hearing group and the Pinniped behavioral group. Model-predicted impacts are presented in Table 2.4-79.

Guadalupe fur seals breed primarily on Guadalupe Island, which is located outside but near the southern edge of the California Study Area. They are found in pelagic waters of the Study Area, but do not typically haul out within the Study Area. They are not found in the Hawaii Study Area. Since the prior analysis, the density of Guadalupe fur seals in the Study Area has substantially increased (see the *Density TR*).

Most auditory impacts would be attributable to sonar used in Navy training and testing activities. Few impacts are predicted outside the SOCAL Range Complex. Most impacts would be behavioral responses due to sonar used in testing activities, and the risk of injurious impacts is low. The predicted auditory injuries due to sonar would likely be from to hull-mounted sonar used in Anti-Submarine Warfare training activities. Predicted AINJ and non-auditory injury due to explosives is unlikely to occur, and activity-based mitigation may further reduce the likelihood of these impacts. The risk of repeated impacts on individuals is moderate. On average, individuals would be impacted three times per year.

The risk of repeated impacts on individuals and consequences to populations from disturbances of individuals can be mediated by certain life history traits of a species. Guadalupe fur seals have a fast pace of life. However, pinnipeds have a relatively lower energy requirement for their body size, which may moderate any impact due to foraging disruption. The Mexico stock of Guadalupe fur seals is migratory, so the risk of repeated impacts is likely lower for individuals in this population as they travel seasonally through their range. Although this stock is threatened and depleted, their population may be increasing. In addition, Guadalupe fur seals have shorter generation times, so this population would require less time to recover if significantly impacted.

A few instances of disturbance over a year are unlikely to have any long-term consequences for individuals, although individuals who experience injury may incur energetic costs. Based on the above analysis, long-term consequences for the Mexico stock of Guadalupe fur seals are unlikely.

Based on the analysis presented above, vessel, aircraft, and weapons noise produced during training activities may affect, but are not likely to adversely affect, Guadalupe fur seals. The use of sonars and explosives during training activities may affect, and are likely to adversely affect Guadalupe fur seals. Activities that involve the use of pile driving are not applicable to Guadalupe fur seals because there is no geographic overlap of this stressor with species occurrence. Air gun activities are not conducted during training.

Based on the analysis presented above, vessel, aircraft, and weapons noise produced during testing activities may affect, but are not likely to adversely affect, Guadalupe fur seals. The use of sonars, explosives, and air guns during testing activities may affect, and are likely to adversely affect Guadalupe fur seals. Pile diving activities are not conducted during testing.

Table 2.4-79: Estimated Effects to the Mexico Stock of Guadalupe Fur Seals over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Air gun	Navy Testing	(1)	-	-	-	-
Explosive	Navy Training	24	29	2	1	0
Explosive	Navy Testing	35	43	6	1	0
Explosive	USCG Training	(1)	-	-	-	-
Sonar	Navy Training	105,220	37,448	15	-	-
Sonar	Navy Testing	21,472	1,846	2	-	-
Sonar	USCG Training	1,863	2	-	-	-
Maximum Annual Total		**128,616**	**39,368**	**25**	**2**	**0**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
48,780	3.44	0.00

	Percent of Total Effects		
Season	SOCAL	PMSR	NOCAL
Warm	40%	7%	1%
Cold	42%	7%	1%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	31%
Medium Coordinated Anti-Submarine Warfare	Navy Training	13%
Small Joint Coordinated Anti-Submarine Warfare	Navy Training	8%
Submarine Sonar Maintenance and Systems Checks	Navy Training	7%
Composite Training Unit Exercise (Strike Group)	Navy Training	7%
Surface Ship Sonar Maintenance and Systems Checks	Navy Training	6%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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2.4.3.6 California Sea Lion (*Zalophus californianus*)

The only stock of California sea lions in the Study Area is the United States stock. Sea lions are in the OCW hearing group and the Pinniped behavioral group. Model-predicted impacts are presented in Table 2.4-80.

California sea lions are found in the southern portion of the California Study Area and not the Hawaii Study Area. They are found in coastal waters and forage primarily in the open ocean over the continental shelf and slope and pelagic waters. They range from southern Mexico to the Gulf of Alaska, with seasonal shifts in their distribution to the northwest in the fall and southeast during the winter and spring.

Most predicted auditory impacts on California sea lions are due to sonar and explosives used in Navy training activities. The individual risk of injurious impacts is low. Auditory injuries would be due to explosives, sonar, and pile driving, while non-auditory injuries would be due to explosives. For pile driving, the implementation of 'soft start' procedures that may warn California sea lions to avoid the area, or haul out, prior to receiving sound levels that could produce these effects. Furthermore, the risk of AINJ or TTS from pile driving may be reduced further through visual observation mitigation. It is more likely that California sea lions may experience short-term behavioral impacts from this activity. A small number of mortalities due to explosives used in training and testing over seven years is predicted. However, the average risk of injurious impacts on individuals is low. The largest proportion of impacts on this species would be behavioral responses to sonar used in Navy training and testing activities and Intelligence, Surveillance, Reconnaissance activities. The risk of repeated impacts on individuals is high. On average, individuals would be impacted seven times per year.

The risk of repeated impacts on individuals and consequences to populations from disturbances of individuals can be mediated by certain life history traits of a species. California sea lions have a fast pace of life. However, pinnipeds have a relatively lower energy requirement for their body size, which may moderate any impact due to foraging disruption. The movement ecology of California sea lions is dependent on demographics, but all individuals typically have residential site fidelity during the breeding season (summer). At the end of the breeding season, a portion of the population (females and young) stay in the area while another portion (typically males) migrates northward. Additionally, certain subpopulations of California sea lions (e.g., San Clemente Island population) tend to remain in Southern California year-round. The risk of repeated impacts on individuals who migrate seasonally may be lower compared to individuals who have site fidelity in areas that overlap with proposed activities. However, the entire United States stock of California sea lions is stable, and since this species has shorter generation times, this population would require less time to recover if significantly impacted.

Several instances of disturbance over a year are unlikely to have any long-term consequences for individuals, although individuals who experience injury may incur energetic costs. Based on the above analysis, long-term consequences for the California sea lion are unlikely.

Table 2.4-80: Estimated Effects to the United States Stock California Sea Lions over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Air gun	Navy Testing	8	(1)	-	-	-
Explosive	Navy Training	3,254	4,576	313	43	4
Explosive	Navy Testing	842	1,046	161	14	1
Explosive	USCG Training	2	2	0	0	-
Pile Driving	Navy Training	16,992	1,891	61	-	-
Sonar	Navy Training	662,716	186,625	115	-	-
Sonar	Navy Testing	928,540	67,321	16	-	-
Sonar	USCG Training	14,931	2	-	-	-
Maximum Annual Total		**1,627,285**	**261,464**	**666**	**57**	**5**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
257,606	7.33	0.00

Season	Percent of Total Effects		
	SOCAL	PMSR	NOCAL
Warm	35%	10%	2%
Cold	39%	12%	2%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Intelligence, Surveillance, Reconnaissance (NAVWAR)	Navy Testing	16%
Unmanned Underwater Vehicle Testing	Navy Testing	12%
Anti-Submarine Warfare Torpedo Exercise - Ship	Navy Training	12%
Medium Coordinated Anti-Submarine Warfare	Navy Training	10%
Undersea Warfare Testing	Navy Testing	9%
Anti-Submarine Warfare Tracking Exercise - Ship	Navy Training	8%
At-Sea Sonar Testing	Navy Testing	6%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
version.20241107

2.4.3.7 Steller Sea Lion (*Eumetopias jubatus*)

The only stock of Steller sea lions in the Study Area is the Eastern United States stock. Sea lions are in the OCW hearing group and the Pinniped behavioral group. Model-predicted impacts are presented in Table 2.4-81.

The Stellar sea lion primarily ranges along the North Pacific Rim with most of the population occurring in the Gulf of Alaska and Aleutian Islands. In the Study Area, they are found with greater abundance in northern California and fewer occur in the Channel Islands and in Southern California waters. Most predicted auditory impacts are due to sonar used in Navy training and testing activities. While a few instances of auditory injury are predicted, most impacts would be TTS or behavioral responses. The risk of repeated impacts on individuals is low, and the risk of repeated injurious impacts is negligible.

The risk of repeated impacts on individuals and consequences to populations from disturbances of individuals can be mediated by certain life history traits of a species. Steller sea lions have a fast pace of life. However, pinnipeds have a relatively lower energy requirement for their body size, which may moderate any impact due to foraging disruption. The Eastern United States stock of Steller sea lions is residential, so the risk of repeated impacts is likely higher for individuals in this population as they have site fecundity to important haul outs along the California coastline including Año Nuevo Island and the Farallon Islands in Central California, which is directly adjacent to the NOCAL Range Complex. However, this population may be increasing, and since Steller sea lions have shorter generation times, this population would require less time to recover if significantly impacted.

A few instances of disturbance over a year are unlikely to have any long-term consequences for individuals, although individuals who experience injury may incur energetic costs. Based on the above analysis, long-term consequences for the Steller sea lion are unlikely.

Table 2.4-81: Estimated Effects to the Eastern United States Stock of Steller Sea Lions over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Explosive	Navy Training	5	8	2	-	-
Explosive	Navy Testing	0	(1)	0	-	-
Sonar	Navy Training	389	122	(1)	-	-
Sonar	Navy Testing	439	31	-	-	-
Sonar	USCG Training	4	-	-	-	-
Maximum Annual Total		**837**	**162**	**3**	**-**	**-**

Population Abundance Estimate	Annual Effects per Individual	Annual Injurious Effects per Individual
36,308	0.03	0.00

Season	Percent of Total Effects		
	SOCAL	PMSR	NOCAL
Warm	20%	1%	23%
Cold	29%	2%	25%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Medium Coordinated Anti-Submarine Warfare	Navy Training	33%
Intelligence, Surveillance, Reconnaissance (NAVWAR)	Navy Testing	24%
Unmanned Underwater Vehicle Testing	Navy Testing	13%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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2.4.4 Impacts on Mustelids

The southern sea otter is the only species of mustelid present in the Study Area. Sea otters are in the OCW hearing group. The updated OCW criteria reflects substantially greater susceptibility to auditory effects across their hearing range compared to previous analyses (Figure 2.2-1).

Southern sea otters would not be exposed to nearshore pile driving near Port Hueneme because there is no geographic overlap of this stressor with species occurrence. Impacts due to non-modeled acoustic stressors are discussed above in Section 2.1.4 (Impacts from Vessel Noise), Section 2.1.5 (Impacts from Aircraft Noise), and Section 2.1.6 (Impacts from Weapons Noise).

2.4.4.1 Southern Sea Otter (*Enhydra lutris*)*

The only stock of southern sea otters in the Study Area is the California stock which is threatened.

There are two populations of southern sea otters in the Study Area. The mainland population of sea otters ranges from Pigeon Point, north of Monterrey Bay, to just south of Point Conception on the central coast of California. These areas are shoreward of the NOCAL Range Complex and PMSR. The second population of southern sea otters around San Nicolas Island in the PMSR were translocated there by the United States Fish and Wildlife Service before 1991.[8] Sea otters prefer nearshore areas with kelp canopy but may occasionally be present in deeper waters when moving between areas or attempting to establish new habitat. The two populations of southern sea otters are considered largely residential and are not known to make seasonal migrations.

Southern sea otters are unlikely to be affected by noise from military readiness activities conducted offshore in the range complexes. Southern sea otters congregate in shallow, coastal environments, including bays and estuaries, as well as exposed coastal areas that are mostly shoreward and outside of the range complexes. They would not be exposed to noise from offshore military readiness activities when in inshore areas. Sonar activities would not occur close to shore in the area where sea otter habitat may overlap the PMSR near Point Conception, nor would explosives be used in the nearshore environments they inhabit on the mainland and at San Nicolas Island. Some coastal areas have higher levels of ambient noise that would mask or kelp forests that would attenuate underwater noise from military readiness activities. In addition, Ghoul and Reichmuth (2014) have shown that sea otters are not especially well adapted for hearing underwater, which suggests that the function of this sense has been less important in their survival and evolution than in comparison to pinnipeds. Sea otters also spend most of their time floating at the surface with their ears above the water.

Vessel noise would potentially disturb sea otters where training in the amphibious approach lanes would overlap mainland southern sea otter habitat around the southern border of the NOCAL Range Complex, from Mill Creek Beach to San Carpoforo Beach, and the three amphibious approach lanes bordering the northern portion of PMSR (near Morro Bay, Pismo Beach, and Vandenberg Space Force Base). Vessels in these amphibious approach lanes will avoid large areas of kelp canopy where sea otters are most likely to congregate. Sea otters spend most of their time on the surface, often together in large groups or rafts, and may be more visible to lookouts conducting visual observation mitigation.

The risk of repeated exposures to individuals and consequences to populations from disturbances of individuals can be mediated by certain life history traits of a species. This species is an extreme income breeder; their metabolism demands high caloric intake with minimal energy in reserve. Therefore, females are required to forage throughout lactation to meet both the caloric needs of themselves and their pups. As such small income breeders with a fast pace of life, southern sea otters are less resilient to missed foraging opportunities than larger marine mammals. While other marine mammals might avoid the same stressor, sea otters' dependence on constant and successful foraging opportunities likely drives this species to remain in productive foraging habitats even if foraging sites are near anthropogenic activities. Because the California stock of southern sea otters is residential, the risk of repeated exposure is higher for populations that have high site fidelity in locations that overlap frequently used training and testing sites. Although this stock of southern sea otters is threatened and depleted, the population in the HCTT Study Area may be somewhat stable, while the population at San Nicolas Island has been higher than the mainland population.

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[8] Per the National Defense Authorization Act (NDAA) for Fiscal Year 2016, the provisions in the MMPA sections 101 and 102 and in the ESA sections 4 and 9 and do not apply to the incidental taking of southern sea otters in the designated Southern Sea Otter Military Readiness Areas at San Nicolas Island and San Clemente Island..

Based on the above analysis, significant impacts on individual sea otters are unlikely, and therefore it is unlikely that military readiness activities will produce long-term consequences for the California stock of southern sea otters.

Based on the analysis presented above, the use of sonar and explosives, and activities that produce aircraft and weapons noise during training activities would not affect the mainland population of southern sea otters. Activities that produce vessel noise during training activities may affect, but are not likely to adversely affect, the mainland population of southern sea otters. Activities that involve the use of pile driving are not applicable to the mainland population of southern sea otters because there is no geographic overlap of this stressor with species occurrence. Air gun activities are not conducted during training.

Based on the analysis presented above, the use of sonar, explosives, and air guns, and activities that produce vessel, aircraft, and weapons noise during testing activities would not affect the mainland population of southern sea otters. Pile diving activities are not conducted during testing.

2.4.5 Impact Summary Tables

The tables in in this section show impacts on all stocks under the preferred alternative for the following:

- Maximum annual and seven-year total impacts due to sonar use during Navy training activities, during Navy testing activities, and during U.S. Coast Guard training activities. The maximum annual impacts per stock are the same values presented in each species impact assessment above. See Table 2.4-82 through Table 2.4-87.
- Maximum annual and seven-year total impacts due to air gun use during testing activities. See Table 2.4-88 and Table 2.4-89.
- Maximum annual and seven-year total impacts due to pile driving during training activities. See Table 2.4-90 and Table 2.4-91.
- Maximum annual and seven-year total impacts due to explosives during Navy training activities, during Navy testing activities (with Ship Shock Trials included in the total and broken out), during Coast Guard training activities, and during Army activities. See Table 2.4-92 through Table 2.4-100.
- A description of the methods used to calculate the estimated effects to marine mammal stocks from acoustic and explosive stressors over seven years of Navy training and testing is available in Section 2.4 (Species Impact Assessments).

2.4.5.1 Sonar Impact Summary Tables

2.4.5.1.1 Navy Training Sonar Impact Summary Tables

Table 2.4-82: Estimated Effects to Marine Mammal Stocks from Sonar and Other Active Transducers over One Year of Maximum Navy Training

Species	Stock or Population	BEH	TTS	AINJ	INJ	MORT
ESA-Listed						
Blue whale	Eastern North Pacific	1,447	3,124	27	-	-
	Central North Pacific	17	75	1	-	-
Fin whale	Hawai'i	21	65	1	-	-
	California/Oregon/Washington	3,704	9,797	54	1	-
Gray whale	Western North Pacific	72	97	2	-	-
Humpback whale	Mainland Mexico - California/Oregon/Washington	1,274	3,175	43	1	-
	Central America/Southern Mexico - California/Oregon/Washington	547	1,341	19	-	-
Sei whale	Hawai'i	38	215	2	-	-
	Eastern North Pacific	83	219	3	-	-
False killer whale	Main Hawaiian Islands Insular	105	64	-	-	-
Killer whale	Southern Resident	0	-	-	-	-
Sperm whale	Hawai'i	1,237	412	1	-	-
	California/Oregon/Washington	2,999	892	3	-	-
Guadalupe fur seal	Mexico	128,616	39,368	25	2	0
Hawaiian monk seal	Hawai'i	536	153	4	1	0
Non ESA-Listed						
Bryde’s whale	Hawai'i	68	341	3	-	-
	Eastern Tropical Pacific	111	211	5	-	-
Gray whale	Eastern North Pacific	7,151	9,560	167	0	-
Humpback whale	Hawai'i	1,227	1,807	24	-	-
Minke whale	Hawai'i	44	252	3	-	-
	California/Oregon/Washington	942	2,051	32	-	0
Bottlenose dolphin	O'ahu	7,108	124	5	1	1
	Maui Nui (formerly 4-Islands)	309	17	0	-	-
	Kaua'i/Ni'ihau	1,221	239	0	0	-
	Hawai'i Pelagic	37,284	6,029	23	2	1
	Hawai'i Island	5	4	-	-	-
	California/Oregon/Washington Offshore	21,232	6,826	14	1	0
	California Coastal	1,306	44	6	1	-
Dall’s porpoise	California/Oregon/Washington	13,394	46,225	1,235	2	0
Dwarf sperm whale	Hawai'i	10,880	34,344	914	1	0
	California/Oregon/Washington	1,505	4,159	94	-	0
False killer whale	Northwest Hawaiian Islands	128	63	-	-	-
	Hawai'i Pelagic	936	734	1	-	-
	Eastern Tropical Pacific [Nsd]	1,710	827	2	0	-
Fraser’s dolphin	Hawai'i	19,854	15,626	6	2	-
Killer whale	West Coast Transient	27	28	-	-	-
	Hawai'i	57	70	0	-	-
	Eastern North Pacific Offshore	830	193	4	0	-
Long-beaked common dolphin	California	253,952	42,926	128	24	4
Melon-headed whale	Kohala Resident	41	15	-	-	-
	Hawaiian Islands	16,187	15,269	13	0	0
Northern right whale dolphin	California/Oregon/Washington	23,867	21,647	19	2	1
Pacific white-sided dolphin	California/Oregon/Washington	45,571	23,639	38	4	2
Pantropical spotted dolphin	O'ahu	6,255	171	5	1	-

Species	Stock or Population	BEH	TTS	AINJ	INJ	MORT
	Northeastern Offshore [Nsd]	60,809	36,817	45	2	2
	Maui Nui (formerly 4-Islands)	2,191	182	4	0	-
	Hawai'i Pelagic	24,231	20,159	16	3	0
	Hawai'i Island	2,902	3,122	6	1	-
Pygmy killer whale	Hawai'i	4,654	4,241	3	0	-
	California [Nsd]	622	173	0	0	-
Pygmy sperm whale	Hawai'i	10,954	34,833	935	1	0
	California/Oregon/Washington	1,549	4,066	107	0	-
Risso's dolphin	Hawai'i	3,564	2,994	4	0	-
	California/Oregon/Washington	33,191	10,642	17	4	0
Rough-toothed dolphin	Hawai'i	57,947	38,926	31	5	2
Short-beaked common dolphin	California/Oregon/Washington	1,499,861	669,693	806	71	18
Short-finned pilot whale	Hawai'i	11,626	5,678	6	1	0
	California/Oregon/Washington	3,353	926	9	2	1
Spinner dolphin	O'ahu/4 Islands	1,156	45	1	0	0
	Kaua'i Ni'ihau	3,561	885	2	0	0
	Hawai'i Pelagic	2,177	2,367	2	0	-
	Hawai'i Island	60	50	1	0	-
Striped dolphin	Hawai'i Pelagic	18,620	19,162	10	2	-
	California/Oregon/Washington	81,046	52,353	42	2	1
Baird's beaked whale	California/Oregon/Washington	10,112	62	0	-	-
Blainville's beaked whale	Hawai'i	7,508	34	-	-	-
Goose-beaked whale	Hawai'i	30,230	129	0	-	-
	California/Oregon/Washington	166,204	612	2	0	-
Harbor porpoise	San Francisco Russian River	9,898	62	26	-	-
	Northern California/Southern Oregon	481	0	-	-	-
	Morro Bay	4,152	221	87	1	0
	Monterey Bay	2,179	0	-	-	-
Longman's beaked whale	Hawai'i	18,219	97	1	-	-
Mesoplodont beaked whales	California/Oregon/Washington	92,419	420	2	0	0
California sea lion	United States	1,627,285	261,464	666	57	5
Harbor seal	California	51,674	19,309	254	7	1
Northern elephant seal	California Breeding	65,055	53,419	109	2	0
Northern fur seal	Eastern Pacific	23,105	10,090	11	1	0
	California	15,853	6,245	9	1	0
Steller sea lion	Eastern	837	162	3	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
A dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Stocks are not shown if no effects are estimated.
Nsd = No stock designation under MMPA.
version.20241108

Table 2.4-83: Estimated Effects to Marine Mammal Stocks from Sonar and Other Active Transducers Over Seven Years of Navy Training

Species	Stock or Population	BEH	TTS	AINJ	INJ	MORT
ESA-Listed						
Blue whale	Eastern North Pacific	8,513	16,295	150	-	-
	Central North Pacific	92	432	2	-	-
Fin whale	Hawai'i	113	374	1	-	-
	California/Oregon/Washington	21,366	47,192	299	1	-
Gray whale	Western North Pacific	434	418	5	-	-
Humpback whale	Mainland Mexico - California/Oregon/Washington	7,701	15,669	219	1	-
	Central America/Southern Mexico - California/Oregon/Washington	3,305	6,593	96	-	-
Sei whale	Hawai'i	227	1,210	5	-	-
	Eastern North Pacific	487	1,124	9	-	-
False killer whale	Main Hawaiian Islands Insular	637	372	-	-	-
Killer whale	Southern Resident	0	-	-	-	-
Sperm whale	Hawai'i	7,313	2,306	1	-	-
	California/Oregon/Washington	16,304	4,302	5	-	-
Guadalupe fur seal	Mexico	720,550	198,223	137	7	0
Hawaiian monk seal	Hawai'i	3,595	953	19	1	0
Non ESA-Listed						
Bryde's whale	Hawai'i	392	1,964	11	-	-
	Eastern Tropical Pacific	664	1,210	14	-	-
Gray whale	Eastern North Pacific	43,599	43,693	1,010	0	-
Humpback whale	Hawai'i	7,828	11,117	151	-	-
Minke whale	Hawai'i	259	1,439	13	-	-
	California/Oregon/Washington	5,735	10,381	193	-	0
Bottlenose dolphin	O'ahu	49,565	810	27	3	1
	Maui Nui (formerly 4-Islands)	2,049	102	0	-	-
	Kaua'i/Ni'ihau	7,657	1,657	0	0	-
	Hawai'i Pelagic	251,065	36,054	151	12	2
	Hawai'i Island	27	17	-	-	-
	California/Oregon/Washington Offshore	122,030	35,598	80	3	0
	California Coastal	8,502	259	41	1	-
Dall's porpoise	California/Oregon/Washington	76,921	228,511	6,781	5	0
Dwarf sperm whale	Hawai'i	67,933	194,468	5,102	1	0
	California/Oregon/Washington	8,583	21,510	517	-	0
False killer whale	Northwest Hawaiian Islands	775	390	-	-	-
	Hawai'i Pelagic	5,719	4,146	1	-	-
	Eastern Tropical Pacific [Nsd]	9,540	4,348	2	0	-
Fraser's dolphin	Hawai'i	122,248	88,278	32	2	-
Killer whale	West Coast Transient	137	124	-	-	-
	Hawai'i	337	396	0	-	-
	Eastern North Pacific Offshore	5,053	1,036	23	0	-
Long-beaked common dolphin	California	1,588,795	215,998	804	148	17
Melon-headed whale	Kohala Resident	250	82	-	-	-
	Hawaiian Islands	98,220	85,553	68	0	0
Northern right whale dolphin	California/Oregon/Washington	125,984	98,055	90	6	1
Pacific white-sided dolphin	California/Oregon/Washington	254,280	106,769	218	24	2
Pantropical spotted dolphin	O'ahu	43,081	1,119	22	1	-
	Northeastern Offshore [Nsd]	341,397	194,284	232	7	2
	Maui Nui (formerly 4-Islands)	14,107	1,085	18	0	-
	Hawai'i Pelagic	148,329	113,826	77	4	0
	Hawai'i Island	17,820	17,764	23	2	-

Species	Stock or Population	BEH	TTS	AINJ	INJ	MORT
Pygmy killer whale	Hawai'i	28,302	23,757	8	0	-
	California Nsd	3,499	859	0	0	-
Pygmy sperm whale	Hawai'i	68,237	197,085	5,220	1	0
	California/Oregon/Washington	8,830	21,038	609	0	-
Risso's dolphin	Hawai'i	21,364	16,676	5	0	-
	California/Oregon/Washington	188,061	52,786	107	18	0
Rough-toothed dolphin	Hawai'i	367,021	220,798	175	21	2
Short-beaked common dolphin	California/Oregon/Washington	8,473,412	3,331,011	4,634	441	107
Short-finned pilot whale	Hawai'i	72,315	32,457	25	1	0
	California/Oregon/Washington	19,691	4,841	44	12	4
Spinner dolphin	O'ahu/4 Islands	7,942	263	2	0	0
	Kaua'i Ni'ihau	22,186	6,148	6	0	0
	Hawai'i Pelagic	13,145	13,394	4	0	-
	Hawai'i Island	362	282	1	0	-
Striped dolphin	Hawai'i Pelagic	112,710	106,884	48	4	-
	California/Oregon/Washington	453,209	270,965	222	9	1
Baird's beaked whale	California/Oregon/Washington	55,858	291	0	-	-
Blainville's beaked whale	Hawai'i	45,810	194	-	-	-
Goose-beaked whale	Hawai'i	184,319	720	0	-	-
	California/Oregon/Washington	936,000	3,012	4	0	-
Harbor porpoise	San Francisco Russian River	48,554	346	169	-	-
	Northern California/Southern Oregon	2,339	0	-	-	-
	Morro Bay	24,909	1,407	588	2	0
	Monterey Bay	10,934	0	-	-	-
Longman's beaked whale	Hawai'i	111,612	540	4	-	-
Mesoplodont beaked whales	California/Oregon/Washington	518,892	2,046	6	0	0
California sea lion	United States	9,344,167	1,206,972	4,203	369	27
Harbor seal	California	282,977	104,852	1,598	44	7
Northern elephant seal	California Breeding	379,100	247,160	643	2	0
Northern fur seal	Eastern Pacific	114,217	44,579	53	2	0
	California	78,553	27,745	44	3	0
Steller sea lion	Eastern	4,601	745	13	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
A dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Stocks are not shown if no effects are estimated.
Nsd = No stock designation under MMPA.
version.20241108

2.4.5.1.2 Navy Testing Sonar Impact Summary Tables

Table 2.4-84: Estimated Effects to Marine Mammal Stocks from Sonar and Other Active Transducers Over a Maximum Year of Navy Testing

Species	Stock or Population	BEH	TTS	AINJ
ESA-Listed				
Blue whale	Eastern North Pacific	696	1,094	8
	Central North Pacific	5	19	(1)
Fin whale	Hawai'i	5	19	(1)
	California/Oregon/Washington	1,741	4,144	21
Gray whale	Western North Pacific	50	67	1
Humpback whale	Mainland Mexico - California/Oregon/Washington	818	1,155	8
	Central America/Southern Mexico - California/Oregon/Washington	343	472	4
Sei whale	Hawai'i	11	41	(1)
	Eastern North Pacific	37	65	(1)
False killer whale	Main Hawaiian Islands Insular	32	9	-
Killer whale	Southern Resident	0	-	-
Sperm whale	Hawai'i	288	56	0
	California/Oregon/Washington	834	129	-
Guadalupe fur seal	Mexico	21,472	1,846	2
Hawaiian monk seal	Hawai'i	58	33	(1)
Non ESA-Listed				
Bryde's whale	Hawai'i	22	75	(1)
	Eastern Tropical Pacific	47	89	2
Gray whale	Eastern North Pacific	4,876	6,722	64
Humpback whale	Hawai'i	348	358	4
Minke whale	Hawai'i	12	50	(1)
	California/Oregon/Washington	563	718	7
Bottlenose dolphin	O'ahu	407	35	(1)
	Maui Nui (formerly 4-Islands)	121	12	0
	Kaua'i/Ni'ihau	276	5	-
	Hawai'i Pelagic	4,805	842	1
	Hawai'i Island	3	-	-
	California/Oregon/Washington Offshore	9,699	1,286	(1)
	California Coastal	811	20	-
Dall's porpoise	California/Oregon/Washington	6,191	8,086	222
Dwarf sperm whale	Hawai'i	2,189	6,048	371
	California/Oregon/Washington	519	709	26
False killer whale	Northwest Hawaiian Islands	30	8	-
	Hawai'i Pelagic	192	95	(1)
	Eastern Tropical Pacific [Nsd]	332	60	0
Fraser's dolphin	Hawai'i	3,562	1,524	(1)
Killer whale	West Coast Transient	7	1	-
	Hawai'i	14	8	-
	Eastern North Pacific Offshore	399	75	0
Long-beaked common dolphin	California	181,795	11,646	6
Melon-headed whale	Kohala Resident	25	6	-
	Hawaiian Islands	3,396	1,711	2
Northern right whale dolphin	California/Oregon/Washington	7,934	1,997	2
Pacific white-sided dolphin	California/Oregon/Washington	23,127	3,851	2
Pantropical spotted dolphin	O'ahu	748	58	(1)
	Northeastern Offshore [Nsd]	12,181	2,468	2
	Maui Nui (formerly 4-Islands)	1,358	157	(1)
	Hawai'i Pelagic	5,521	2,324	2

Species	Stock or Population	BEH	TTS	AINJ
	Hawai'i Island	789	234	(1)
Pygmy killer whale	Hawai'i	928	481	(1)
	California Nsd	260	53	-
Pygmy sperm whale	Hawai'i	2,243	6,137	373
	California/Oregon/Washington	525	743	23
Risso's dolphin	Hawai'i	745	396	(1)
	California/Oregon/Washington	15,852	2,686	1
Rough-toothed dolphin	Hawai'i	11,455	4,768	3
Short-beaked common dolphin	California/Oregon/Washington	611,376	119,400	58
Short-finned pilot whale	Hawai'i	2,625	734	(1)
	California/Oregon/Washington	1,899	371	(1)
Spinner dolphin	O'ahu/4 Islands	180	28	0
	Kaua'i Ni'ihau	901	16	-
	Hawai'i Pelagic	473	265	(1)
	Hawai'i Island	13	0	-
Striped dolphin	Hawai'i Pelagic	3,793	2,473	1
	California/Oregon/Washington	16,581	5,362	2
Baird's beaked whale	California/Oregon/Washington	2,823	5	-
Blainville's beaked whale	Hawai'i	1,702	2	-
Goose-beaked whale	Hawai'i	6,945	8	-
	California/Oregon/Washington	55,207	92	-
Harbor porpoise	San Francisco Russian River	3,023	6	0
	Northern California/Southern Oregon	124	-	-
	Morro Bay	254	3	(1)
	Monterey Bay	865	-	-
Longman's beaked whale	Hawai'i	4,106	12	-
Mesoplodont beaked whales	California/Oregon/Washington	27,697	62	-
California sea lion	United States	928,540	67,321	16
Harbor seal	California	38,391	15,461	3
Northern elephant seal	California Breeding	34,434	13,065	5
Northern fur seal	Eastern Pacific	3,080	183	(1)
	California	1,769	87	0
Steller sea lion	Eastern	439	31	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury
A dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Stocks are not shown if no effects are estimated.
Nsd = No stock designation under MMPA.
version.20241108

Table 2.4-85: Estimated Effects to Marine Mammal Stocks from Sonar and Other Active Transducers Over Seven Years of Navy Testing

Species	Stock or Population	BEH	TTS	AINJ
ESA-Listed				
Blue whale	Eastern North Pacific	4,028	5,743	52
	Central North Pacific	27	107	2
Fin whale	Hawai'i	29	114	1
	California/Oregon/Washington	10,107	19,655	117
Gray whale	Western North Pacific	302	233	3
Humpback whale	Mainland Mexico - California/Oregon/Washington	4,947	5,553	43
	Central America/Southern Mexico - California/Oregon/Washington	2,076	2,269	23
Sei whale	Hawai'i	57	230	3
	Eastern North Pacific	215	345	1
False killer whale	Main Hawaiian Islands Insular	171	53	-
Killer whale	Southern Resident	0	-	-
Sperm whale	Hawai'i	1,452	291	0
	California/Oregon/Washington	4,350	594	-
Guadalupe fur seal	Mexico	120,817	11,643	10
Hawaiian monk seal	Hawai'i	314	199	1
Non ESA-Listed				
Bryde's whale	Hawai'i	112	412	1
	Eastern Tropical Pacific	275	517	8
Gray whale	Eastern North Pacific	28,937	24,742	335
Humpback whale	Hawai'i	2,045	2,082	27
Minke whale	Hawai'i	64	283	1
	California/Oregon/Washington	3,412	3,555	43
Bottlenose dolphin	O'ahu	2,727	237	1
	Maui Nui (formerly 4-Islands)	751	72	0
	Kaua'i/Ni'ihau	1,559	27	-
	Hawai'i Pelagic	28,873	4,998	7
	Hawai'i Island	19	-	-
	California/Oregon/Washington Offshore	55,144	6,926	3
	California Coastal	5,123	103	-
Dall's porpoise	California/Oregon/Washington	34,212	43,404	1,300
Dwarf sperm whale	Hawai'i	10,769	31,271	1,805
	California/Oregon/Washington	2,796	3,966	149
False killer whale	Northwest Hawaiian Islands	150	47	-
	Hawai'i Pelagic	987	502	1
	Eastern Tropical Pacific [Nsd]	1,831	392	0
Fraser's dolphin	Hawai'i	18,148	7,963	2
Killer whale	West Coast Transient	45	7	-
	Hawai'i	71	42	-
	Eastern North Pacific Offshore	2,318	440	0
Long-beaked common dolphin	California	1,156,935	57,311	31
Melon-headed whale	Kohala Resident	161	34	-
	Hawaiian Islands	17,285	9,306	13
Northern right whale dolphin	California/Oregon/Washington	43,020	8,762	9
Pacific white-sided dolphin	California/Oregon/Washington	132,034	17,006	13
Pantropical spotted dolphin	O'ahu	4,749	392	2
	Northeastern Offshore [Nsd]	67,222	16,411	10
	Maui Nui (formerly 4-Islands)	8,514	943	1
	Hawai'i Pelagic	28,528	12,527	9
	Hawai'i Island	4,524	1,389	1
Pygmy killer whale	Hawai'i	4,641	2,510	1

Species	Stock or Population	BEH	TTS	AINJ
	California Nsd	1,376	257	-
Pygmy sperm whale	Hawai'i	10,987	31,760	1,821
	California/Oregon/Washington	2,819	4,116	129
Risso's dolphin	Hawai'i	3,652	2,091	2
	California/Oregon/Washington	86,994	12,028	5
Rough-toothed dolphin	Hawai'i	62,028	25,394	15
Short-beaked common dolphin	California/Oregon/Washington	3,312,917	550,748	324
Short-finned pilot whale	Hawai'i	14,186	3,955	2
	California/Oregon/Washington	10,796	2,075	1
Spinner dolphin	O'ahu/4 Islands	1,120	155	0
	Kaua'i Ni'ihau	5,096	90	-
	Hawai'i Pelagic	2,345	1,445	1
	Hawai'i Island	82	0	-
Striped dolphin	Hawai'i Pelagic	18,660	12,807	6
	California/Oregon/Washington	88,084	29,998	12
Baird's beaked whale	California/Oregon/Washington	16,049	23	-
Blainville's beaked whale	Hawai'i	8,904	13	-
Goose-beaked whale	Hawai'i	36,195	44	-
	California/Oregon/Washington	295,610	393	-
Harbor porpoise	San Francisco Russian River	18,554	36	0
	Northern California/Southern Oregon	763	-	-
	Morro Bay	1,660	19	1
	Monterey Bay	5,307	-	-
Longman's beaked whale	Hawai'i	21,483	61	-
Mesoplodont beaked whales	California/Oregon/Washington	146,347	259	-
California sea lion	United States	5,191,344	245,578	71
Harbor seal	California	204,018	81,833	14
Northern elephant seal	California Breeding	203,952	54,851	27
Northern fur seal	Eastern Pacific	18,776	1,111	1
	California	10,740	521	0
Steller sea lion	Eastern	2,678	174	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury
A dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Stocks are not shown if no effects are estimated.
Nsd = No stock designation under MMPA.
version.20241108

2.4.5.1.3 Coast Guard Training Sonar Impact Summary Tables

Table 2.4-86: Estimated Effects to Marine Mammal Stocks from Sonar and Other Active Transducers Over a Maximum Year of Coast Guard Training

Species	Stock or Population	BEH	TTS	AINJ
ESA-Listed				
Blue whale	Eastern North Pacific	18	-	-
	Central North Pacific	(1)	-	-
Fin whale	Hawai'i	2	-	-
	California/Oregon/Washington	62	-	-
Gray whale	Western North Pacific	(1)	-	-
Humpback whale	Mainland Mexico - California/Oregon/Washington	14	-	-
	Central America/Southern Mexico - California/Oregon/Washington	7	-	-
Sei whale	Hawai'i	1	-	-
	Eastern North Pacific	1	-	-
False killer whale	Main Hawaiian Islands Insular	4	-	-
Sperm whale	Hawai'i	7	-	-
	California/Oregon/Washington	28	-	-
Guadalupe fur seal	Mexico	1,863	2	-
Hawaiian monk seal	Hawai'i	1	-	-
Non ESA-Listed				
Bryde's whale	Hawai'i	2	-	-
	Eastern Tropical Pacific	1	-	-
Gray whale	Eastern North Pacific	15	-	-
Humpback whale	Hawai'i	7	-	-
Minke whale	Hawai'i	2	-	-
	California/Oregon/Washington	7	-	-
Bottlenose dolphin	Hawai'i Pelagic	33	-	-
	California/Oregon/Washington Offshore	119	-	-
	California Coastal	2	-	-
Dall's porpoise	California/Oregon/Washington	169	239	-
Dwarf sperm whale	Hawai'i	159	225	2
	California/Oregon/Washington	16	34	-
False killer whale	Northwest Hawaiian Islands	2	-	-
	Hawai'i Pelagic	12	-	-
	Eastern Tropical Pacific [Nsd]	16	-	-
Fraser's dolphin	Hawai'i	17	-	-
Killer whale	West Coast Transient	1	-	-
	Hawai'i	2	-	-
	Eastern North Pacific Offshore	1	-	-
Long-beaked common dolphin	California	924	1	-
Melon-headed whale	Hawaiian Islands	223	-	-
Northern right whale dolphin	California/Oregon/Washington	249	2	-
Pacific white-sided dolphin	California/Oregon/Washington	246	1	-
Pantropical spotted dolphin	O'ahu	1	-	-
	Northeastern Offshore [Nsd]	490	-	-
	Hawai'i Pelagic	226	-	-
	Hawai'i Island	24	-	-
Pygmy killer whale	Hawai'i	56	-	-
	California [Nsd]	3	-	-
Pygmy sperm whale	Hawai'i	160	192	-
	California/Oregon/Washington	17	31	-
Risso's dolphin	Hawai'i	35	-	-
	California/Oregon/Washington	187	-	-

Species	Stock or Population	BEH	TTS	AINJ
Rough-toothed dolphin	Hawai'i	406	-	-
Short-beaked common dolphin	California/Oregon/Washington	9,634	19	-
Short-finned pilot whale	Hawai'i	83	-	-
	California/Oregon/Washington	10	-	-
Spinner dolphin	Hawai'i Pelagic	24	-	-
Striped dolphin	Hawai'i Pelagic	247	2	-
	California/Oregon/Washington	775	-	-
Baird's beaked whale	California/Oregon/Washington	54	-	-
Blainville's beaked whale	Hawai'i	25	-	-
Goose-beaked whale	Hawai'i	143	-	-
	California/Oregon/Washington	653	-	-
Harbor porpoise	San Francisco Russian River	2	-	-
Longman's beaked whale	Hawai'i	145	-	-
Mesoplodont beaked whales	California/Oregon/Washington	415	-	-
California sea lion	United States	14,931	2	-
Harbor seal	California	140	-	-
Northern elephant seal	California Breeding	1,790	(1)	-
Northern fur seal	Eastern Pacific	633	-	-
	California	555	-	-
Steller sea lion	Eastern	4	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury
A dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Stocks are not shown if no effects are estimated.
Nsd = No stock designation under MMPA.
version.20241108

Table 2.4-87: Estimated Effects to Marine Mammal Stocks from Sonar and Other Active Transducers Over Seven Years of Coast Guard Training

Species	Stock or Population	BEH	TTS	AINJ
ESA-Listed				
Blue whale	Eastern North Pacific	124	-	-
	Central North Pacific	1	-	-
Fin whale	Hawai'i	8	-	-
	California/Oregon/Washington	432	-	-
Gray whale	Western North Pacific	2	-	-
Humpback whale	Mainland Mexico - California/Oregon/Washington	96	-	-
	Central America/Southern Mexico - California/Oregon/Washington	45	-	-
Sei whale	Hawai'i	4	-	-
	Eastern North Pacific	4	-	-
False killer whale	Main Hawaiian Islands Insular	27	-	-
Sperm whale	Hawai'i	45	-	-
	California/Oregon/Washington	196	-	-
Guadalupe fur seal	Mexico	13,035	12	-
Hawaiian monk seal	Hawai'i	4	-	-
Non ESA-Listed				
Bryde's whale	Hawai'i	13	-	-
	Eastern Tropical Pacific	5	-	-
Gray whale	Eastern North Pacific	102	-	-
Humpback whale	Hawai'i	46	-	-
Minke whale	Hawai'i	14	-	-
	California/Oregon/Washington	48	-	-
Bottlenose dolphin	Hawai'i Pelagic	226	-	-
	California/Oregon/Washington Offshore	828	-	-
	California Coastal	12	-	-
Dall's porpoise	California/Oregon/Washington	1,178	1,669	-
Dwarf sperm whale	Hawai'i	1,109	1,575	12
	California/Oregon/Washington	108	235	-
False killer whale	Northwest Hawaiian Islands	9	-	-
	Hawai'i Pelagic	83	-	-
	Eastern Tropical Pacific [Nsd]	109	-	-
Fraser's dolphin	Hawai'i	113	-	-
Killer whale	West Coast Transient	5	-	-
	Hawai'i	10	-	-
	Eastern North Pacific Offshore	7	-	-
Long-beaked common dolphin	California	6,467	6	-
Melon-headed whale	Hawaiian Islands	1,558	-	-
Northern right whale dolphin	California/Oregon/Washington	1,742	12	-
Pacific white-sided dolphin	California/Oregon/Washington	1,722	7	-
Pantropical spotted dolphin	O'ahu	7	-	-
	Northeastern Offshore [Nsd]	3,428	-	-
	Hawai'i Pelagic	1,579	-	-
	Hawai'i Island	164	-	-
Pygmy killer whale	Hawai'i	390	-	-
	California [Nsd]	18	-	-
Pygmy sperm whale	Hawai'i	1,117	1,342	-
	California/Oregon/Washington	116	215	-
Risso's dolphin	Hawai'i	240	-	-
	California/Oregon/Washington	1,308	-	-
Rough-toothed dolphin	Hawai'i	2,838	-	-
Short-beaked common dolphin	California/Oregon/Washington	67,436	131	-

Species	Stock or Population	BEH	TTS	AINJ
Short-finned pilot whale	Hawai'i	578	-	-
	California/Oregon/Washington	69	-	-
Spinner dolphin	Hawai'i Pelagic	165	-	-
Striped dolphin	Hawai'i Pelagic	1,726	12	-
	California/Oregon/Washington	5,419	-	-
Baird's beaked whale	California/Oregon/Washington	378	-	-
Blainville's beaked whale	Hawai'i	170	-	-
Goose-beaked whale	Hawai'i	1,001	-	-
	California/Oregon/Washington	4,569	-	-
Harbor porpoise	San Francisco Russian River	11	-	-
Longman's beaked whale	Hawai'i	1,013	-	-
Mesoplodont beaked whales	California/Oregon/Washington	2,901	-	-
California sea lion	United States	104,514	13	-
Harbor seal	California	976	-	-
Northern elephant seal	California Breeding	12,529	1	-
Northern fur seal	Eastern Pacific	4,425	-	-
	California	3,885	-	-
Steller sea lion	Eastern	22	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury
A dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Stocks are not shown if no effects are estimated.
Nsd = No stock designation under MMPA.
version.20241108

2.4.5.2 Air Gun Impact Summary Tables

Table 2.4-88: Estimated Effects to Marine Mammal Stocks from Air Guns Over a Maximum Year of Navy Testing

Species	Stock or Population	BEH	TTS	AINJ
ESA-Listed				
Blue whale	Eastern North Pacific	0	-	-
Fin whale	California/Oregon/Washington	0	0	-
Humpback whale	Mainland Mexico - California/Oregon/Washington	0	0	-
	Central America/Southern Mexico - California/Oregon/Washington	0	-	-
Sperm whale	Hawai'i	(1)	-	-
Guadalupe fur seal	Mexico	(1)	-	-
Non ESA-Listed				
Gray whale	Eastern North Pacific	0	-	-
Humpback whale	Hawai'i	(1)	-	-
Minke whale	California/Oregon/Washington	0	-	-
Bottlenose dolphin	Hawai'i Pelagic	(1)	-	-
	California/Oregon/Washington Offshore	(1)	-	-
Dall's porpoise	California/Oregon/Washington	9	8	1
Dwarf sperm whale	Hawai'i	8	5	(1)
	California/Oregon/Washington	1	1	-
Long-beaked common dolphin	California	3	-	-
Melon-headed whale	Hawaiian Islands	(1)	-	-
Northern right whale dolphin	California/Oregon/Washington	(1)	-	-
Pacific white-sided dolphin	California/Oregon/Washington	1	-	-
Pantropical spotted dolphin	Northeastern Offshore [Nsd]	2	-	-
	Hawai'i Pelagic	(1)	-	-
	Hawai'i Island	(1)	-	-
Pygmy killer whale	California [Nsd]	(1)	-	-
Pygmy sperm whale	Hawai'i	6	6	1
	California/Oregon/Washington	(1)	1	-
Risso's dolphin	California/Oregon/Washington	1	-	-
Rough-toothed dolphin	Hawai'i	(1)	-	-
Short-beaked common dolphin	California/Oregon/Washington	17	-	-
Short-finned pilot whale	Hawai'i	(1)	-	-
Striped dolphin	Hawai'i Pelagic	-	(1)	-
	California/Oregon/Washington	1	-	-
Goose-beaked whale	Hawai'i	(1)	-	-
Harbor porpoise	San Francisco Russian River	1	2	(1)
Mesoplodont beaked whales	California/Oregon/Washington	0	-	-
California sea lion	United States	8	(1)	-
Northern elephant seal	California Breeding	1	-	-
Northern fur seal	Eastern Pacific	(1)	-	-
	California	(1)	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury
A dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Stocks are not shown if no effects are estimated.
Nsd = No stock designation under MMPA.
version.20241108

Table 2.4-89: Estimated Effects to Marine Mammal Stocks from Air Guns over Seven Years of Navy Testing

Species	Stock or Population	BEH	TTS	AINJ
ESA-Listed				
Blue whale	Eastern North Pacific	0	-	-
Fin whale	California/Oregon/Washington	0	0	-
Humpback whale	Mainland Mexico - California/Oregon/Washington	0	0	-
	Central America/Southern Mexico - California/Oregon/Washington	0	-	-
Sperm whale	Hawai'i	1	-	-
Guadalupe fur seal	Mexico	3	-	-
Non ESA-Listed				
Gray whale	Eastern North Pacific	0	-	-
Humpback whale	Hawai'i	1	-	-
Minke whale	California/Oregon/Washington	0	-	-
Bottlenose dolphin	Hawai'i Pelagic	3	-	-
	California/Oregon/Washington Offshore	2	-	-
Dall's porpoise	California/Oregon/Washington	58	48	4
Dwarf sperm whale	Hawai'i	50	34	1
	California/Oregon/Washington	4	3	-
Long-beaked common dolphin	California	13	-	-
Melon-headed whale	Hawaiian Islands	2	-	-
Northern right whale dolphin	California/Oregon/Washington	2	-	-
Pacific white-sided dolphin	California/Oregon/Washington	5	-	-
Pantropical spotted dolphin	Northeastern Offshore [Nsd]	9	-	-
	Hawai'i Pelagic	1	-	-
	Hawai'i Island	1	-	-
Pygmy killer whale	California [Nsd]	1	-	-
Pygmy sperm whale	Hawai'i	34	37	3
	California/Oregon/Washington	3	6	-
Risso's dolphin	California/Oregon/Washington	6	-	-
Rough-toothed dolphin	Hawai'i	1	-	-
Short-beaked common dolphin	California/Oregon/Washington	85	-	-
Short-finned pilot whale	Hawai'i	1	-	-
Striped dolphin	Hawai'i Pelagic	-	1	-
	California/Oregon/Washington	5	-	-
Goose-beaked whale	Hawai'i	1	-	-
Harbor porpoise	San Francisco Russian River	6	12	1
Mesoplodont beaked whales	California/Oregon/Washington	0	-	-
California sea lion	United States	33	1	-
Northern elephant seal	California Breeding	3	-	-
Northern fur seal	Eastern Pacific	2	-	-
	California	1	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury
A dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Stocks are not shown if no effects are estimated.
Nsd = No stock designation under MMPA.
version.20241108

2.4.5.3 Pile Driving Impact Summary Tables

Table 2.4-90: Estimated Effects to Marine Mammal Stocks from Pile Driving over a Maximum Year of Navy Training

Species	Stock or Population	BEH	TTS	AINJ
Non ESA-Listed				
California sea lion	United States	16,992	1,891	61
Harbor seal	California	952	183	20

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury
A dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Stocks are not shown if no effects are estimated.
Nsd = No stock designation under MMPA.
version.20241108

Table 2.4-91: Estimated Effects to Marine Mammal Stocks from Pile Driving over Seven Years of Navy Training

Species	Stock or Population	BEH	TTS	AINJ
Non ESA-Listed				
California sea lion	United States	118,938	13,237	423
Harbor seal	California	6,664	1,281	138

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury
A dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Stocks are not shown if no effects are estimated.
Nsd = No stock designation under MMPA.
version.20241108

2.4.5.4 Explosives Impact Summary Tables

2.4.5.4.1 Navy Training Explosives Impact Summary Tables

Table 2.4-92: Estimated Effects to Marine Mammal Stocks from Explosives over a Maximum Year of Navy Training

Species	Stock or Population	BEH	TTS	AINJ	INJ	MORT
ESA-Listed						
Blue whale	Eastern North Pacific	65	81	1	-	-
	Central North Pacific	(1)	-	-	-	-
Fin whale	Hawai'i	(1)	0	0	-	-
	California/Oregon/Washington	98	114	5	1	-
Gray whale	Western North Pacific	(1)	(1)	0	-	-
Humpback whale	Mainland Mexico - California/Oregon/Washington	35	85	3	-	-
	Central America/Southern Mexico - California/Oregon/Washington	18	27	(1)	-	-
Sei whale	Hawai'i	1	(1)	0	-	-
	Eastern North Pacific	5	1	0	-	-
False killer whale	Main Hawaiian Islands Insular	-	0	-	-	-
Sperm whale	Hawai'i	2	1	(1)	-	-
	California/Oregon/Washington	2	4	(1)	-	-
Guadalupe fur seal	Mexico	24	29	2	1	0
Hawaiian monk seal	Hawai'i	11	16	2	1	0
Non ESA-Listed						
Bryde’s whale	Hawai'i	1	(1)	0	-	-
	Eastern Tropical Pacific	12	39	1	-	-
Gray whale	Eastern North Pacific	234	391	33	0	-
Humpback whale	Hawai'i	48	58	7	-	-
Minke whale	Hawai'i	1	(1)	-	-	-
	California/Oregon/Washington	29	81	9	-	-
Bottlenose dolphin	O'ahu	29	21	4	1	1
	Maui Nui (formerly 4-Islands)	0	1	-	-	-
	Kaua'i/Ni'ihau	-	(1)	0	0	-
	Hawai'i Pelagic	134	114	14	1	1
	Hawai'i Island	0	(1)	-	-	-
	California/Oregon/Washington Offshore	38	40	9	1	0
	California Coastal	9	15	6	1	-
Dall’s porpoise	California/Oregon/Washington	155	433	185	1	-
Dwarf sperm whale	Hawai'i	272	407	171	1	0
	California/Oregon/Washington	12	35	13	-	-
False killer whale	Hawai'i Pelagic	(1)	(1)	-	-	-
	Eastern Tropical Pacific [Nsd]	0	1	-	-	-
Fraser’s dolphin	Hawai'i	13	10	3	1	-
Killer whale	Hawai'i	-	0	0	-	-
	Eastern North Pacific Offshore	6	7	3	-	-
Long-beaked common dolphin	California	273	306	75	18	3
Melon-headed whale	Hawaiian Islands	4	3	1	0	0
Northern right whale dolphin	California/Oregon/Washington	2	4	(1)	1	0
Pacific white-sided dolphin	California/Oregon/Washington	77	73	16	3	1
Pantropical spotted dolphin	O'ahu	17	15	3	1	-
	Northeastern Offshore [Nsd]	15	11	5	1	1
	Maui Nui (formerly 4-Islands)	3	2	2	0	-
	Hawai'i Pelagic	11	13	3	1	0
	Hawai'i Island	1	8	2	1	-

Species	Stock or Population	BEH	TTS	AINJ	INJ	MORT
Pygmy killer whale	Hawai'i	2	2	(1)	0	-
	California Nsd	(1)	(1)	-	-	-
Pygmy sperm whale	Hawai'i	259	414	167	1	0
	California/Oregon/Washington	19	41	23	0	-
Risso's dolphin	Hawai'i	2	2	0	0	-
	California/Oregon/Washington	23	38	9	3	-
Rough-toothed dolphin	Hawai'i	72	63	6	3	1
Short-beaked common dolphin	California/Oregon/Washington	1,413	1,078	255	50	13
Short-finned pilot whale	Hawai'i	6	9	1	0	0
	California/Oregon/Washington	6	6	6	2	1
Spinner dolphin	O'ahu/4 Islands	4	3	(1)	0	0
	Kaua'i Ni'ihau	0	2	0	0	0
	Hawai'i Pelagic	(1)	(1)	0	0	-
	Hawai'i Island	1	(1)	(1)	0	-
Striped dolphin	Hawai'i Pelagic	11	5	1	1	-
	California/Oregon/Washington	12	23	4	1	1
Baird's beaked whale	California/Oregon/Washington	-	1	-	-	-
Blainville's beaked whale	Hawai'i	(1)	-	-	-	-
Goose-beaked whale	Hawai'i	2	1	0	-	-
	California/Oregon/Washington	6	13	(1)	-	-
Harbor porpoise	San Francisco Russian River	-	22	24	-	-
	Morro Bay	-	13	11	0	-
Longman's beaked whale	Hawai'i	(1)	(1)	1	-	-
Mesoplodont beaked whales	California/Oregon/Washington	2	5	(1)	-	-
California sea lion	United States	3,254	4,576	313	43	4
Harbor seal	California	1,510	2,050	214	6	1
Northern elephant seal	California Breeding	147	229	31	1	-
Northern fur seal	Eastern Pacific	(1)	2	(1)	0	-
	California	(1)	2	(1)	0	-
Steller sea lion	Eastern	5	8	2	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
A dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Stocks are not shown if no effects are estimated.
Nsd = No stock designation under MMPA.
version.20241108

Table 2.4-93: Estimated Effects to Marine Mammal Stocks from Explosives over Seven Years of Navy Training

Species	Stock or Population	BEH	TTS	AINJ	INJ	MORT
ESA-Listed						
Blue whale	Eastern North Pacific	415	535	4	-	-
	Central North Pacific	1	-	-	-	-
Fin whale	Hawai'i	1	0	0	-	-
	California/Oregon/Washington	633	747	35	1	-
Gray whale	Western North Pacific	2	2	0	-	-
Humpback whale	Mainland Mexico - California/Oregon/Washington	225	574	18	-	-
	Central America/Southern Mexico - California/Oregon/Washington	115	181	3	-	-
Sei whale	Hawai'i	4	2	0	-	-
	Eastern North Pacific	34	6	0	-	-
False killer whale	Main Hawaiian Islands Insular	-	0	-	-	-
Sperm whale	Hawai'i	9	6	1	-	-
	California/Oregon/Washington	8	24	3	-	-
Guadalupe fur seal	Mexico	151	174	12	3	0
Hawaiian monk seal	Hawai'i	69	105	13	1	0
Non ESA-Listed						
Bryde’s whale	Hawai'i	5	2	0	-	-
	Eastern Tropical Pacific	73	259	4	-	-
Gray whale	Eastern North Pacific	1,491	2,578	217	0	-
Humpback whale	Hawai'i	312	390	43	-	-
Minke whale	Hawai'i	4	1	-	-	-
	California/Oregon/Washington	182	529	63	-	-
Bottlenose dolphin	O'ahu	200	142	26	3	1
	Maui Nui (formerly 4-Islands)	0	4	-	-	-
	Kaua'i/Ni'ihau	-	1	0	0	-
	Hawai'i Pelagic	920	783	96	7	2
	Hawai'i Island	0	1	-	-	-
	California/Oregon/Washington Offshore	240	260	57	3	0
	California Coastal	59	103	41	1	-
Dall’s porpoise	California/Oregon/Washington	975	2,787	1,214	1	-
Dwarf sperm whale	Hawai'i	1,692	2,630	1,109	1	0
	California/Oregon/Washington	75	219	83	-	-
False killer whale	Hawai'i Pelagic	2	3	-	-	-
	Eastern Tropical Pacific [Nsd]	0	4	-	-	-
Fraser’s dolphin	Hawai'i	74	64	18	1	-
Killer whale	Hawai'i	-	0	0	-	-
	Eastern North Pacific Offshore	38	47	21	-	-
Long-beaked common dolphin	California	1,641	1,976	498	117	15
Melon-headed whale	Hawaiian Islands	24	20	5	0	0
Northern right whale dolphin	California/Oregon/Washington	13	24	1	3	0
Pacific white-sided dolphin	California/Oregon/Washington	463	470	101	19	1
Pantropical spotted dolphin	O'ahu	118	100	18	1	-
	Northeastern Offshore [Nsd]	93	75	29	6	1
	Maui Nui (formerly 4-Islands)	18	12	10	0	-
	Hawai'i Pelagic	69	87	15	2	0
	Hawai'i Island	7	55	13	2	-
Pygmy killer whale	Hawai'i	11	13	3	0	-
	California [Nsd]	1	1	-	-	-
Pygmy sperm whale	Hawai'i	1,617	2,711	1,084	1	0
	California/Oregon/Washington	117	272	153	0	-

Species	Stock or Population	BEH	TTS	AINJ	INJ	MORT
Risso's dolphin	Hawai'i	9	9	0	0	-
	California/Oregon/Washington	146	252	62	17	-
Rough-toothed dolphin	Hawai'i	481	426	38	17	1
Short-beaked common dolphin	California/Oregon/Washington	8,979	6,965	1,684	329	91
Short-finned pilot whale	Hawai'i	40	57	7	0	0
	California/Oregon/Washington	35	39	41	12	4
Spinner dolphin	O'ahu/4 Islands	27	19	2	0	0
	Kaua'i Ni'ihau	0	11	0	0	0
	Hawai'i Pelagic	2	2	0	0	-
	Hawai'i Island	7	2	1	0	-
Striped dolphin	Hawai'i Pelagic	59	31	4	3	-
	California/Oregon/Washington	73	148	27	6	1
Baird's beaked whale	California/Oregon/Washington	-	4	-	-	-
Blainville's beaked whale	Hawai'i	2	-	-	-	-
Goose-beaked whale	Hawai'i	11	4	0	-	-
	California/Oregon/Washington	36	89	2	-	-
Harbor porpoise	San Francisco Russian River	-	153	164	-	-
	Morro Bay	-	76	71	0	-
Longman's beaked whale	Hawai'i	2	3	4	-	-
Mesoplodont beaked whales	California/Oregon/Washington	11	34	2	-	-
California sea lion	United States	20,202	29,753	2,048	282	22
Harbor seal	California	9,224	12,668	1,343	42	7
Northern elephant seal	California Breeding	936	1,505	201	1	-
Northern fur seal	Eastern Pacific	1	14	1	0	-
	California	1	11	1	0	-
Steller sea lion	Eastern	31	50	12	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
A dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Stocks are not shown if no effects are estimated.
Nsd = No stock designation under MMPA.
version.20241108

2.4.5.4.2 Navy Testing Explosives Impact Summary Tables

Table 2.4-94: Estimated Effects to Marine Mammal Stocks from Explosives over a Maximum Year of Navy Testing (includes Small Ship Shock Trials)

Species	Stock or Population	BEH	TTS	AINJ	INJ	MORT
ESA-Listed						
Blue whale	Eastern North Pacific	21	25	2	-	-
Fin whale	Hawai'i	(1)	0	-	-	-
	California/Oregon/Washington	76	69	6	0	-
Gray whale	Western North Pacific	2	(1)	0	-	-
Humpback whale	Mainland Mexico - California/Oregon/Washington	31	29	1	1	-
	Central America/Southern Mexico - California/Oregon/Washington	13	11	1	-	-
Sei whale	Hawai'i	0	0	-	-	-
	Eastern North Pacific	2	2	(1)	-	-
False killer whale	Main Hawaiian Islands Insular	(1)	(1)	-	-	-
Sperm whale	Hawai'i	0	(1)	-	-	-
	California/Oregon/Washington	2	1	(1)	-	-
Guadalupe fur seal	Mexico	35	43	6	1	0
Hawaiian monk seal	Hawai'i	8	9	1	-	-
Non ESA-Listed						
Bryde's whale	Hawai'i	(1)	1	0	-	-
	Eastern Tropical Pacific	3	3	(1)	-	-
Gray whale	Eastern North Pacific	123	56	5	0	-
Humpback whale	Hawai'i	40	32	2	-	-
Minke whale	Hawai'i	1	(1)	0	-	-
	California/Oregon/Washington	9	10	1	-	0
Bottlenose dolphin	O'ahu	-	(1)	0	0	-
	Maui Nui (formerly 4-Islands)	2	2	-	-	-
	Kaua'i/Ni'ihau	0	0	0	-	-
	Hawai'i Pelagic	51	32	4	1	-
	California/Oregon/Washington Offshore	6	7	1	0	-
	California Coastal	-	(1)	0	0	-
Dall's porpoise	California/Oregon/Washington	438	631	304	1	0
Dwarf sperm whale	Hawai'i	86	107	27	0	0
	California/Oregon/Washington	20	33	17	-	0
False killer whale	Hawai'i Pelagic	0	0	0	-	-
	Eastern Tropical Pacific [Nsd]	0	(1)	0	0	-
Fraser's dolphin	Hawai'i	0	0	0	-	-
Killer whale	Eastern North Pacific Offshore	2	1	(1)	0	-
Long-beaked common dolphin	California	72	83	27	6	1
Melon-headed whale	Hawaiian Islands	1	(1)	(1)	0	-
Northern right whale dolphin	California/Oregon/Washington	9	9	3	1	1
Pacific white-sided dolphin	California/Oregon/Washington	25	31	6	1	1
Pantropical spotted dolphin	O'ahu	-	(1)	0	-	-
	Northeastern Offshore [Nsd]	25	19	1	1	1
	Maui Nui (formerly 4-Islands)	19	8	1	0	-
	Hawai'i Pelagic	12	4	(1)	1	0
	Hawai'i Island	(1)	(1)	(1)	-	-
Pygmy killer whale	Hawai'i	(1)	0	0	0	-
	California [Nsd]	-	(1)	0	0	-
Pygmy sperm whale	Hawai'i	97	114	28	0	-
	California/Oregon/Washington	22	33	18	-	-
Risso's dolphin	Hawai'i	(1)	(1)	(1)	-	-

Species	Stock or Population	BEH	TTS	AINJ	INJ	MORT
	California/Oregon/Washington	11	10	4	1	0
Rough-toothed dolphin	Hawai'i	42	23	3	1	1
Short-beaked common dolphin	California/Oregon/Washington	428	492	103	21	5
Short-finned pilot whale	Hawai'i	4	3	1	-	-
	California/Oregon/Washington	2	2	(1)	-	-
Spinner dolphin	O'ahu/4 Islands	1	(1)	-	-	-
	Kaua'i Ni'ihau	0	(1)	(1)	-	-
	Hawai'i Pelagic	0	(1)	0	0	-
	Hawai'i Island	0	-	-	-	-
Striped dolphin	Hawai'i Pelagic	2	1	(1)	0	-
	California/Oregon/Washington	16	22	4	1	0
Baird’s beaked whale	California/Oregon/Washington	1	(1)	0	-	-
Blainville’s beaked whale	Hawai'i	0	-	-	-	-
Goose-beaked whale	Hawai'i	1	(1)	0	-	-
	California/Oregon/Washington	8	3	1	0	-
Harbor porpoise	San Francisco Russian River	3	3	1	-	-
	Morro Bay	74	159	75	1	0
	Monterey Bay	0	-	-	-	-
Longman’s beaked whale	Hawai'i	0	0	-	-	-
Mesoplodont beaked whales	California/Oregon/Washington	6	3	1	0	0
California sea lion	United States	842	1,046	161	14	1
Harbor seal	California	170	158	14	1	0
Northern elephant seal	California Breeding	220	332	55	1	0
Northern fur seal	Eastern Pacific	19	28	7	1	0
	California	15	22	6	1	0
Steller sea lion	Eastern	0	(1)	0	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
A dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Stocks are not shown if no effects are estimated.
Nsd = No stock designation under MMPA.
version.20241108

Table 2.4-95: Estimated Effects to Marine Mammal Stocks from Explosives over Seven Years of Navy Testing (includes Small Ship Shock Trials)

Species	Stock or Population	BEH	TTS	AINJ	INJ	MORT
ESA-Listed						
Blue whale	Eastern North Pacific	135	96	14	-	-
Fin whale	Hawai'i	2	0	-	-	-
	California/Oregon/Washington	451	284	39	0	-
Gray whale	Western North Pacific	9	1	0	-	-
Humpback whale	Mainland Mexico - California/Oregon/Washington	187	172	5	1	-
	Central America/Southern Mexico - California/Oregon/Washington	80	67	5	-	-
Sei whale	Hawai'i	0	0	-	-	-
	Eastern North Pacific	11	8	1	-	-
False killer whale	Main Hawaiian Islands Insular	3	3	-	-	-
Sperm whale	Hawai'i	0	1	-	-	-
	California/Oregon/Washington	12	7	1	-	-
Guadalupe fur seal	Mexico	234	289	37	4	0
Hawaiian monk seal	Hawai'i	50	57	5	-	-
Non ESA-Listed						
Bryde’s whale	Hawai'i	1	6	0	-	-
	Eastern Tropical Pacific	16	20	1	-	-
Gray whale	Eastern North Pacific	713	353	30	0	-

Species	Stock or Population	BEH	TTS	AINJ	INJ	MORT
Humpback whale	Hawai'i	275	224	11	-	-
Minke whale	Hawai'i	3	1	0	-	-
	California/Oregon/Washington	58	63	6	-	0
Bottlenose dolphin	O'ahu	-	1	0	0	-
	Maui Nui (formerly 4-Islands)	13	14	-	-	-
	Kaua'i/Ni'ihau	0	0	0	-	-
	Hawai'i Pelagic	354	222	27	5	-
	California/Oregon/Washington Offshore	40	48	6	0	-
	California Coastal	-	2	0	0	-
Dall’s porpoise	California/Oregon/Washington	2,808	3,857	1,748	4	0
Dwarf sperm whale	Hawai'i	548	669	135	0	0
	California/Oregon/Washington	127	205	96	-	0
False killer whale	Hawai'i Pelagic	0	0	0	-	-
	Eastern Tropical Pacific Nsd	0	3	0	0	-
Fraser’s dolphin	Hawai'i	0	0	0	-	-
Killer whale	Eastern North Pacific Offshore	8	6	2	0	-
Long-beaked common dolphin	California	472	525	168	31	2
Melon-headed whale	Hawaiian Islands	4	2	1	0	-
Northern right whale dolphin	California/Oregon/Washington	59	55	20	3	1
Pacific white-sided dolphin	California/Oregon/Washington	168	204	36	5	1
Pantropical spotted dolphin	O'ahu	-	1	0	-	-
	Northeastern Offshore Nsd	171	128	4	1	1
	Maui Nui (formerly 4-Islands)	131	54	7	0	-
	Hawai'i Pelagic	78	27	2	1	0
	Hawai'i Island	3	2	1	-	-
Pygmy killer whale	Hawai'i	1	0	0	0	-
	California Nsd	-	1	0	0	-
Pygmy sperm whale	Hawai'i	614	718	142	0	-
	California/Oregon/Washington	145	200	109	-	-
Risso’s dolphin	Hawai'i	2	1	1	-	-
	California/Oregon/Washington	71	62	21	1	0
Rough-toothed dolphin	Hawai'i	289	160	19	3	1
Short-beaked common dolphin	California/Oregon/Washington	2,819	3,129	601	112	16
Short-finned pilot whale	Hawai'i	26	20	3	-	-
	California/Oregon/Washington	14	11	1	-	-
Spinner dolphin	O'ahu/4 Islands	5	3	-	-	-
	Kaua'i Ni'ihau	0	1	1	-	-
	Hawai'i Pelagic	0	1	0	0	-
	Hawai'i Island	0	-	-	-	-
Striped dolphin	Hawai'i Pelagic	9	5	1	0	-
	California/Oregon/Washington	108	147	23	3	0
Baird’s beaked whale	California/Oregon/Washington	5	2	0	-	-
Blainville’s beaked whale	Hawai'i	0	-	-	-	-
Goose-beaked whale	Hawai'i	4	1	0	-	-
	California/Oregon/Washington	50	16	2	0	-
Harbor porpoise	San Francisco Russian River	15	18	4	-	-
	Morro Bay	495	1,091	516	2	0
	Monterey Bay	0	-	-	-	-
Longman’s beaked whale	Hawai'i	0	0	-	-	-
Mesoplodont beaked whales	California/Oregon/Washington	35	21	4	0	0
California sea lion	United States	5,409	6,705	1,008	87	5
Harbor seal	California	1,030	977	90	2	0
Northern elephant seal	California Breeding	1,427	2,096	332	1	0
Northern fur seal	Eastern Pacific	117	177	42	2	0
	California	93	140	35	3	0

Species	Stock or Population	BEH	TTS	AINJ	INJ	MORT
Steller sea lion	Eastern	0	2	0	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
A dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Stocks are not shown if no effects are estimated.
Nsd = No stock designation under MMPA.
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At most, Small Ship Shock Trials could occur once in seven years. The below results show the highest estimated impacts on each stock across all seasons.

Table 2.4-96: Estimated Effects to Marine Mammal Stocks from Small Ship Shock Trials over a Maximum Year of Navy Testing (1 Event)

Species	Stock	TTS	AINJ	INJ	MORT
ESA-Listed					
Blue whale	Eastern North Pacific	12	-	-	-
Fin whale	California/Oregon/Washington	24	0	-	-
Humpback whale	Mainland Mexico - California/Oregon/Washington	2	0	0	-
	Central America/Southern Mexico - California/Oregon/Washington	1	0	-	-
Sei whale	Eastern North Pacific	0	-	-	-
Sperm whale	California/Oregon/Washington	0	0	-	-
Guadalupe fur seal	Mexico	0	-	-	-
Non ESA-Listed					
Minke whale	California/Oregon/Washington	1	0	-	-
Bottlenose dolphin	California/Oregon/Washington Offshore	0	0	0	-
Dall's porpoise	California/Oregon/Washington	39	34	-	0
Dwarf sperm whale	California/Oregon/Washington	2	2	-	-
Long-beaked common dolphin	California	4	1	1	1
Northern right whale dolphin	California/Oregon/Washington	0	0	0	0
Pacific white-sided dolphin	California/Oregon/Washington	1	-	0	0
Pantropical spotted dolphin	Northeastern Offshore Nsd	1	0	0	0
Pygmy sperm whale	California/Oregon/Washington	2	2	-	-
Risso's dolphin	California/Oregon/Washington	1	0	0	0
Short-beaked common dolphin	California/Oregon/Washington	17	5	3	3
Short-finned pilot whale	California/Oregon/Washington	0	-	-	-
Striped dolphin	California/Oregon/Washington	0	0	0	-
Baird's beaked whale	California/Oregon/Washington	0	0	-	-
Goose-beaked whale	California/Oregon/Washington	1	0	0	-
Mesoplodont beaked whales	California/Oregon/Washington	0	0	0	0
California sea lion	United States	6	1	0	0
Northern elephant seal	California Breeding	6	4	0	0

TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
A dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Stocks are not shown if no effects are estimated.
Nsd = No stock designation under MMPA.
version.20241108

2.4.5.4.3 Coast Guard Training Explosives Impact Summary Tables

Table 2.4-97: Estimated Effects to Marine Mammal Stocks from Explosives over a Maximum Year of U.S. Coast Guard Training

Species	Stock or Population	BEH	TTS	AINJ	INJ	MORT
ESA-Listed						
Blue whale	Eastern North Pacific	(1)	-	-	-	-
Fin whale	California/Oregon/Washington	0	0	0	-	-
Humpback whale	Mainland Mexico - California/Oregon/Washington	(1)	0	-	-	-
	Central America/Southern Mexico - California/Oregon/Washington	0	0	-	-	-
Sei whale	Hawai'i	-	0	-	-	-
Sperm whale	California/Oregon/Washington	0	-	-	-	-
Guadalupe fur seal	Mexico	(1)	-	-	-	-
Non ESA-Listed						
Gray whale	Eastern North Pacific	0	(1)	-	-	-
Minke whale	California/Oregon/Washington	0	0	-	-	-
Bottlenose dolphin	California/Oregon/Washington Offshore	(1)	(1)	-	-	-
Dall's porpoise	California/Oregon/Washington	2	2	(1)	-	-
Dwarf sperm whale	Hawai'i	1	1	(1)	-	-
	California/Oregon/Washington	(1)	(1)	(1)	-	-
False killer whale	Eastern Tropical Pacific [Nsd]	(1)	-	(1)	-	-
Fraser's dolphin	Hawai'i	(1)	0	-	-	-
Long-beaked common dolphin	California	(1)	(1)	0	-	-
Melon-headed whale	Hawaiian Islands	(1)	-	-	-	-
Northern right whale dolphin	California/Oregon/Washington	0	0	-	-	-
Pacific white-sided dolphin	California/Oregon/Washington	0	0	-	-	-
Pantropical spotted dolphin	Northeastern Offshore [Nsd]	-	(1)	-	-	-
	Hawai'i Pelagic	-	(1)	-	-	-
	Hawai'i Island	0	0	-	-	-
Pygmy sperm whale	Hawai'i	1	(1)	(1)	-	-
	California/Oregon/Washington	(1)	(1)	0	-	-
Risso's dolphin	California/Oregon/Washington	0	(1)	-	-	-
Rough-toothed dolphin	Hawai'i	0	-	-	-	-
Short-beaked common dolphin	California/Oregon/Washington	3	2	(1)	-	-
Striped dolphin	Hawai'i Pelagic	-	0	0	-	-
	California/Oregon/Washington	-	(1)	-	-	-
Goose-beaked whale	California/Oregon/Washington	0	-	-	-	-
Harbor porpoise	San Francisco Russian River	0	0	0	-	-
Mesoplodont beaked whales	California/Oregon/Washington	(1)	-	0	-	-
California sea lion	United States	2	2	0	0	-
Harbor seal	California	(1)	0	-	-	-
Northern elephant seal	California Breeding	2	2	(1)	-	-
Northern fur seal	Eastern Pacific	0	(1)	-	-	-
	California	0	0	-	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
A dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Stocks are not shown if no effects are estimated.
Nsd = No stock designation under MMPA.
version.20241108

Table 2.4-98: Estimated Effects to Marine Mammal Stocks from Explosives over Seven Years of Coast Guard Training

Species	Stock or Population	BEH	TTS	AINJ	INJ	MORT
ESA-Listed						
Blue whale	Eastern North Pacific	1	-	-	-	-
Fin whale	California/Oregon/Washington	0	0	0	-	-
Humpback whale	Mainland Mexico - California/Oregon/Washington	1	0	-	-	-
	Central America/Southern Mexico - California/Oregon/Washington	0	0	-	-	-
Sei whale	Hawai'i	-	0	-	-	-
Sperm whale	California/Oregon/Washington	0	-	-	-	-
Guadalupe fur seal	Mexico	1	-	-	-	-
Non ESA-Listed						
Gray whale	Eastern North Pacific	0	1	-	-	-
Minke whale	California/Oregon/Washington	0	0	-	-	-
Bottlenose dolphin	California/Oregon/Washington Offshore	1	1	-	-	-
Dall's porpoise	California/Oregon/Washington	11	9	3	-	-
Dwarf sperm whale	Hawai'i	6	5	1	-	-
	California/Oregon/Washington	1	1	1	-	-
False killer whale	Eastern Tropical Pacific Nsd	1	-	1	-	-
Fraser's dolphin	Hawai'i	1	0	-	-	-
Long-beaked common dolphin	California	1	1	0	-	-
Melon-headed whale	Hawaiian Islands	1	-	-	-	-
Northern right whale dolphin	California/Oregon/Washington	0	0	-	-	-
Pacific white-sided dolphin	California/Oregon/Washington	0	0	-	-	-
Pantropical spotted dolphin	Northeastern Offshore Nsd	-	1	-	-	-
	Hawai'i Pelagic	-	1	-	-	-
	Hawai'i Island	0	0	-	-	-
Pygmy sperm whale	Hawai'i	7	3	1	-	-
	California/Oregon/Washington	1	1	0	-	-
Risso's dolphin	California/Oregon/Washington	0	1	-	-	-
Rough-toothed dolphin	Hawai'i	0	-	-	-	-
Short-beaked common dolphin	California/Oregon/Washington	17	14	2	-	-
Striped dolphin	Hawai'i Pelagic	-	0	0	-	-
	California/Oregon/Washington	-	1	-	-	-
Goose-beaked whale	California/Oregon/Washington	0	-	-	-	-
Harbor porpoise	San Francisco Russian River	0	0	0	-	-
Mesoplodont beaked whales	California/Oregon/Washington	1	-	0	-	-
California sea lion	United States	10	8	0	0	-
Harbor seal	California	1	0	-	-	-
Northern elephant seal	California Breeding	8	11	1	-	-
Northern fur seal	Eastern Pacific	0	1	-	-	-
	California	0	0	-	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
A dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Stocks are not shown if no effects are estimated.
Nsd = No stock designation under MMPA.
version.20241108

2.4.5.4.4 Army Training Explosives Impact Summary Tables

Table 2.4-99: Estimated Effects to Marine Mammal Stocks from Explosives over a Maximum Year of Army Training

Species	Stock or Population	BEH	TTS	AINJ	INJ	MORT
ESA-Listed						
Hawaiian monk seal	Hawai'i	(1)	-	-	-	-
Non ESA-Listed						
Bryde's whale	Hawai'i	(1)	(1)	-	-	-
Humpback whale	Hawai'i	3	1	-	-	-
Minke whale	Hawai'i	(1)	-	-	-	-
Bottlenose dolphin	Hawai'i Pelagic	2	1	(1)	0	-
Dwarf sperm whale	Hawai'i	51	46	12	-	-
Fraser's dolphin	Hawai'i	2	3	1	1	-
Melon-headed whale	Kohala Resident	1	(1)	-	-	-
	Hawaiian Islands	1	(1)	(1)	-	-
Pantropical spotted dolphin	Maui Nui (formerly 4-Islands)	-	(1)	-	-	-
	Hawai'i Pelagic	2	1	(1)	1	0
Pygmy killer whale	Hawai'i	(1)	-	-	-	-
Pygmy sperm whale	Hawai'i	57	51	15	-	-
Risso's dolphin	Hawai'i	-	-	(1)	0	-
Rough-toothed dolphin	Hawai'i	3	2	(1)	1	-
Short-finned pilot whale	Hawai'i	2	1	(1)	1	-
Striped dolphin	Hawai'i Pelagic	1	2	(1)	1	-
Blainville's beaked whale	Hawai'i	-	(1)	-	-	-
Goose-beaked whale	Hawai'i	(1)	(1)	0	-	-
Longman's beaked whale	Hawai'i	(1)	(1)	-	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
A dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Stocks are not shown if no effects are estimated.
Nsd = No stock designation under MMPA.
version.20241108

Table 2.4-100: Estimated Effects to Marine Mammal Stocks from Explosives over Seven Years of Army Training

Species	Stock or Population	BEH	TTS	AINJ	INJ	MORT
ESA-Listed						
Hawaiian monk seal	Hawai'i	3	-	-	-	-
Non ESA-Listed						
Bryde's whale	Hawai'i	2	1	-	-	-
Humpback whale	Hawai'i	15	7	-	-	-
Minke whale	Hawai'i	3	-	-	-	-
Bottlenose dolphin	Hawai'i Pelagic	10	4	1	0	-
Dwarf sperm whale	Hawai'i	355	322	84	-	-
Fraser's dolphin	Hawai'i	12	15	5	1	-
Melon-headed whale	Kohala Resident	4	3	-	-	-
	Hawaiian Islands	5	3	1	-	-
Pantropical spotted dolphin	Maui Nui (formerly 4-Islands)	-	1	-	-	-
	Hawai'i Pelagic	8	6	1	1	0
Pygmy killer whale	Hawai'i	3	-	-	-	-
Pygmy sperm whale	Hawai'i	399	356	101	-	-
Risso's dolphin	Hawai'i	-	-	1	0	-
Rough-toothed dolphin	Hawai'i	17	14	1	1	-
Short-finned pilot whale	Hawai'i	9	6	2	1	-
Striped dolphin	Hawai'i Pelagic	7	10	1	1	-
Blainville's beaked whale	Hawai'i	-	1	-	-	-
Goose-beaked whale	Hawai'i	3	3	0	-	-
Longman's beaked whale	Hawai'i	2	1	-	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
A dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Stocks are not shown if no effects are estimated.
Nsd = No stock designation under MMPA.
version.20241108

2.5 Ranges to Effects

The following section provides the range (distance) over which specific physiological or behavioral effects are expected to occur based on the acoustic and explosive criteria in the *Criteria and Thresholds TR*, and the acoustic and explosive propagation calculations from the Navy Acoustic Effects Model described in the *Quantitative Analysis TR*. The ranges to effects are shown for representative sonar systems, air guns, and explosive bins from E1 (0.1–0.25 lb. NEW) to E16 (>7,500–14,500 lb. NEW). Ranges are determined by modeling the distance that noise from a source will need to propagate to reach exposure level thresholds specific to a hearing group that will cause behavioral response, TTS, AINJ, non-auditory injury, and mortality. Ranges to effects are utilized to help predict impacts from acoustic and explosive sources and assess the benefit of mitigation zones.

Tables present median and standard deviation ranges to effects for each hearing group, source or bin, bathymetric depth intervals of ≤200 m and >200 m to represent areas on an off the continental shelf, exposure duration (sonar), and representative cluster size (air guns and explosives). Ranges to effects consider propagation effects of sources modeled at different locations (i.e., analysis points), seasons, source depths, and radials (i.e., each analysis point considers propagation effects in different x-y directions by modeling 18 radials in azimuthal increments of 20° to obtain 360° coverage around an analysis point). The exception to this is ranges to effects for pile driving, which were calculated outside of the Navy Acoustic Effects Model, do not have variance in ranges, and are not presented as a summary statistic (e.g., median and standard deviation).

Boxplots visually present the distribution, variance, and outlier ranges for a given combination of a source or bin, hearing group, and effect. On the boxplots, outliers are plotted as dots, the lowest and highest non-outlier ranges are the extent of the left and right horizontal lines respectively that extend from the sides of a colored box, and the 25th, 50th (i.e., median), and 75th percentiles are the left edge, center line, and right edge of a colored box respectively.

2.5.1 Ranges to Effects for Sonar and Other Transducers

Ranges to effects for sonar were determined by modeling the distance that sound would need to propagate to reach exposure level thresholds specific to a hearing group that would cause behavioral response, TTS, and AINJ, as described in the *Criteria and Thresholds TR*. The ranges do not account for an animal avoiding a source nor for the movement of the platform, both of which would influence the actual range to onset of auditory effects during an actual exposure.

The tables below provide the ranges to TTS and AINJ for an exposure duration of 1, 30, 60, and 120 seconds for six representative sonar systems. Due to the lower acoustic thresholds for TTS versus AINJ, ranges to TTS are longer. Successive pings can be expected to add together, further increasing the range to the onset of TTS and AINJ.

The mean, 5th, and 95th percentile behavioral response curves below, provide the probability of behavioral response as a function of range for the sensitive species (beaked whales and harbor porpoises), mysticete (all baleen whales), odontocete (most toothed whales, dolphins, and porpoises), and pinniped (true seals, sea lions, walruses, sea otters, polar bears) behavioral response groups.

Table 2.5-1: VLF Cetacean Ranges to Effects for Sonar

Sonar Type	Depth	Duration	TTS	AINJ
Dipping Sonar	≤200 m	1 s	160 m (30 m)	12 m (4 m)
		30 s	314 m (75 m)	21 m (6 m)
		60 s	426 m (97 m)	25 m (4 m)
		120 s	631 m (135 m)	35 m (6 m)
	>200 m	1 s	140 m (21 m)	0 m (1 m)
		30 s	260 m (50 m)	0 m (8 m)
		60 s	340 m (72 m)	23 m (10 m)
		120 s	500 m (116 m)	35 m (15 m)
MF1 Ship Sonar	≤200 m	1 s	1,069 m (254 m)	90 m (17 m)
		30 s	1,069 m (254 m)	90 m (17 m)
		60 s	1,528 m (467 m)	140 m (24 m)
		120 s	1,792 m (639 m)	180 m (32 m)
	>200 m	1 s	1,000 m (87 m)	85 m (3 m)
		30 s	1,000 m (87 m)	85 m (3 m)
		60 s	1,500 m (243 m)	130 m (7 m)
		120 s	1,889 m (470 m)	170 m (9 m)
MF1C Ship Sonar	≤200 m	1 s	1,069 m (254 m)	90 m (17 m)
		30 s	1,792 m (639 m)	180 m (32 m)
		60 s	2,319 m (1,027 m)	263 m (56 m)
		120 s	2,806 m (1,488 m)	390 m (73 m)
	>200 m	1 s	1,000 m (87 m)	85 m (3 m)
		30 s	1,889 m (470 m)	170 m (9 m)
		60 s	2,750 m (1,053 m)	250 m (23 m)
		120 s	3,847 m (1,552 m)	370 m (33 m)
MF1K Ship Sonar	≤200 m	1 s	193 m (37 m)	12 m (4 m)
		30 s	355 m (73 m)	24 m (2 m)

Sonar Type	Depth	Duration	TTS	AINJ
		60 s	470 m (83 m)	30 m (3 m)
		120 s	668 m (126 m)	45 m (13 m)
	>200 m	1 s	190 m (16 m)	5 m (5 m)
		30 s	340 m (36 m)	21 m (11 m)
		60 s	440 m (56 m)	25 m (3 m)
		120 s	625 m (70 m)	40 m (2 m)
Mine-Hunting Sonar	≤200 m	1 s	3 m (1 m)	0 m (0 m)
		30 s	6 m (1 m)	0 m (0 m)
		60 s	9 m (1 m)	0 m (0 m)
		120 s	13 m (2 m)	1 m (0 m)
	>200 m	1 s	0 m (0 m)	0 m (0 m)
		30 s	5 m (2 m)	0 m (0 m)
		60 s	8 m (3 m)	0 m (0 m)
		120 s	12 m (0 m)	0 m (0 m)
Sonobuoy Sonar	≤200 m	1 s	13 m (6 m)	0 m (0 m)
		30 s	25 m (6 m)	0 m (0 m)
		60 s	35 m (7 m)	0 m (1 m)
		120 s	50 m (4 m)	0 m (1 m)
	>200 m	1 s	0 m (6 m)	0 m (0 m)
		30 s	23 m (10 m)	0 m (0 m)
		60 s	35 m (11 m)	0 m (0 m)
		120 s	50 m (3 m)	0 m (0 m)

Median ranges with standard deviation ranges in parentheses
TTS = Temporary Threshold Shift, AINJ = Auditory Injury
MF1 = hull-mounted surface ship sonar, MF1C = >80% duty cycle, MF1K = kingfisher mode
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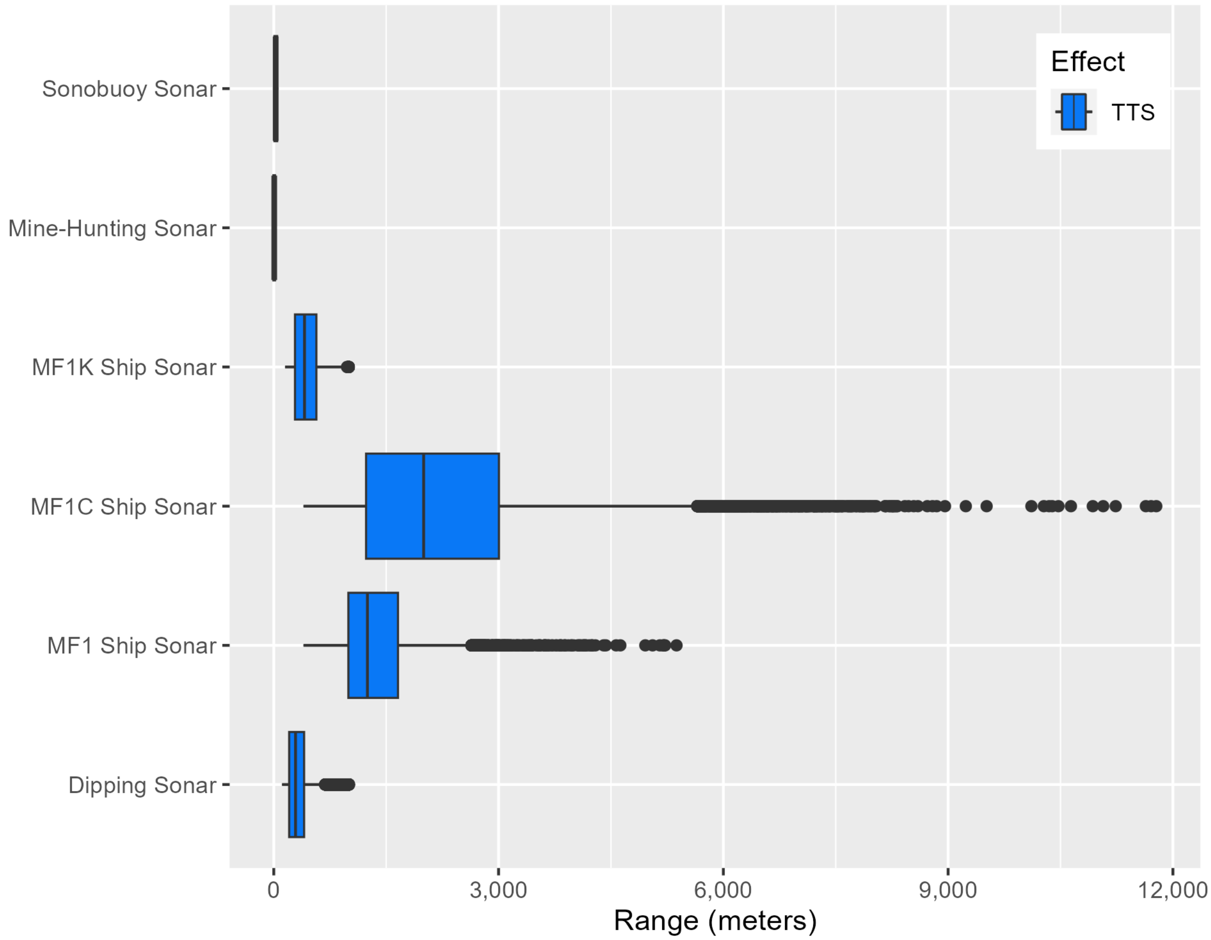

Figure 2.5-1: VLF Cetacean Ranges to Temporary Threshold Shift for Sonar

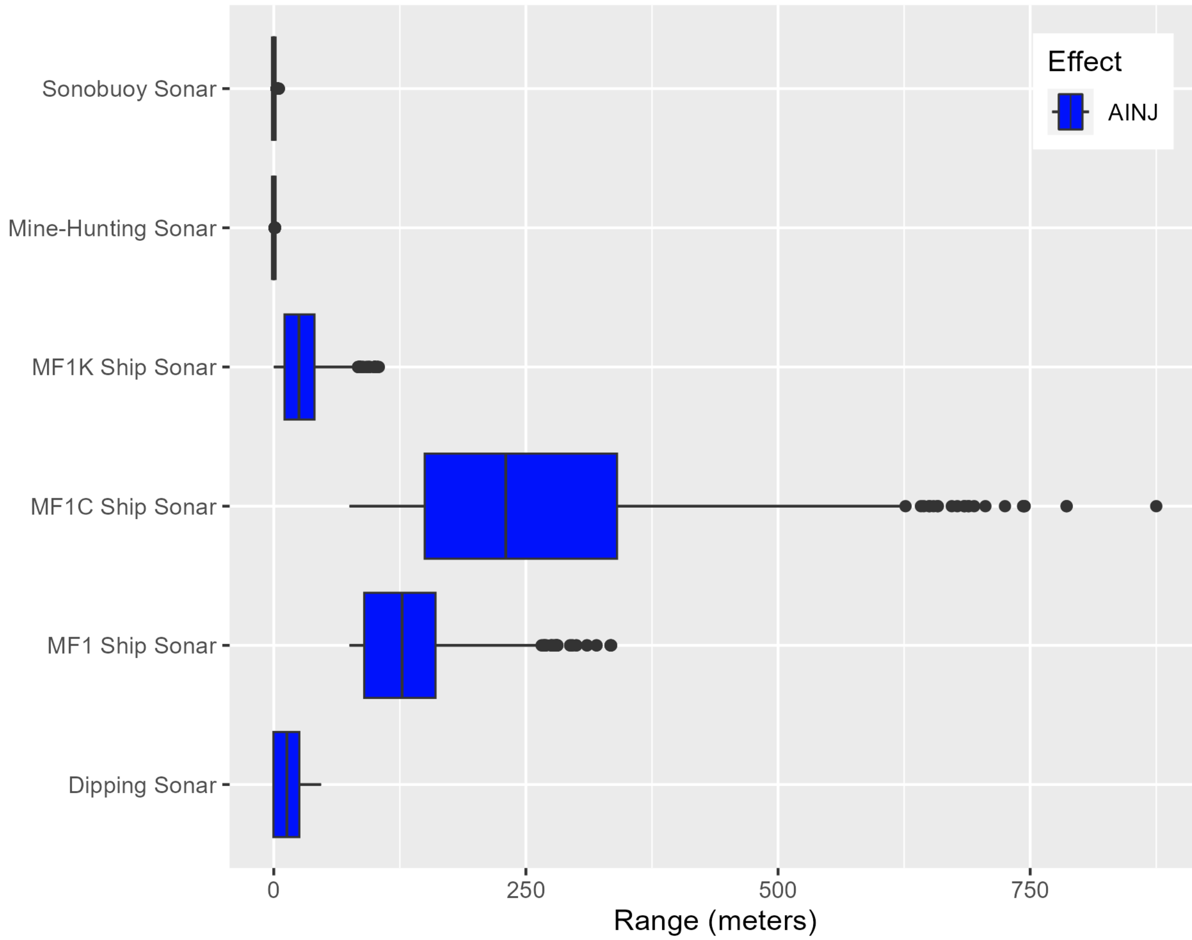

Figure 2.5-2: VLF Cetacean Ranges to Auditory Injury for Sonar

Table 2.5-2: LF Cetacean Ranges to Effects for Sonar

Sonar Type	Depth	Duration	TTS	AINJ
Dipping Sonar	≤200 m	1 s	160 m (55 m)	12 m (4 m)
		30 s	312 m (97 m)	21 m (6 m)
		60 s	412 m (116 m)	25 m (7 m)
		120 s	585 m (135 m)	35 m (10 m)
	>200 m	1 s	150 m (82 m)	0 m (6 m)
		30 s	240 m (125 m)	17 m (10 m)
		60 s	287 m (161 m)	25 m (13 m)
		120 s	410 m (131 m)	35 m (18 m)
MF1 Ship Sonar	≤200 m	1 s	1,069 m (281 m)	95 m (19 m)
		30 s	1,069 m (281 m)	95 m (19 m)
		60 s	1,500 m (502 m)	140 m (24 m)
		120 s	1,736 m (672 m)	180 m (30 m)
	>200 m	1 s	1,000 m (193 m)	90 m (6 m)
		30 s	1,000 m (193 m)	90 m (6 m)
		60 s	1,514 m (414 m)	140 m (13 m)
		120 s	2,056 m (714 m)	180 m (15 m)
MF1C Ship Sonar	≤200 m	1 s	1,069 m (281 m)	95 m (19 m)
		30 s	1,736 m (672 m)	180 m (30 m)
		60 s	2,181 m (1,069 m)	270 m (50 m)
		120 s	2,639 m (1,530 m)	400 m (69 m)
	>200 m	1 s	1,000 m (193 m)	90 m (6 m)
		30 s	2,056 m (714 m)	180 m (15 m)
		60 s	2,986 m (1,270 m)	260 m (22 m)
		120 s	4,153 m (1,788 m)	380 m (31 m)
MF1K Ship Sonar	≤200 m	1 s	200 m (34 m)	14 m (1 m)
		30 s	360 m (67 m)	25 m (1 m)

Sonar Type	Depth	Duration	TTS	AINJ
		60 s	480 m (84 m)	30 m (4 m)
		120 s	661 m (135 m)	45 m (14 m)
	>200 m	1 s	200 m (22 m)	12 m (1 m)
		30 s	350 m (34 m)	24 m (0 m)
		60 s	450 m (47 m)	30 m (0 m)
		120 s	650 m (94 m)	45 m (0 m)
Mine-Hunting Sonar	≤200 m	1 s	8 m (5 m)	0 m (0 m)
		30 s	15 m (8 m)	1 m (0 m)
		60 s	21 m (12 m)	2 m (1 m)
		120 s	30 m (12 m)	3 m (2 m)
	>200 m	1 s	8 m (5 m)	0 m (0 m)
		30 s	15 m (8 m)	0 m (0 m)
		60 s	21 m (12 m)	0 m (1 m)
		120 s	30 m (12 m)	0 m (1 m)
Sonobuoy Sonar	≤200 m	1 s	0 m (8 m)	0 m (0 m)
		30 s	25 m (12 m)	0 m (0 m)
		60 s	35 m (18 m)	0 m (0 m)
		120 s	55 m (25 m)	0 m (1 m)
	>200 m	1 s	0 m (7 m)	0 m (0 m)
		30 s	19 m (12 m)	0 m (0 m)
		60 s	35 m (19 m)	0 m (0 m)
		120 s	55 m (28 m)	0 m (1 m)

Median ranges with standard deviation ranges in parentheses
TTS = Temporary Threshold Shift, AINJ = Auditory Injury
MF1 = hull-mounted surface ship sonar, MF1C = >80% duty cycle, MF1K = kingfisher mode
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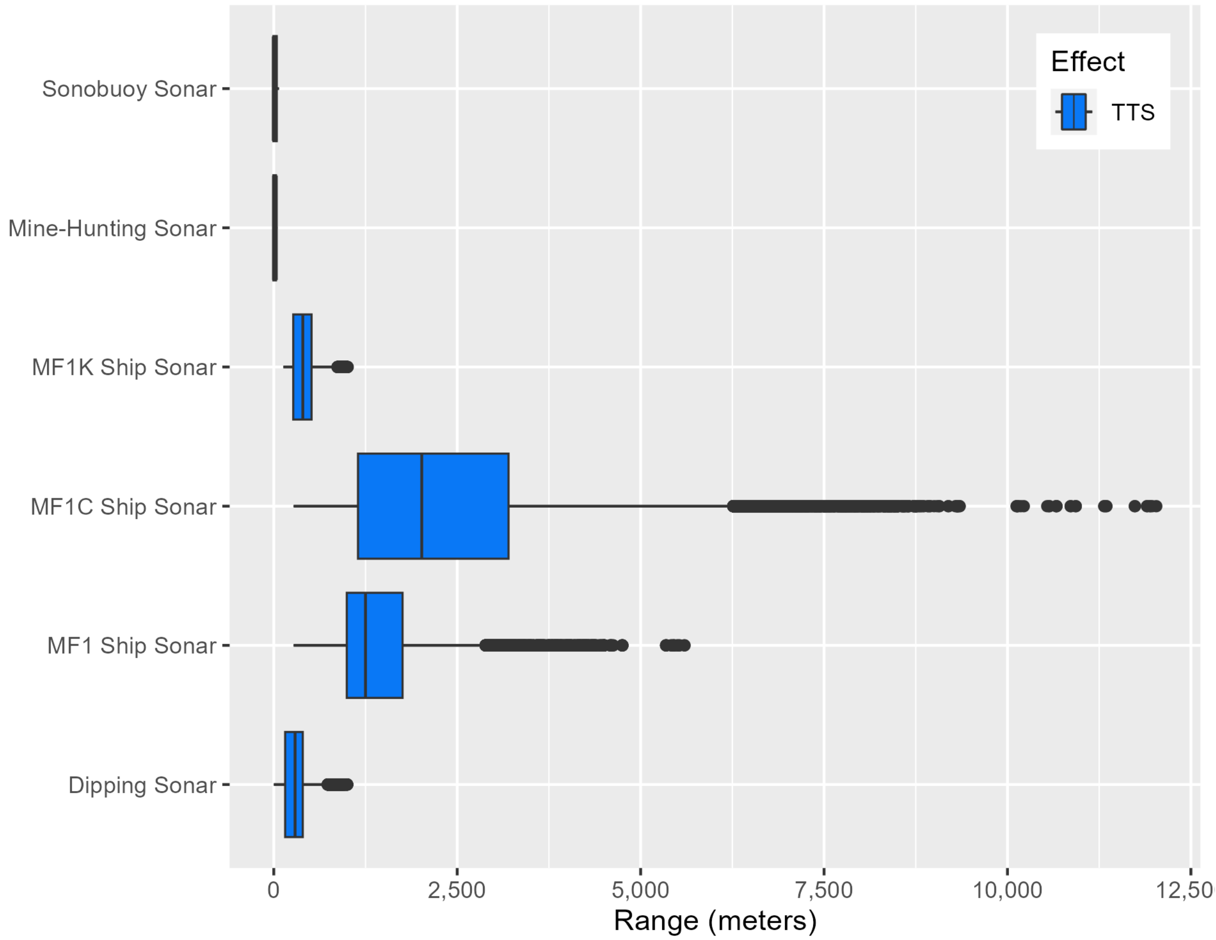

Figure 2.5-3: LF Cetacean Ranges to Temporary Threshold Shift for Sonar

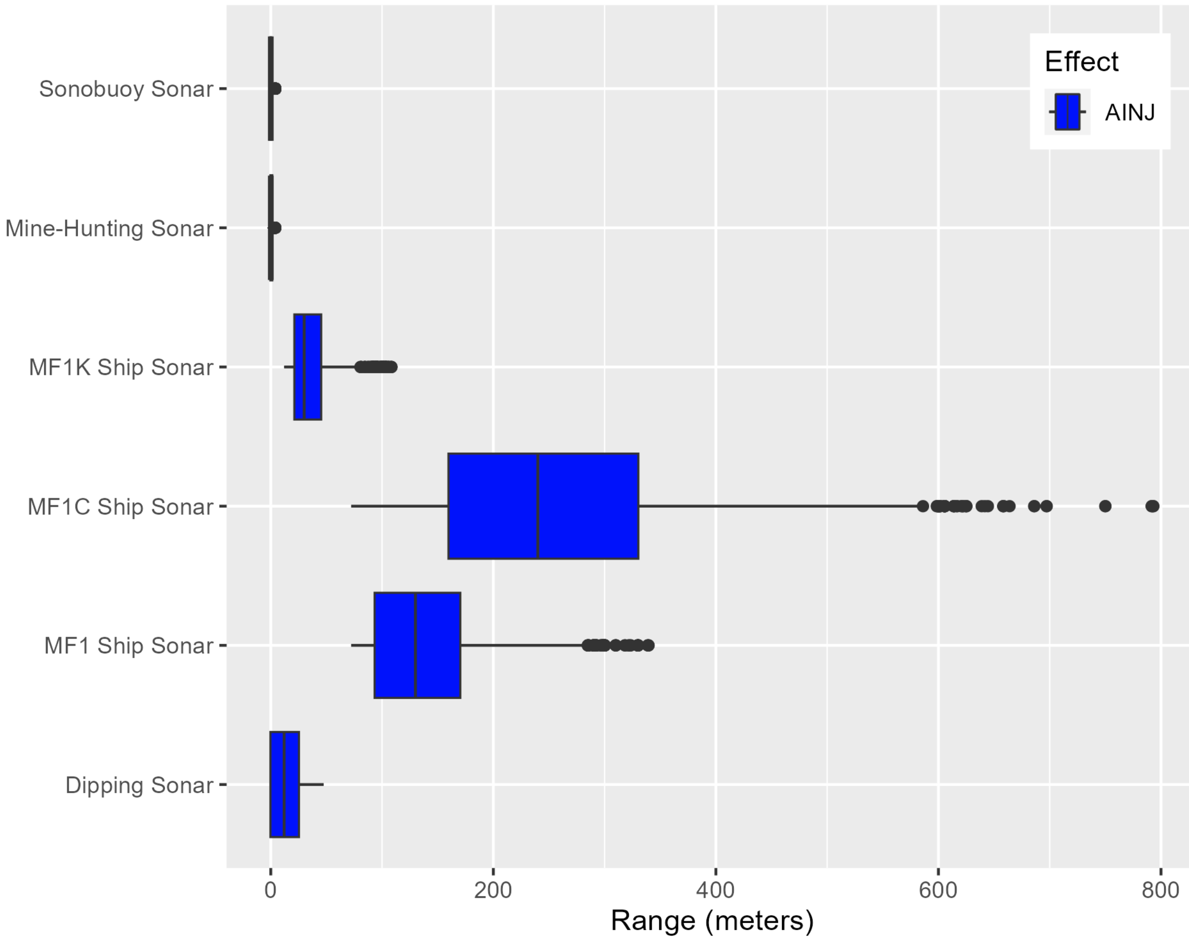

Figure 2.5-4: LF Cetacean Ranges to Auditory Injury for Sonar

Table 2.5-3: HF Cetacean Ranges to Effects for Sonar

Sonar Type	Depth	Duration	TTS	AINJ
Dipping Sonar	≤200 m	1 s	55 m (15 m)	5 m (2 m)
		30 s	120 m (33 m)	9 m (4 m)
		60 s	170 m (49 m)	12 m (5 m)
		120 s	252 m (84 m)	18 m (6 m)
	>200 m	1 s	50 m (28 m)	0 m (2 m)
		30 s	100 m (54 m)	0 m (4 m)
		60 s	130 m (74 m)	0 m (5 m)
		120 s	201 m (106 m)	0 m (8 m)
MF1 Ship Sonar	≤200 m	1 s	646 m (113 m)	45 m (7 m)
		30 s	646 m (113 m)	45 m (7 m)
		60 s	911 m (178 m)	65 m (12 m)
		120 s	1,014 m (244 m)	85 m (14 m)
	>200 m	1 s	600 m (55 m)	40 m (11 m)
		30 s	600 m (55 m)	40 m (11 m)
		60 s	875 m (97 m)	65 m (13 m)
		120 s	1,000 m (132 m)	85 m (7 m)
MF1C Ship Sonar	≤200 m	1 s	646 m (113 m)	45 m (7 m)
		30 s	1,014 m (244 m)	85 m (14 m)
		60 s	1,458 m (439 m)	130 m (24 m)
		120 s	1,889 m (735 m)	200 m (36 m)
	>200 m	1 s	600 m (55 m)	40 m (11 m)
		30 s	1,000 m (132 m)	85 m (7 m)
		60 s	1,500 m (306 m)	130 m (12 m)
		120 s	2,097 m (747 m)	200 m (18 m)
MF1K Ship Sonar	≤200 m	1 s	100 m (21 m)	7 m (3 m)
		30 s	190 m (34 m)	13 m (4 m)

Sonar Type	Depth	Duration	TTS	AINJ
		60 s	250 m (51 m)	17 m (5 m)
		120 s	363 m (72 m)	25 m (2 m)
	>200 m	1 s	100 m (18 m)	0 m (3 m)
		30 s	180 m (21 m)	11 m (6 m)
		60 s	240 m (29 m)	16 m (8 m)
		120 s	350 m (42 m)	24 m (11 m)
Mine-Hunting Sonar	≤200 m	1 s	8 m (3 m)	0 m (0 m)
		30 s	15 m (5 m)	1 m (0 m)
		60 s	21 m (6 m)	1 m (1 m)
		120 s	30 m (6 m)	2 m (1 m)
	>200 m	1 s	7 m (3 m)	0 m (0 m)
		30 s	15 m (6 m)	0 m (0 m)
		60 s	21 m (8 m)	0 m (1 m)
		120 s	30 m (5 m)	0 m (1 m)
Sonobuoy Sonar	≤200 m	1 s	8 m (4 m)	0 m (0 m)
		30 s	18 m (8 m)	0 m (0 m)
		60 s	25 m (12 m)	0 m (0 m)
		120 s	35 m (14 m)	0 m (1 m)
	>200 m	1 s	0 m (4 m)	0 m (0 m)
		30 s	0 m (9 m)	0 m (0 m)
		60 s	0 m (12 m)	0 m (0 m)
		120 s	30 m (16 m)	0 m (1 m)

Median ranges with standard deviation ranges in parentheses
TTS = Temporary Threshold Shift, AINJ = Auditory Injury
MF1 = hull-mounted surface ship sonar, MF1C = >80% duty cycle, MF1K = kingfisher mode
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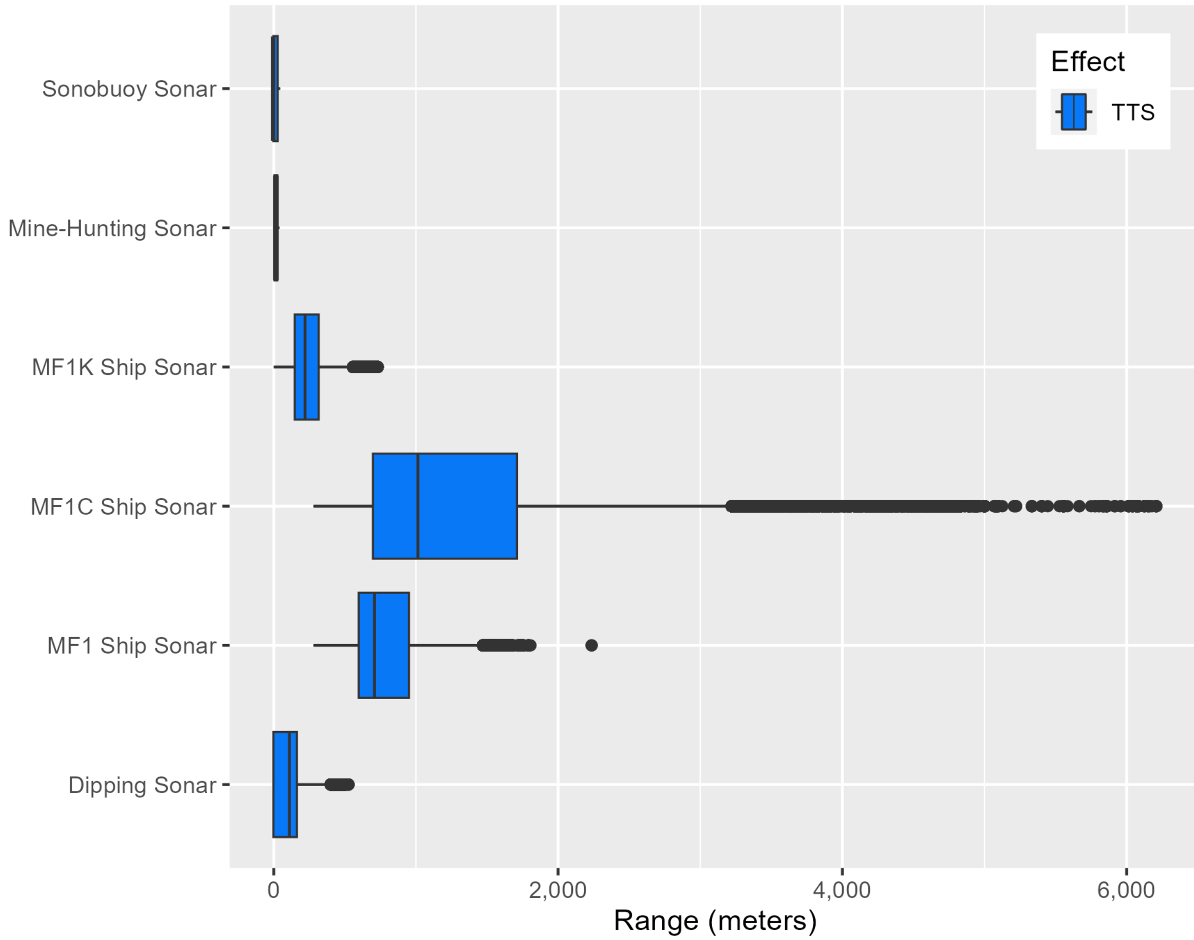

Figure 2.5-5: HF Cetacean Ranges to Temporary Threshold Shift for Sonar

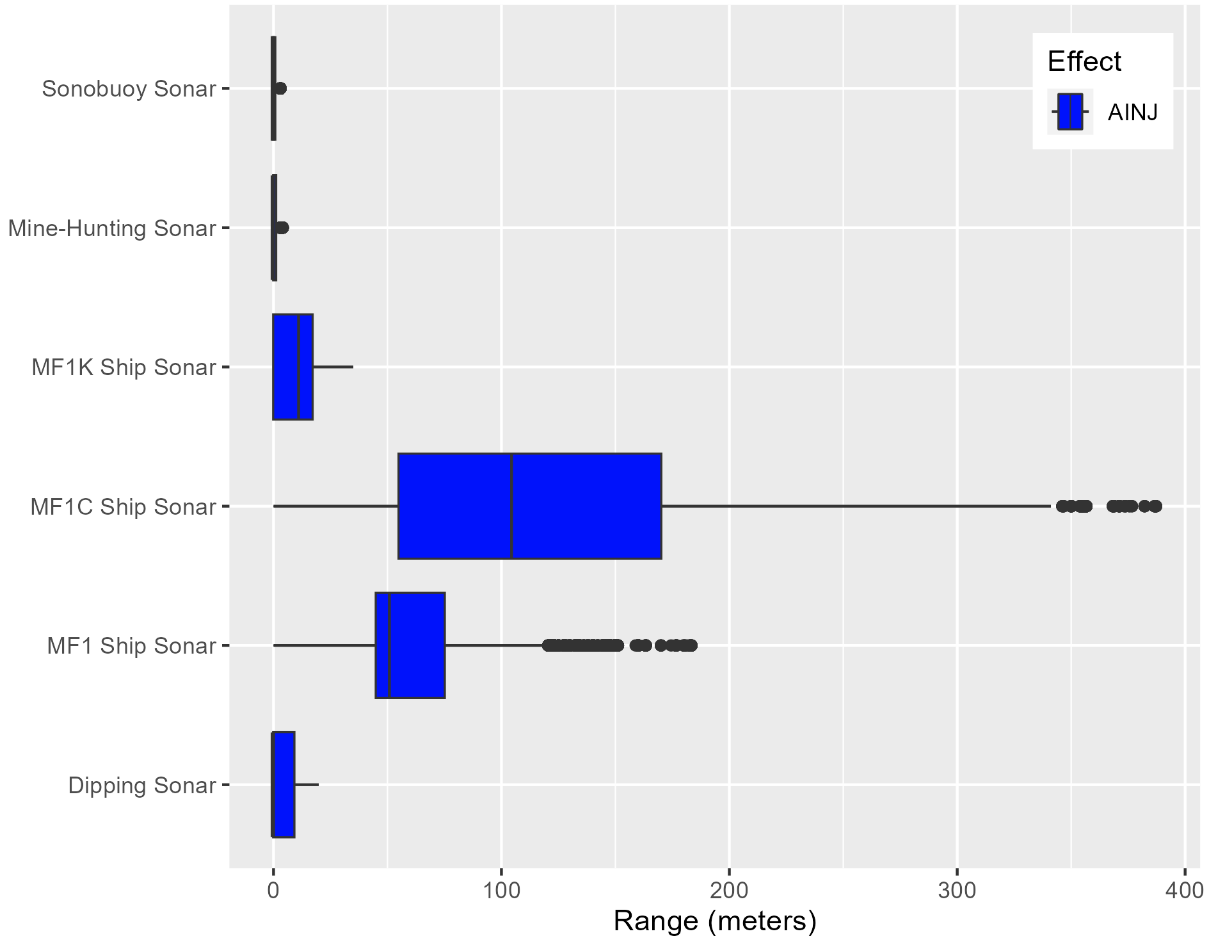

Figure 2.5-6: HF Cetacean Ranges to Auditory Injury for Sonar

Table 2.5-4: VHF Cetacean Ranges to Effects for Sonar

Sonar Type	Depth	Duration	TTS	AINJ
Dipping Sonar	≤200 m	1 s	100 m (29 m)	8 m (2 m)
		30 s	203 m (75 m)	14 m (4 m)
		60 s	280 m (91 m)	19 m (5 m)
		120 s	421 m (99 m)	25 m (6 m)
	>200 m	1 s	95 m (50 m)	0 m (3 m)
		30 s	180 m (101 m)	0 m (6 m)
		60 s	240 m (123 m)	14 m (8 m)
		120 s	330 m (86 m)	24 m (12 m)
MF1 Ship Sonar	≤200 m	1 s	1,514 m (471 m)	150 m (25 m)
		30 s	1,514 m (471 m)	150 m (25 m)
		60 s	1,986 m (759 m)	220 m (39 m)
		120 s	2,236 m (979 m)	280 m (57 m)
	>200 m	1 s	1,514 m (344 m)	150 m (13 m)
		30 s	1,514 m (344 m)	150 m (13 m)
		60 s	2,306 m (837 m)	220 m (22 m)
		120 s	2,819 m (1,098 m)	270 m (29 m)
MF1C Ship Sonar	≤200 m	1 s	1,514 m (471 m)	150 m (25 m)
		30 s	2,236 m (979 m)	280 m (57 m)
		60 s	2,703 m (1,382 m)	417 m (69 m)
		120 s	3,264 m (1,830 m)	592 m (100 m)
	>200 m	1 s	1,514 m (344 m)	150 m (13 m)
		30 s	2,819 m (1,098 m)	270 m (29 m)
		60 s	3,972 m (1,547 m)	390 m (31 m)
		120 s	5,792 m (2,220 m)	550 m (40 m)
MF1K Ship Sonar	≤200 m	1 s	315 m (60 m)	20 m (2 m)
		30 s	550 m (103 m)	35 m (5 m)

Sonar Type	Depth	Duration	TTS	AINJ
		60 s	712 m (139 m)	50 m (12 m)
		120 s	958 m (214 m)	85 m (12 m)
	>200 m	1 s	300 m (39 m)	16 m (3 m)
		30 s	525 m (46 m)	35 m (1 m)
		60 s	675 m (70 m)	50 m (2 m)
		120 s	957 m (120 m)	85 m (4 m)
Mine-Hunting Sonar	≤200 m	1 s	90 m (26 m)	9 m (1 m)
		30 s	190 m (85 m)	16 m (2 m)
		60 s	329 m (128 m)	22 m (2 m)
		120 s	521 m (166 m)	30 m (3 m)
	>200 m	1 s	90 m (6 m)	7 m (1 m)
		30 s	150 m (31 m)	15 m (0 m)
		60 s	210 m (59 m)	22 m (0 m)
		120 s	300 m (82 m)	30 m (0 m)
Sonobuoy Sonar	≤200 m	1 s	65 m (20 m)	0 m (2 m)
		30 s	126 m (39 m)	9 m (5 m)
		60 s	191 m (79 m)	15 m (5 m)
		120 s	314 m (120 m)	22 m (7 m)
	>200 m	1 s	65 m (31 m)	0 m (1 m)
		30 s	110 m (59 m)	0 m (4 m)
		60 s	178 m (76 m)	10 m (7 m)
		120 s	280 m (75 m)	21 m (10 m)

Median ranges with standard deviation ranges in parentheses
TTS = Temporary Threshold Shift, AINJ = Auditory Injury
MF1 = hull-mounted surface ship sonar, MF1C = >80% duty cycle, MF1K = kingfisher mode
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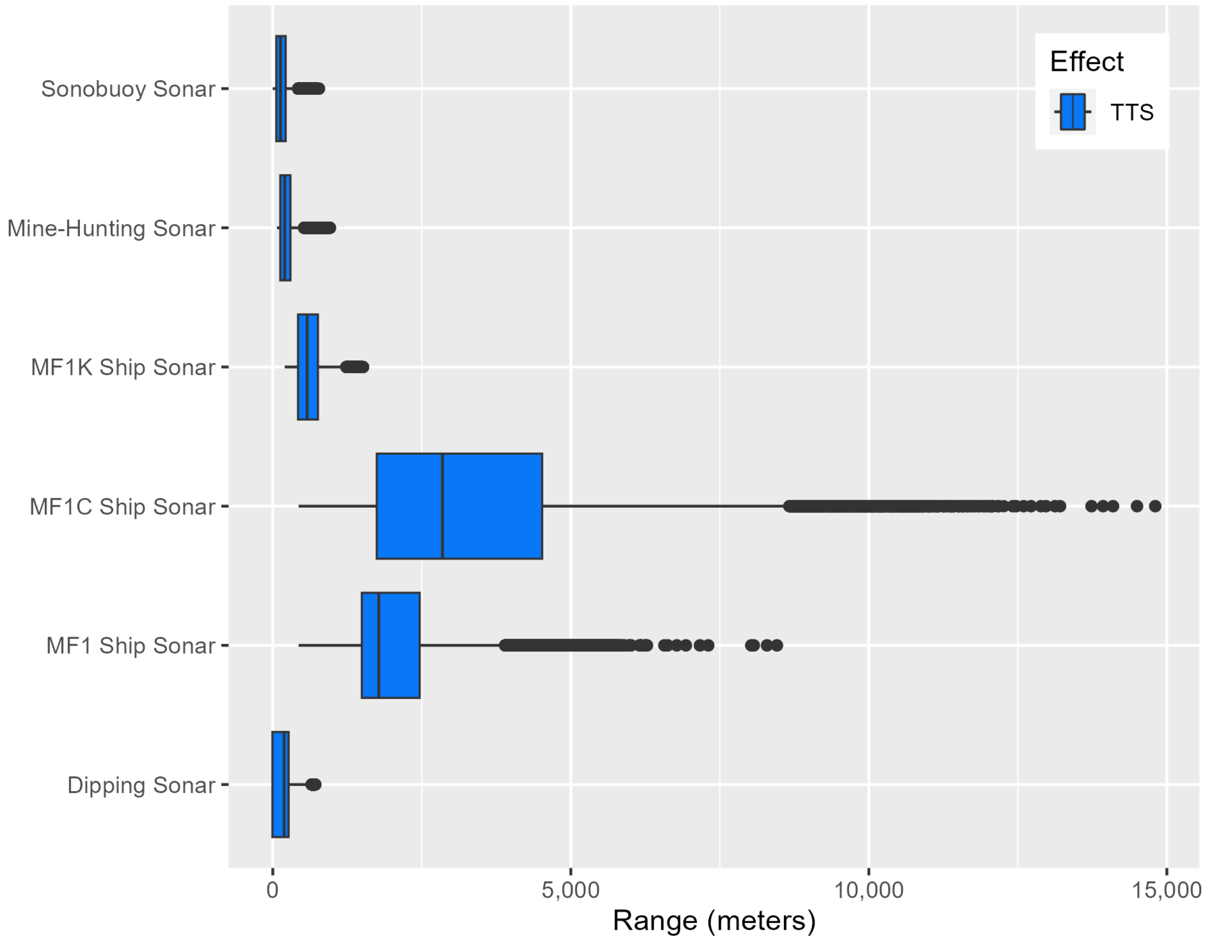

Figure 2.5-7: VHF Cetacean Ranges to Temporary Threshold Shift for Sonar

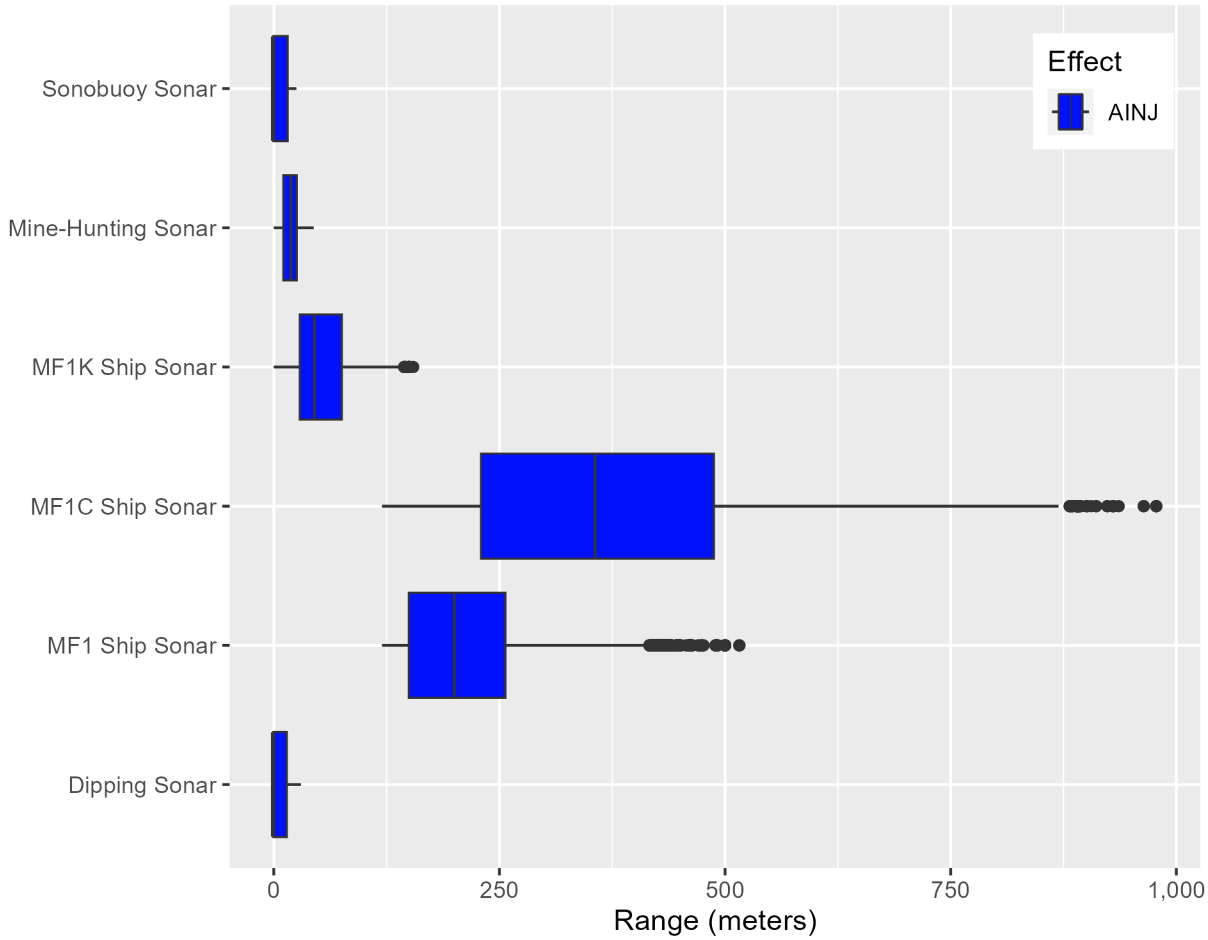

Figure 2.5-8: VHF Cetacean Ranges to Auditory Injury for Sonar

Table 2.5-5: Phocids in Water Ranges to Effects for Sonar

Sonar Type	Depth	Duration	TTS	AINJ
Dipping Sonar	≤200 m	1 s	200 m (50 m)	0 m (7 m)
		30 s	372 m (98 m)	22 m (12 m)
		60 s	497 m (130 m)	30 m (15 m)
		120 s	708 m (144 m)	45 m (12 m)
	>200 m	1 s	160 m (71 m)	0 m (4 m)
		30 s	298 m (130 m)	0 m (8 m)
		60 s	370 m (171 m)	0 m (10 m)
		120 s	550 m (81 m)	0 m (19 m)
MF1 Ship Sonar	≤200 m	1 s	1,250 m (386 m)	120 m (20 m)
		30 s	1,250 m (386 m)	120 m (20 m)
		60 s	1,625 m (635 m)	180 m (33 m)
		120 s	1,861 m (838 m)	230 m (45 m)
	>200 m	1 s	1,250 m (289 m)	120 m (53 m)
		30 s	1,250 m (289 m)	120 m (53 m)
		60 s	1,750 m (672 m)	180 m (21 m)
		120 s	2,250 m (939 m)	220 m (23 m)
MF1C Ship Sonar	≤200 m	1 s	1,250 m (386 m)	120 m (20 m)
		30 s	1,861 m (838 m)	230 m (45 m)
		60 s	2,319 m (1,230 m)	330 m (74 m)
		120 s	2,799 m (1,642 m)	484 m (98 m)
	>200 m	1 s	1,250 m (289 m)	120 m (53 m)
		30 s	2,250 m (939 m)	220 m (23 m)
		60 s	3,306 m (1,352 m)	320 m (32 m)
		120 s	4,486 m (1,866 m)	460 m (47 m)
MF1K Ship Sonar	≤200 m	1 s	248 m (58 m)	0 m (9 m)
		30 s	435 m (97 m)	25 m (8 m)

Sonar Type	Depth	Duration	TTS	AINJ
		60 s	550 m (133 m)	35 m (10 m)
		120 s	771 m (190 m)	65 m (14 m)
	>200 m	1 s	240 m (27 m)	0 m (8 m)
		30 s	430 m (51 m)	24 m (13 m)
		60 s	550 m (64 m)	35 m (16 m)
		120 s	775 m (108 m)	65 m (28 m)
Mine-Hunting Sonar	≤200 m	1 s	12 m (7 m)	0 m (0 m)
		30 s	24 m (11 m)	0 m (1 m)
		60 s	35 m (11 m)	0 m (1 m)
		120 s	50 m (15 m)	0 m (2 m)
	>200 m	1 s	0 m (5 m)	0 m (0 m)
		30 s	22 m (9 m)	0 m (0 m)
		60 s	30 m (4 m)	0 m (1 m)
		120 s	45 m (5 m)	0 m (1 m)
Sonobuoy Sonar	≤200 m	1 s	0 m (11 m)	0 m (0 m)
		30 s	35 m (16 m)	0 m (1 m)
		60 s	50 m (19 m)	0 m (1 m)
		120 s	75 m (20 m)	0 m (3 m)
	>200 m	1 s	0 m (7 m)	0 m (0 m)
		30 s	0 m (16 m)	0 m (0 m)
		60 s	45 m (23 m)	0 m (0 m)
		120 s	70 m (32 m)	0 m (1 m)

Median ranges with standard deviation ranges in parentheses
TTS = Temporary Threshold Shift, AINJ = Auditory Injury
MF1 = hull-mounted surface ship sonar, MF1C = >80% duty cycle, MF1K = kingfisher mode
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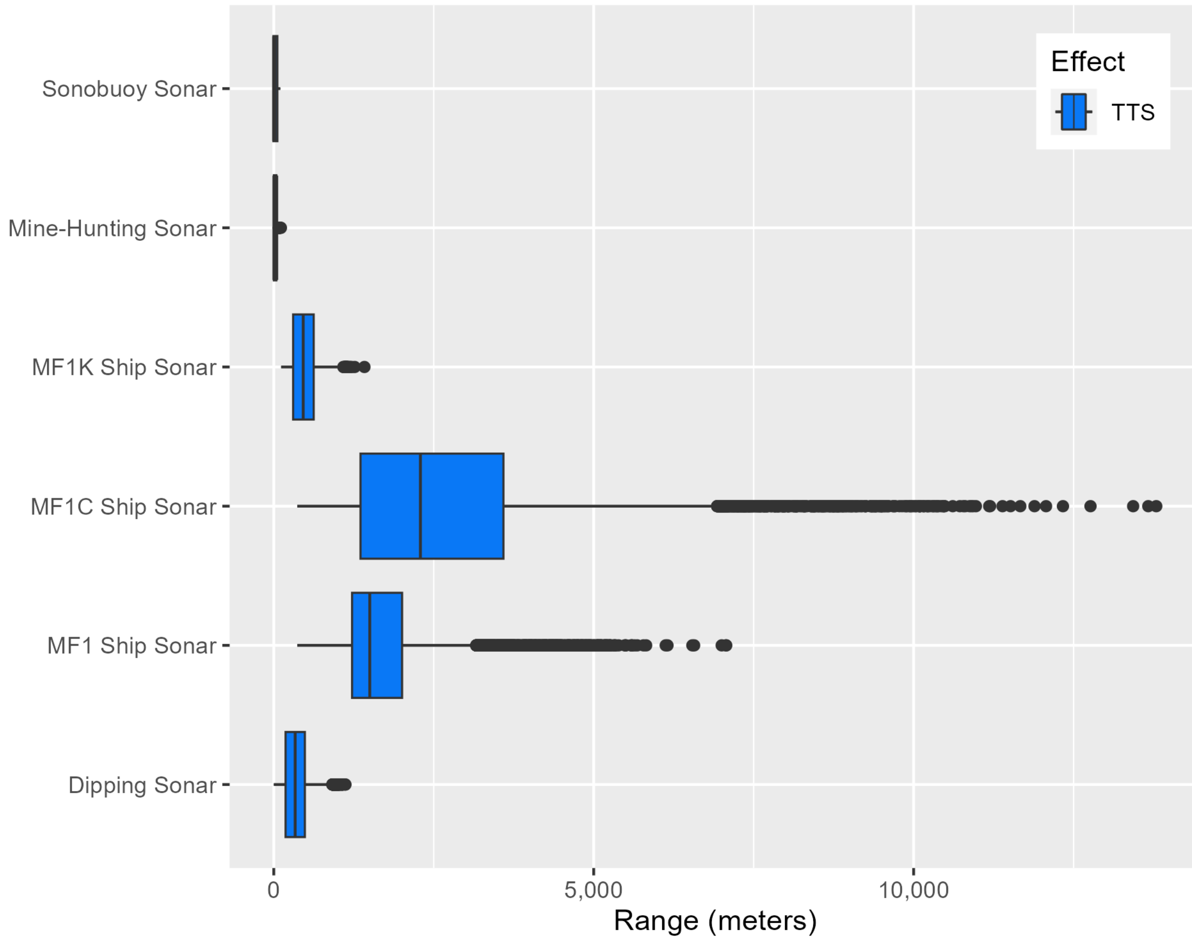

Figure 2.5-9: Phocids in Water Ranges to Temporary Threshold Shift for Sonar

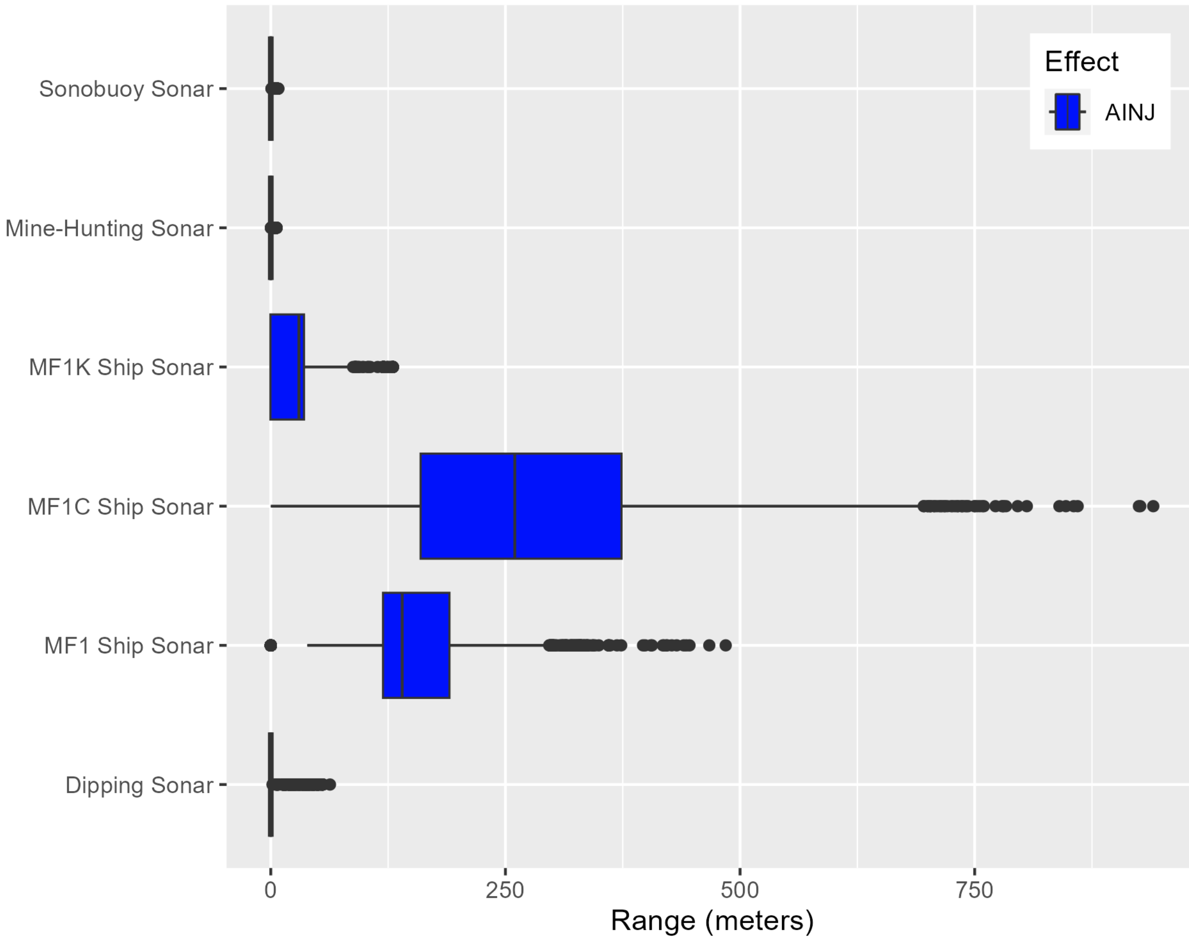

Figure 2.5-10: Phocids in Water Ranges to Auditory Injury for Sonar

Table 2.5-6: Otariids in Water Ranges to Effects for Sonar

Sonar Type	Depth	Duration	TTS	AINJ
Dipping Sonar	≤200 m	1 s	60 m (15 m)	0 m (3 m)
		30 s	130 m (37 m)	0 m (5 m)
		60 s	180 m (55 m)	0 m (6 m)
		120 s	277 m (84 m)	14 m (9 m)
	>200 m	1 s	55 m (31 m)	0 m (2 m)
		30 s	120 m (66 m)	0 m (4 m)
		60 s	160 m (90 m)	0 m (5 m)
		120 s	210 m (117 m)	0 m (8 m)
MF1 Ship Sonar	≤200 m	1 s	731 m (149 m)	50 m (10 m)
		30 s	731 m (149 m)	50 m (10 m)
		60 s	981 m (221 m)	80 m (12 m)
		120 s	1,139 m (297 m)	110 m (19 m)
	>200 m	1 s	725 m (98 m)	50 m (1 m)
		30 s	725 m (98 m)	50 m (1 m)
		60 s	1,000 m (163 m)	80 m (5 m)
		120 s	1,250 m (256 m)	100 m (8 m)
MF1C Ship Sonar	≤200 m	1 s	731 m (149 m)	50 m (10 m)
		30 s	1,139 m (297 m)	110 m (19 m)
		60 s	1,493 m (462 m)	160 m (23 m)
		120 s	1,847 m (691 m)	240 m (40 m)
	>200 m	1 s	725 m (98 m)	50 m (1 m)
		30 s	1,250 m (256 m)	100 m (8 m)
		60 s	1,653 m (527 m)	160 m (13 m)
		120 s	2,222 m (1,019 m)	240 m (23 m)
MF1K Ship Sonar	≤200 m	1 s	120 m (22 m)	8 m (4 m)
		30 s	230 m (40 m)	16 m (4 m)

Sonar Type	Depth	Duration	TTS	AINJ
		60 s	300 m (56 m)	20 m (3 m)
		120 s	426 m (77 m)	25 m (4 m)
	>200 m	1 s	120 m (12 m)	0 m (4 m)
		30 s	220 m (31 m)	14 m (6 m)
		60 s	290 m (40 m)	20 m (5 m)
		120 s	420 m (60 m)	25 m (1 m)
Mine-Hunting Sonar	≤200 m	1 s	6 m (3 m)	0 m (0 m)
		30 s	11 m (6 m)	0 m (0 m)
		60 s	18 m (8 m)	0 m (0 m)
		120 s	25 m (10 m)	0 m (1 m)
	>200 m	1 s	6 m (3 m)	0 m (0 m)
		30 s	11 m (5 m)	0 m (0 m)
		60 s	18 m (7 m)	0 m (0 m)
		120 s	25 m (10 m)	0 m (1 m)
Sonobuoy Sonar	≤200 m	1 s	0 m (6 m)	0 m (0 m)
		30 s	18 m (11 m)	0 m (0 m)
		60 s	30 m (13 m)	0 m (1 m)
		120 s	45 m (20 m)	0 m (1 m)
	>200 m	1 s	0 m (5 m)	0 m (0 m)
		30 s	0 m (11 m)	0 m (0 m)
		60 s	25 m (14 m)	0 m (0 m)
		120 s	40 m (22 m)	0 m (1 m)

Median ranges with standard deviation ranges in parentheses
TTS = Temporary Threshold Shift, AINJ = Auditory Injury
MF1 = hull-mounted surface ship sonar, MF1C = >80% duty cycle, MF1K = kingfisher mode
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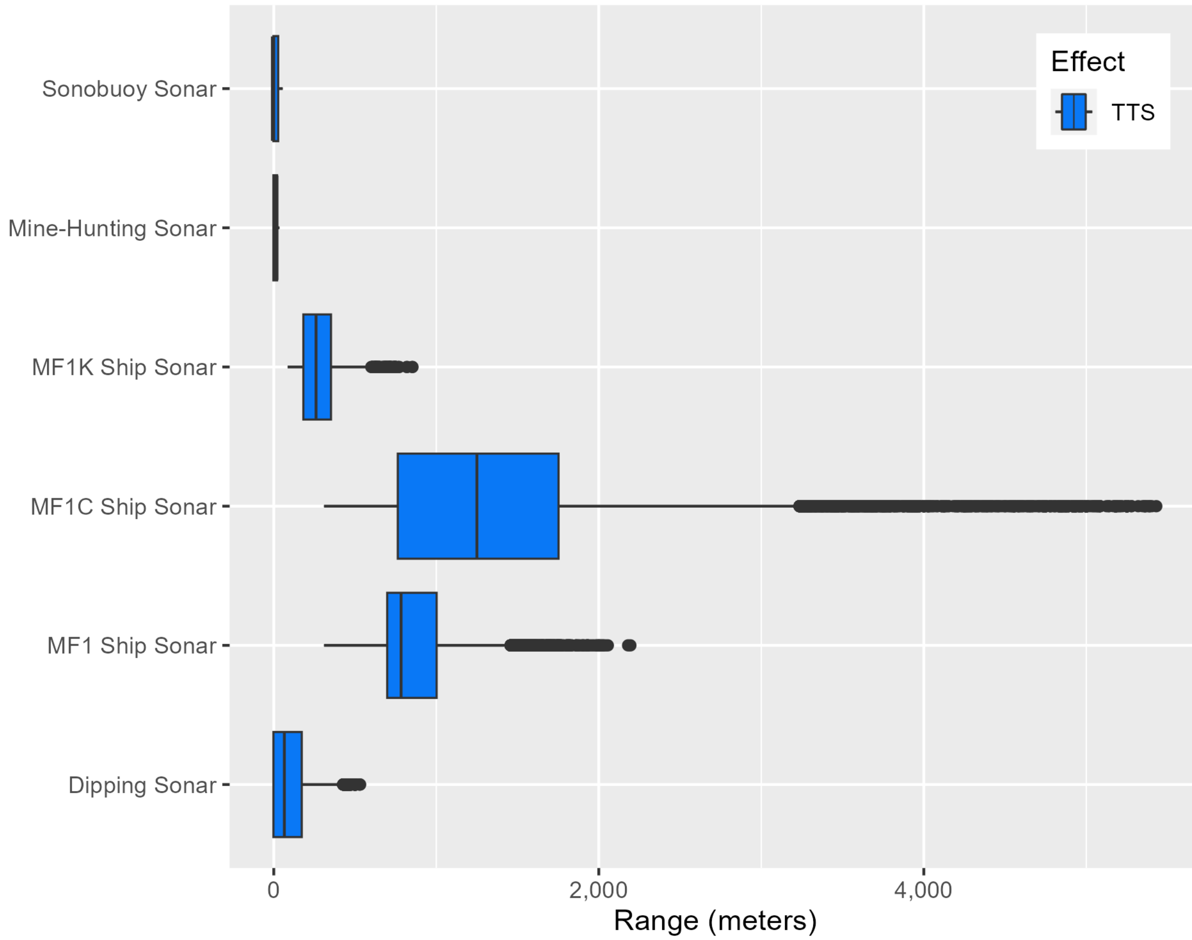

Figure 2.5-11: Otariids in Water Ranges to Temporary Threshold Shift for Sonar

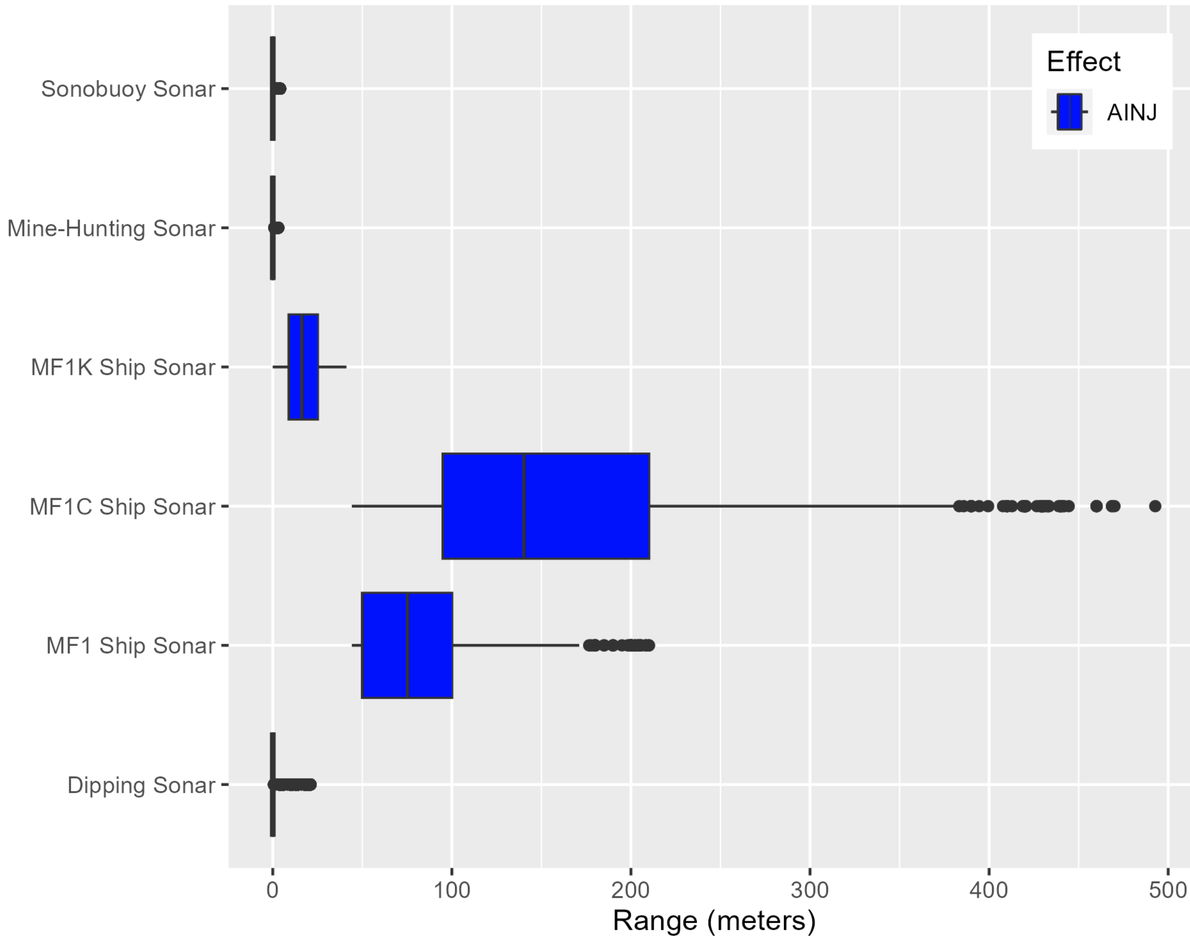

Figure 2.5-12: Otariids in Water Ranges to Auditory Injury for Sonar

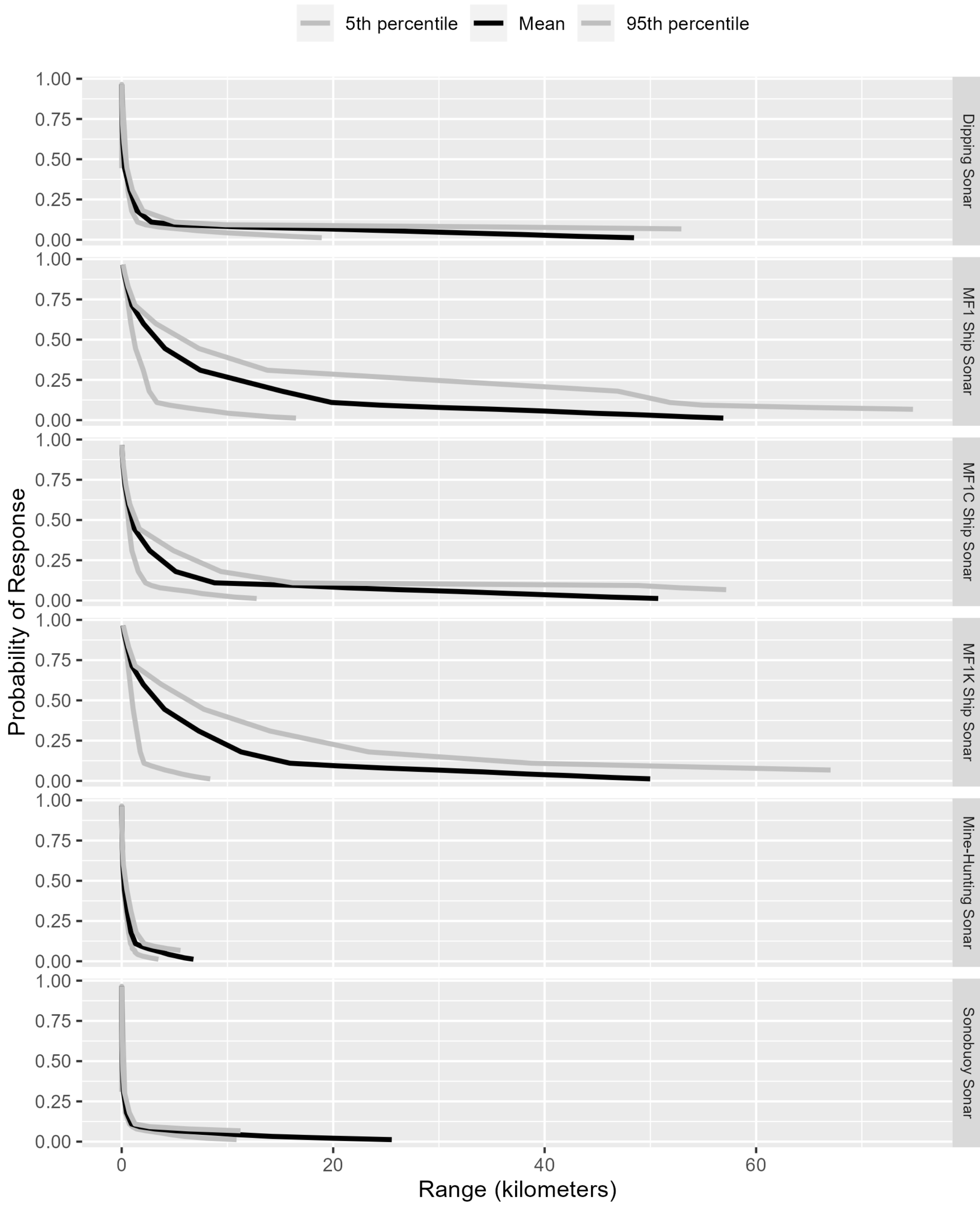

Figure 2.5-13: Probability of Behavioral Response to Sonar as a Function of Range for Odontocetes

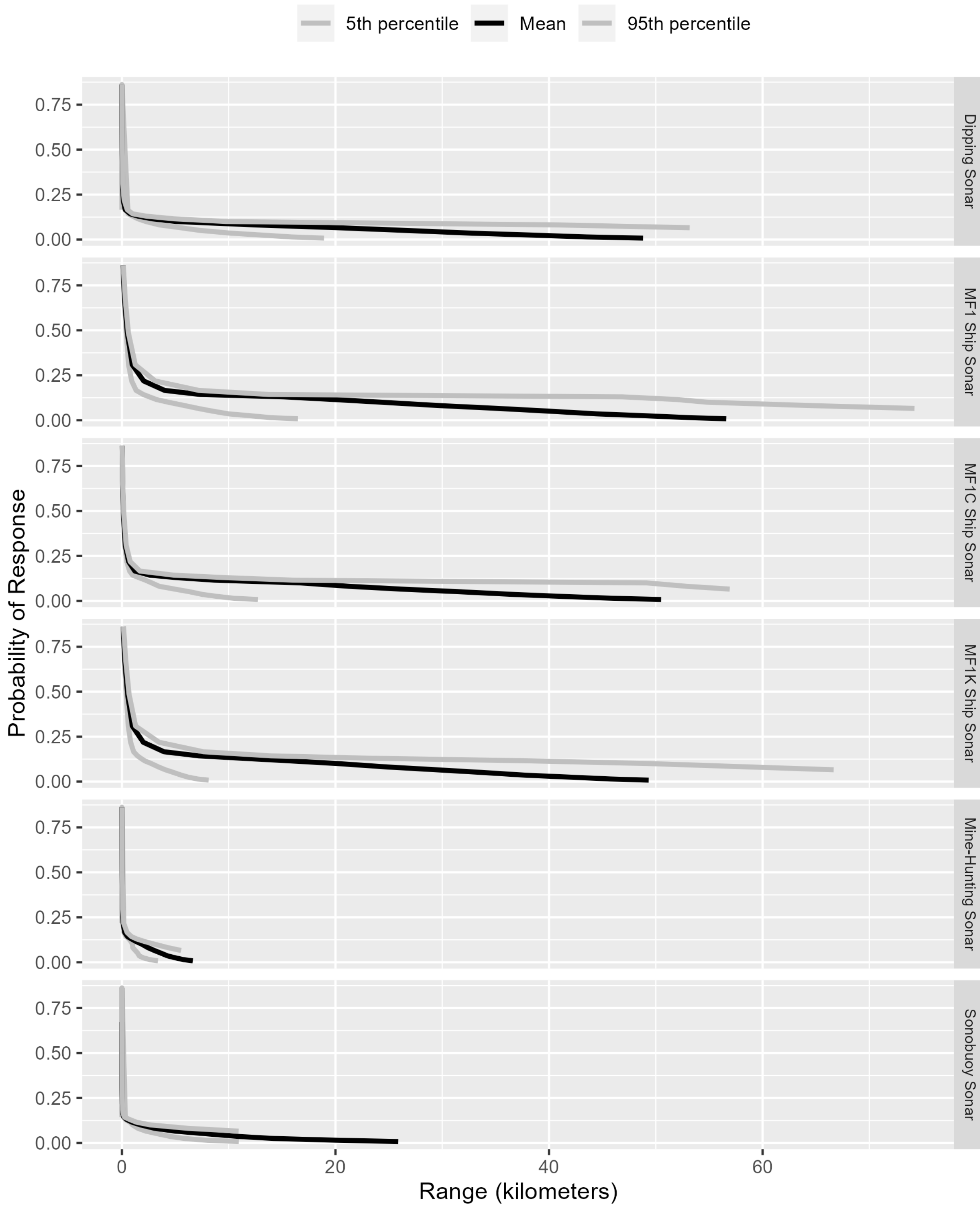

Figure 2.5-14: Probability of Behavioral Response to Sonar as a Function of Range for Mysticetes

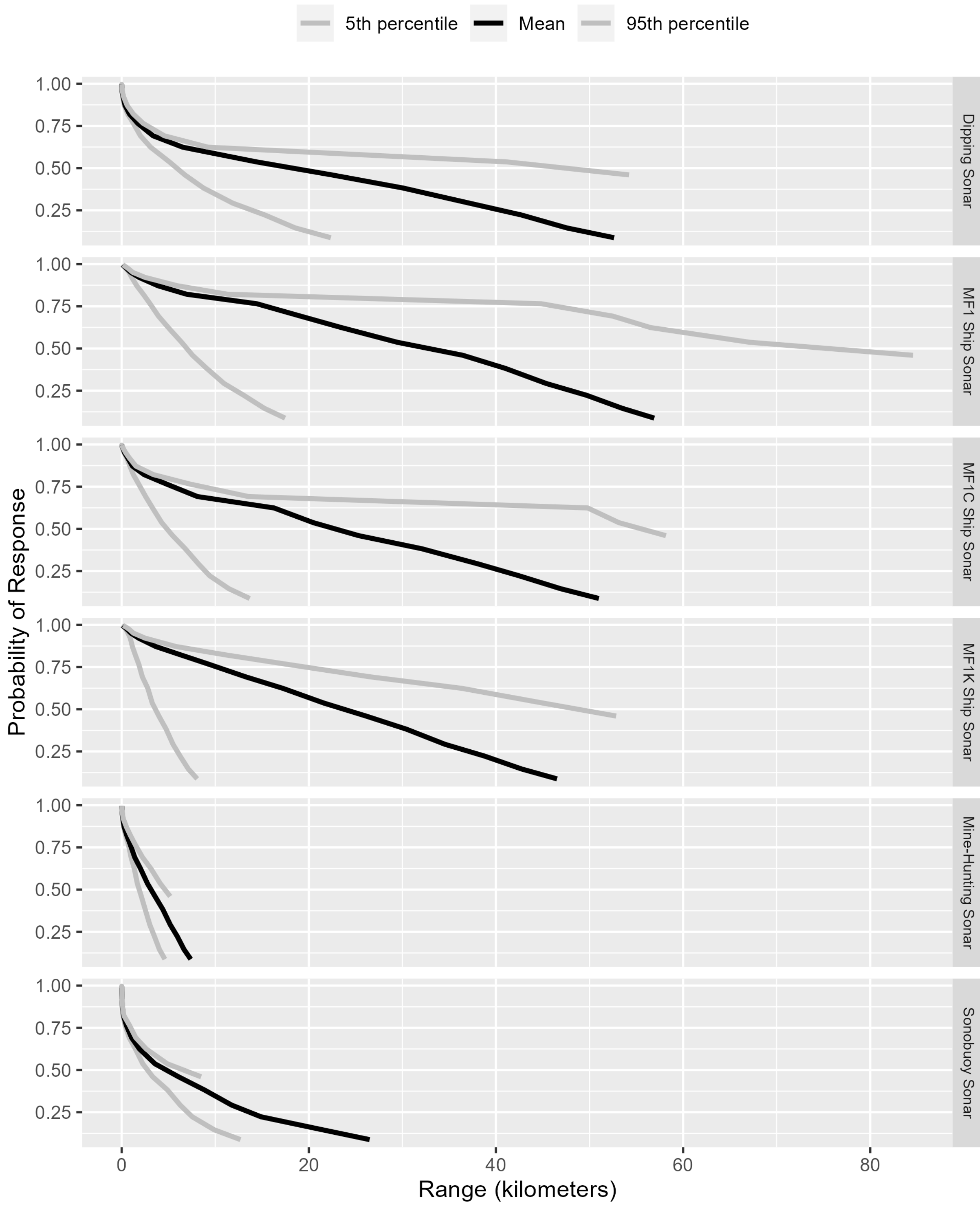

Figure 2.5-15: Probability of Behavioral Response to Sonar as a Function of Range for Sensitive Species

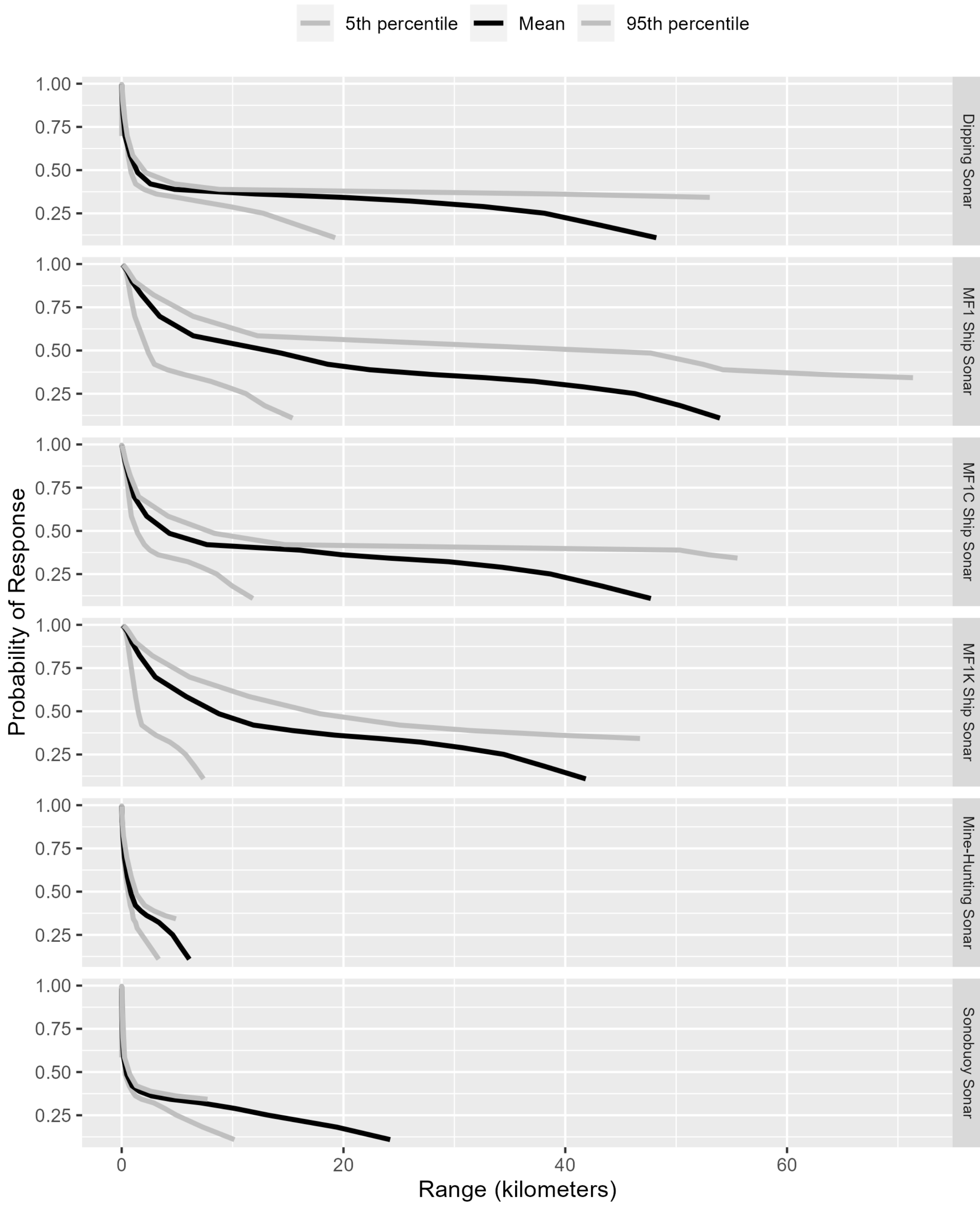

Figure 2.5-16: Probability of Behavioral Response to Sonar as a Function of Range for Pinnipeds

2.5.2 Ranges to Effects for Air Guns

Ranges to effects for air guns were determined by modeling the distance that sound would need to propagate to reach exposure level thresholds specific to a hearing group that would cause behavioral response, TTS, and AINJ, as described in the *Criteria and Thresholds TR*. The air gun ranges to effects for TTS and AINJ that are in the tables are based on the metric (i.e., SEL or SPL) that produced longer ranges.

Table 2.5-7: VLF Cetacean Ranges to Effects for Air Guns

Bin	Depth	Cluster Size	BEH	TTS	AINJ
Air Gun	≤200 m	1	NA	5 m (0 m)	1 m (1 m)
		10	113 m (6 m)	81 m (1 m)	14 m (0 m)
	>200 m	1	NA	5 m (0 m)	1 m (1 m)
		10	114 m (6 m)	81 m (1 m)	14 m (0 m)

Median ranges with standard deviation ranges in parentheses, TTS and AINJ = the greater of respective SPL and SEL ranges
BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, NA = not applicable
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Table 2.5-8: LF Cetacean Ranges to Effects for Air Guns

Bin	Depth	Cluster Size	BEH	TTS	AINJ
Air Gun	≤200 m	1	NA	5 m (0 m)	2 m (0 m)
		10	104 m (6 m)	36 m (0 m)	6 m (0 m)
	>200 m	1	NA	5 m (0 m)	2 m (0 m)
		10	107 m (7 m)	35 m (0 m)	6 m (0 m)

Median ranges with standard deviation ranges in parentheses, TTS and AINJ = the greater of respective SPL and SEL ranges
BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, NA = not applicable
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Table 2.5-9: HF Cetacean Ranges to Effects for Air Guns

Bin	Depth	Cluster Size	BEH	TTS	AINJ
Air Gun	≤200 m	1	NA	2 m (1 m)	0 m (0 m)
		10	108 m (6 m)	2 m (1 m)	0 m (0 m)
	>200 m	1	NA	2 m (1 m)	0 m (0 m)
		10	112 m (7 m)	2 m (1 m)	0 m (0 m)

Median ranges with standard deviation ranges in parentheses, TTS and AINJ = the greater of respective SPL and SEL ranges
BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, NA = not applicable
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Table 2.5-10: VHF Cetacean Ranges to Effects for Air Guns

Bin	Depth	Cluster Size	BEH	TTS	AINJ
Air Gun	≤200 m	1	NA	51 m (1 m)	25 m (0 m)
		10	108 m (6 m)	51 m (1 m)	25 m (0 m)
	>200 m	1	NA	50 m (1 m)	25 m (0 m)
		10	113 m (7 m)	50 m (1 m)	25 m (0 m)

Median ranges with standard deviation ranges in parentheses, TTS and AINJ = the greater of respective SPL and SEL ranges
BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, NA = not applicable
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2.5.3 Ranges to Effects for Pile Driving

Table 2.5-11 shows the predicted ranges to AINJ, TTS, and behavioral response for each marine mammal hearing group exposed to impact and vibratory pile driving. These ranges were estimated based on activity parameters described in the *Acoustic Stressors* section and using the calculations described in the *Quantitative Analysis TR.*

Table 2.5-11: Marine Mammal Ranges to Effects for Pile Driving

FHG	Pile Type/Size and Method	BEH	TTS	AINJ
OCW	20" Timber/Plastic Round Piles using Impact Methods	46 m	43 m	4 m
	20" Steel H Piles using Impact Methods	215 m	201 m	20 m
	20" Steel/Timber/Plastic Round or H Piles using Impact Methods	858 m	685 m	69 m
	27.5" Steel Sheet or Z-Shape Piles using Vibratory Methods	3,981 m	12 m	1 m
	20" Steel/Timber/Plastic Round Piles using Vibratory Methods	3,981 m	36 m	2 m
PCW	20" Timber/Plastic Round Piles using Impact Methods	46 m	116 m	12 m
	20" Steel H Piles using Impact Methods	215 m	538 m	54 m
	20" Steel/Timber/Plastic Round or H Piles using Impact Methods	858 m	1,839 m	184 m
	27.5" Steel Sheet or Z-Shape Piles using Vibratory Methods	11,659 m	35 m	2 m
	20" Steel/Timber/Plastic Round Piles using Vibratory Methods	11,659 m	105 m	5 m

Note: AINJ = auditory injury, TTS = temporary threshold shift, BEH = behavior, OCW = otariids in water, PCW = phocids in water

2.5.4 Ranges to Effects for Explosives

Ranges to effects for explosives were determined by modeling the distance that noise from an explosion would need to propagate to reach exposure level thresholds specific to a hearing group that would cause behavioral response, TTS, AINJ, non-auditory injury, and mortality, as described in the *Criteria and Thresholds TR*.

The Navy Acoustic Effects Model cannot account for the highly non-linear effects of cavitation and surface blow off for shallow underwater explosions, nor can it estimate the explosive energy entering the water from a low-altitude detonation. Thus, for this analysis, in-air sources detonating at or near (within 10 m) the surface are modeled as if detonating completely underwater at a source depth of 0.1 m, with all energy reflected into the water rather than released into the air. Therefore, the amount of explosive and acoustic energy entering the water, and consequently the estimated ranges to effects, are likely to be overestimated. In the tables below, near surface explosions can occur for bathymetric depth intervals of ≤200 m and >200 m.

The tables below provide the ranges for a representative cluster size for each bin. Ranges for behavioral response are only provided if more than one explosive cluster occurs. Single explosions at received sound levels below TTS and AINJ thresholds are most likely to result in a brief alerting or orienting response. Due to the lack of subsequent explosions, a significant behavioral response is not expected for a single explosive cluster. For events with multiple explosions, sound from successive explosions can be expected to accumulate and increase the range to the onset of an impact based on SEL thresholds. Modeled ranges to TTS and AINJ based on peak pressure for a single explosion generally exceed the modeled ranges based on SEL even when accumulated for multiple explosions. Peak pressure-based ranges are estimated using the best available science; however, data on peak pressure at far distances from explosions are very limited. The explosive ranges to effects for TTS and AINJ that are in the tables are based on the metric (i.e., SEL or SPL) that produced longer ranges.

For non-auditory injury in the tables, the larger of the range to slight lung injury or gastrointestinal tract injury was used as a conservative estimate, and the boxplots present ranges for both metrics for comparison. Since the non-auditory metric is SPL-based, ranges are only available for a cluster size of one. Animals within water volumes encompassing the estimated range to non-auditory injury would be expected to receive minor injuries at the outer ranges, increasing to more substantial injuries, and finally mortality as an animal approaches the detonation point.

Table 2.5-12: VLF Cetacean Ranges to Effects for Explosives

Bin	Depth	Cluster Size	BEH	TTS	AINJ
E1	≤200 m	1	NA	201 m (72 m)	96 m (2 m)
		5	627 m (231 m)	390 m (164 m)	96 m (2 m)
		25	1,262 m (443 m)	798 m (266 m)	180 m (62 m)
		50	1,419 m (471 m)	800 m (178 m)	250 m (34 m)
	>200 m	1	NA	220 m (55 m)	96 m (2 m)
		5	603 m (58 m)	430 m (17 m)	96 m (2 m)
		25	950 m (152 m)	700 m (81 m)	190 m (5 m)
		50	1,000 m (296 m)	850 m (89 m)	270 m (5 m)
E2	≤200 m	1	NA	359 m (40 m)	130 m (11 m)
	>200 m	1	NA	369 m (44 m)	131 m (12 m)
E3	≤200 m	1	NA	484 m (367 m)	213 m (7 m)
		5	1,542 m (616 m)	919 m (370 m)	213 m (7 m)
		25	2,703 m (1,191 m)	1,740 m (690 m)	421 m (181 m)
	>200 m	1	NA	825 m (305 m)	218 m (6 m)
		5	1,000 m (330 m)	750 m (144 m)	220 m (5 m)
		25	1,812 m (1,028 m)	1,000 m (366 m)	420 m (15 m)
E4	≤200 m	1	NA	1,903 m (777 m)	375 m (21 m)
	>200 m	1	NA	1,292 m (277 m)	370 m (24 m)
E5	≤200 m	1	NA	833 m (862 m)	358 m (25 m)
		5	2,956 m (1,325 m)	1,597 m (723 m)	358 m (25 m)
	>200 m	1	NA	650 m (146 m)	344 m (22 m)
		5	2,208 m (988 m)	1,056 m (443 m)	350 m (53 m)
		20	3,965 m (992 m)	2,486 m (578 m)	575 m (170 m)
E6	≤200 m	1	NA	1,868 m (1,345 m)	547 m (386 m)
		15	7,258 m (1,106 m)	5,397 m (814 m)	2,029 m (104 m)
	>200 m	1	NA	1,514 m (792 m)	512 m (44 m)

Bin	Depth	Cluster Size	BEH	TTS	AINJ
E7	≤200 m	1	NA	1,658 m (738 m)	538 m (23 m)
	>200 m	1	NA	1,500 m (1,296 m)	538 m (22 m)
E8	≤200 m	1	NA	2,555 m (414 m)	773 m (51 m)
	>200 m	1	NA	2,503 m (398 m)	764 m (48 m)
E9	≤200 m	1	NA	3,375 m (1,548 m)	757 m (48 m)
	>200 m	1	NA	2,722 m (1,222 m)	758 m (48 m)
E10	≤200 m	1	NA	4,243 m (722 m)	893 m (80 m)
	>200 m	1	NA	4,174 m (754 m)	892 m (94 m)
E11	≤200 m	1	NA	17,083 m (3,549 m)	1,799 m (57 m)
	>200 m	1	NA	15,833 m (3,966 m)	1,833 m (111 m)
E12	≤200 m	1	NA	4,507 m (633 m)	992 m (79 m)
	>200 m	1	NA	4,361 m (691 m)	1,012 m (85 m)
E13	≤200 m	1	NA	7,208 m (5,750 m)	3,361 m (1,875 m)
E16	>200 m	1	NA	10,778 m (8,250 m)	2,438 m (65 m)

Median ranges with standard deviation ranges in parentheses, TTS and AINJ = the greater of respective SPL and SEL ranges, behavioral response criteria are applied to explosive clusters >1
BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, NA = not applicable
E1 (0.1 - 0.25 lbs), E2 (>0.25 - 0.5 lbs), E3 (>0.5 - 2.5 lbs), E4 (>2.5 - 5 lbs), E5 (>5 - 10 lbs), E6 (>10 - 20 lbs), E7 (>20 - 60 lbs), E8 (>60 - 100 lbs), E9 (>100 - 250 lbs), E10 (>250 - 500 lbs), E11 (>500 - 675 lbs), E12 (>675 - 1,000 lbs), E13 (>1,000 - 1,740), E16 (10,000 lbs)
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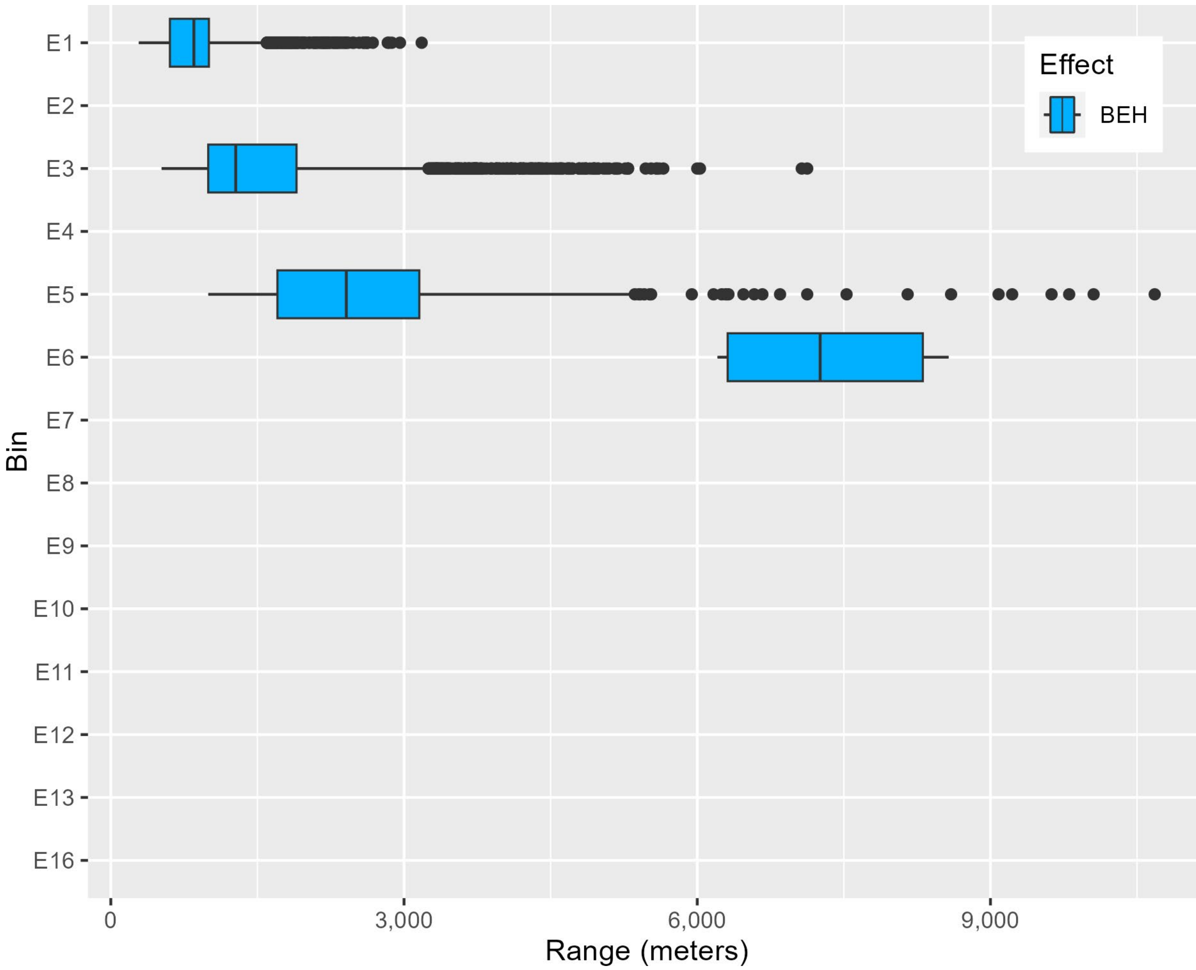

Figure 2.5-17: VLF Cetacean Ranges to Behavioral Response for Explosives

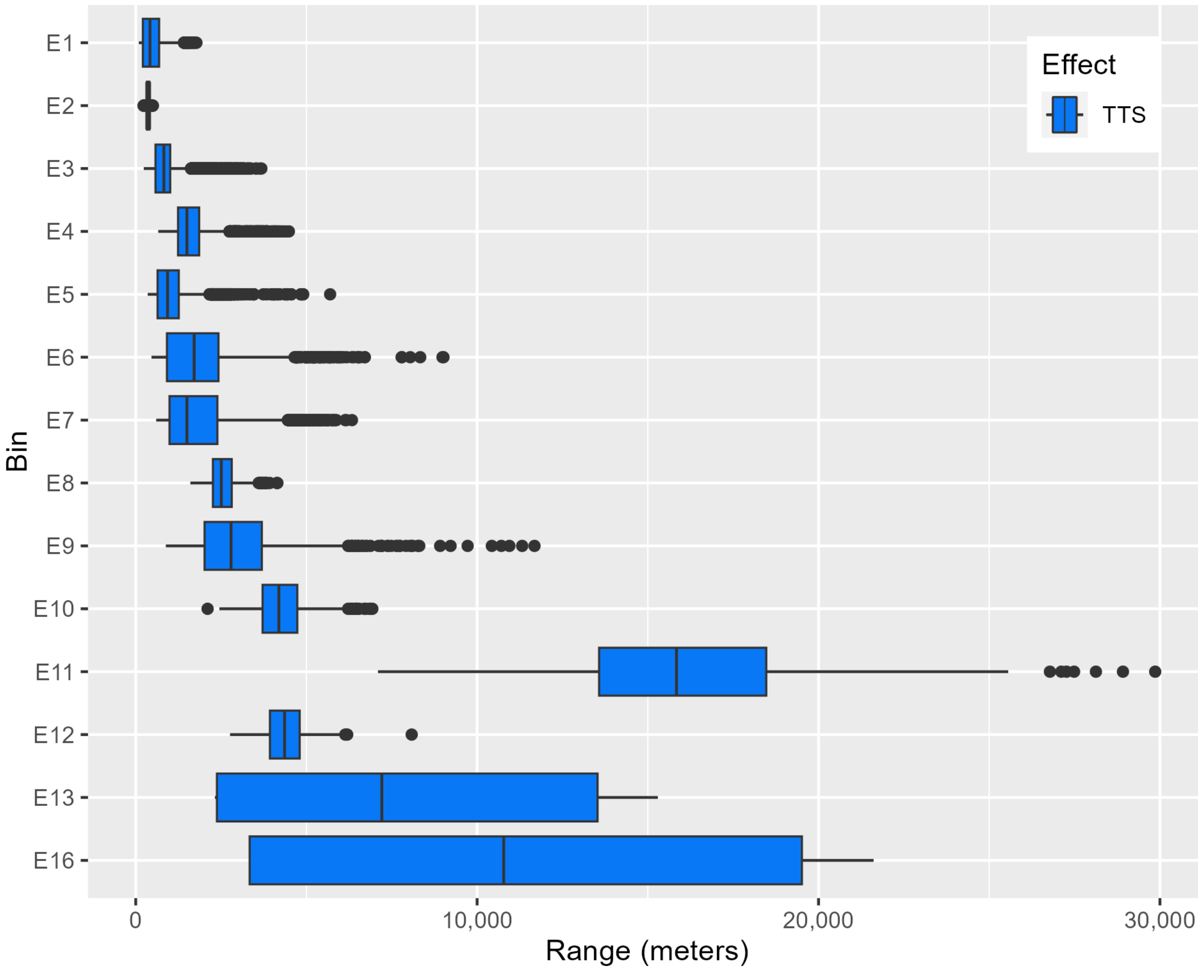

Figure 2.5-18: VLF Cetacean Ranges to Temporary Threshold Shift for Explosives

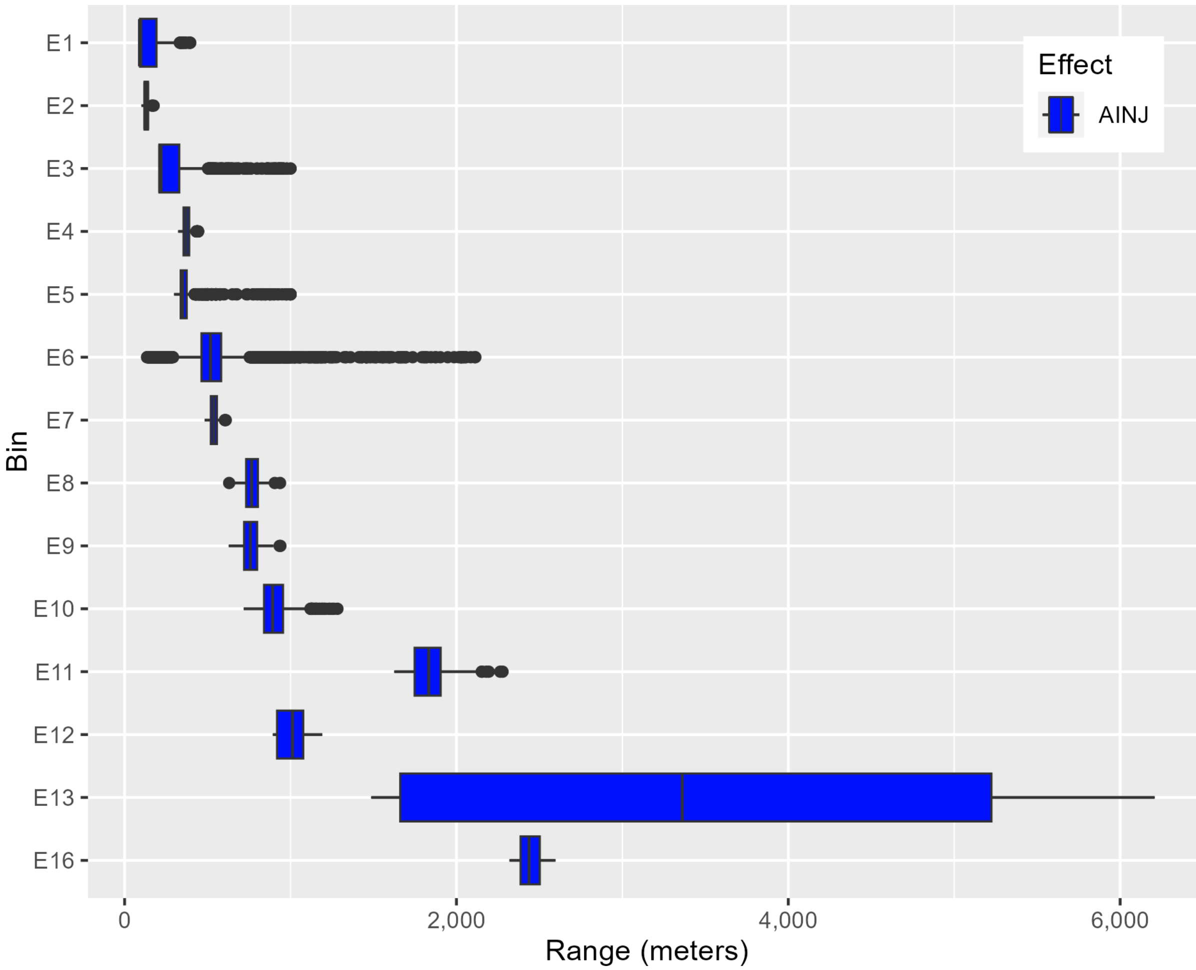

Figure 2.5-19: VLF Cetacean Ranges to Auditory Injury for Explosives

Table 2.5-13: LF Cetacean Ranges to Effects for Explosives

Bin	Depth	Cluster Size	BEH	TTS	AINJ
E1	≤200 m	1	NA	210 m (75 m)	95 m (4 m)
		5	747 m (231 m)	438 m (165 m)	100 m (23 m)
		25	1,355 m (457 m)	901 m (261 m)	191 m (64 m)
		50	1,457 m (602 m)	846 m (296 m)	240 m (47 m)
	>200 m	1	NA	250 m (61 m)	95 m (4 m)
		5	723 m (140 m)	473 m (88 m)	110 m (8 m)
		25	1,000 m (250 m)	800 m (162 m)	220 m (25 m)
		50	1,000 m (315 m)	950 m (173 m)	310 m (38 m)
E2	≤200 m	1	NA	378 m (45 m)	128 m (13 m)
	>200 m	1	NA	381 m (47 m)	130 m (13 m)
E3	≤200 m	1	NA	535 m (252 m)	202 m (8 m)
		5	1,503 m (562 m)	962 m (327 m)	204 m (87 m)
		25	2,281 m (1,014 m)	1,669 m (605 m)	442 m (159 m)
	>200 m	1	NA	799 m (212 m)	204 m (9 m)
		5	1,000 m (352 m)	850 m (186 m)	240 m (32 m)
		25	1,500 m (957 m)	1,000 m (408 m)	340 m (108 m)
E4	≤200 m	1	NA	1,624 m (658 m)	372 m (37 m)
	>200 m	1	NA	1,000 m (259 m)	361 m (39 m)
E5	≤200 m	1	NA	863 m (762 m)	310 m (30 m)
		5	2,305 m (1,156 m)	1,480 m (604 m)	319 m (83 m)
	>200 m	1	NA	725 m (180 m)	303 m (28 m)
		5	1,917 m (1,004 m)	1,000 m (415 m)	380 m (69 m)
		20	3,958 m (1,082 m)	2,403 m (601 m)	725 m (104 m)
E6	≤200 m	1	NA	1,612 m (1,172 m)	485 m (50 m)
		15	4,916 m (981 m)	3,605 m (763 m)	1,433 m (181 m)
	>200 m	1	NA	1,250 m (879 m)	488 m (49 m)

Bin	Depth	Cluster Size	BEH	TTS	AINJ
E7	≤200 m	1	NA	1,389 m (576 m)	498 m (67 m)
	>200 m	1	NA	1,250 m (1,021 m)	496 m (68 m)
E8	≤200 m	1	NA	2,111 m (309 m)	685 m (62 m)
	>200 m	1	NA	2,062 m (287 m)	681 m (60 m)
E9	≤200 m	1	NA	2,498 m (1,175 m)	722 m (69 m)
	>200 m	1	NA	2,194 m (971 m)	724 m (71 m)
E10	≤200 m	1	NA	3,208 m (554 m)	860 m (91 m)
	>200 m	1	NA	3,191 m (546 m)	859 m (104 m)
E11	≤200 m	1	NA	8,806 m (2,227 m)	1,528 m (129 m)
	>200 m	1	NA	8,910 m (3,010 m)	1,653 m (170 m)
E12	≤200 m	1	NA	3,780 m (412 m)	1,013 m (84 m)
	>200 m	1	NA	3,501 m (503 m)	1,004 m (71 m)
E13	≤200 m	1	NA	4,542 m (1,609 m)	2,757 m (1,128 m)
E16	>200 m	1	NA	5,194 m (1,347 m)	2,667 m (513 m)

Median ranges with standard deviation ranges in parentheses, TTS and AINJ = the greater of respective SPL and SEL ranges, behavioral response criteria are applied to explosive clusters >1
BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, NA = not applicable
E1 (0.1 - 0.25 lbs), E2 (>0.25 - 0.5 lbs), E3 (>0.5 - 2.5 lbs), E4 (>2.5 - 5 lbs), E5 (>5 - 10 lbs), E6 (>10 - 20 lbs), E7 (>20 - 60 lbs), E8 (>60 - 100 lbs), E9 (>100 - 250 lbs), E10 (>250 - 500 lbs), E11 (>500 - 675 lbs), E12 (>675 - 1,000 lbs), E13 (>1,000 - 1,740), E16 (10,000 lbs)
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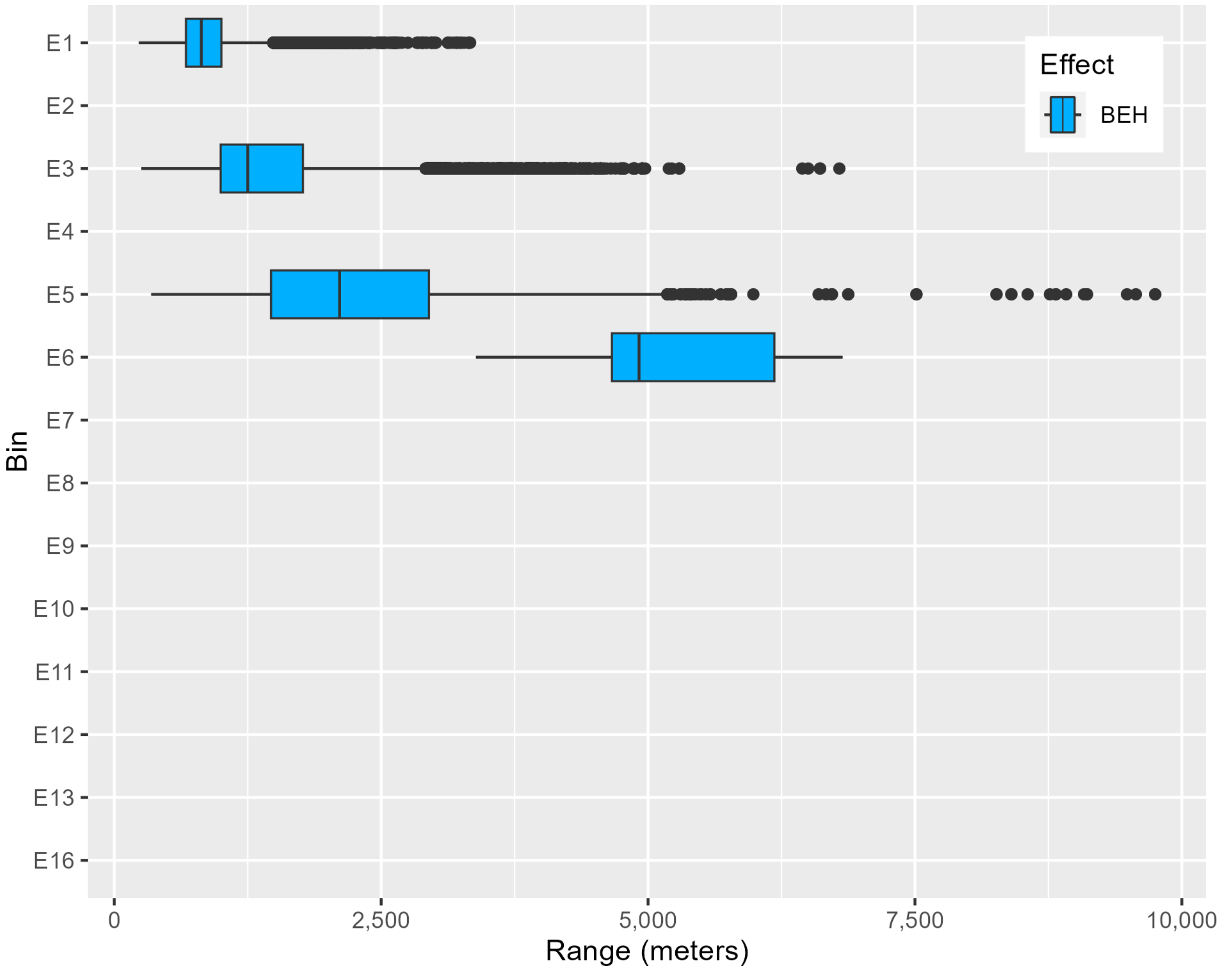

Figure 2.5-20: LF Cetacean Ranges to Behavioral Response for Explosives

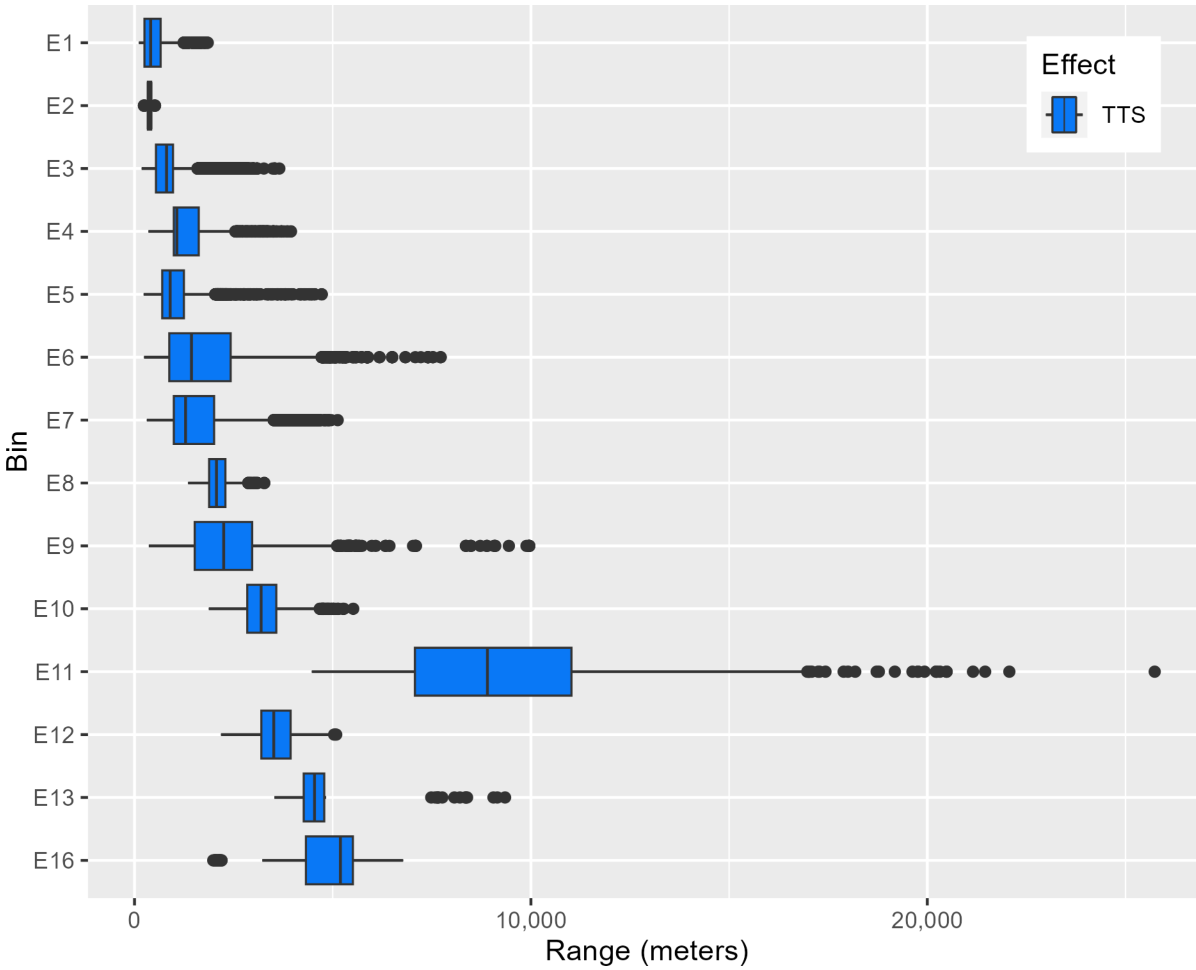

Figure 2.5-21: LF Cetacean Ranges to Temporary Threshold Shift for Explosives

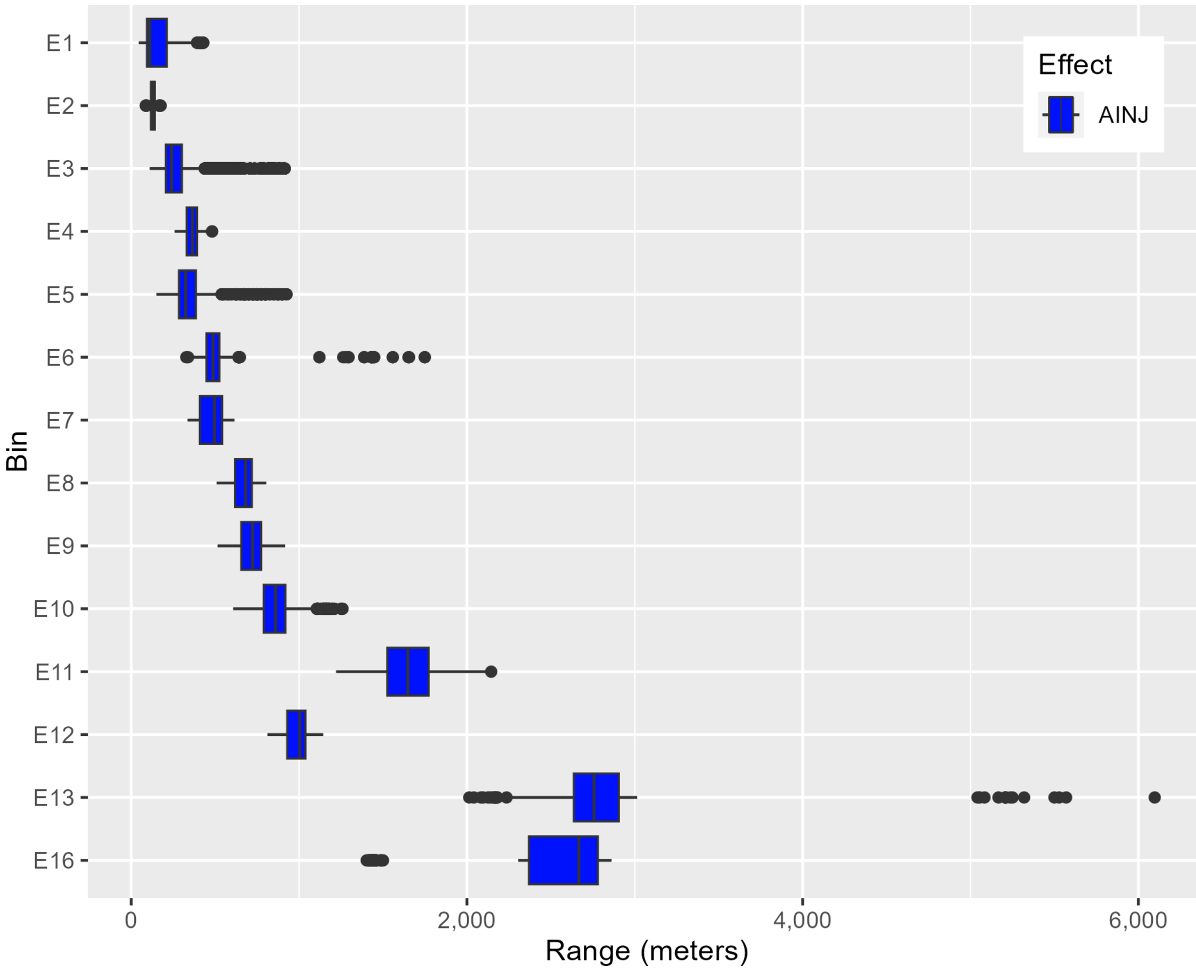

Figure 2.5-22: LF Cetacean Ranges to Auditory Injury for Explosives

Table 2.5-14: HF Cetacean Ranges to Effects for Explosives

Bin	Depth	Cluster Size	BEH	TTS	AINJ
E1	≤200 m	1	NA	92 m (19 m)	42 m (3 m)
		5	259 m (91 m)	180 m (50 m)	42 m (3 m)
		25	485 m (203 m)	317 m (124 m)	85 m (17 m)
		50	497 m (182 m)	367 m (101 m)	110 m (8 m)
	>200 m	1	NA	90 m (3 m)	42 m (3 m)
		5	280 m (29 m)	180 m (9 m)	42 m (3 m)
		25	490 m (110 m)	310 m (47 m)	85 m (3 m)
		50	760 m (178 m)	500 m (81 m)	110 m (4 m)
E2	≤200 m	1	NA	122 m (9 m)	58 m (5 m)
	>200 m	1	NA	123 m (9 m)	58 m (6 m)
E3	≤200 m	1	NA	180 m (49 m)	93 m (3 m)
		5	493 m (185 m)	321 m (112 m)	93 m (3 m)
		25	860 m (281 m)	592 m (184 m)	144 m (43 m)
	>200 m	1	NA	180 m (15 m)	92 m (4 m)
		5	525 m (107 m)	330 m (47 m)	92 m (4 m)
		25	974 m (256 m)	702 m (177 m)	160 m (6 m)
E4	≤200 m	1	NA	361 m (105 m)	132 m (15 m)
	>200 m	1	NA	279 m (24 m)	129 m (16 m)
E5	≤200 m	1	NA	297 m (139 m)	150 m (13 m)
		5	840 m (231 m)	530 m (169 m)	150 m (13 m)
	>200 m	1	NA	260 m (26 m)	148 m (11 m)
		5	775 m (214 m)	500 m (99 m)	148 m (11 m)
		20	1,171 m (306 m)	840 m (180 m)	220 m (17 m)
E6	≤200 m	1	NA	464 m (221 m)	209 m (22 m)
		15	1,624 m (167 m)	1,223 m (117 m)	427 m (47 m)
	>200 m	1	NA	410 m (85 m)	214 m (20 m)

Bin	Depth	Cluster Size	BEH	TTS	AINJ
E7	≤200 m	1	NA	425 m (138 m)	213 m (37 m)
	>200 m	1	NA	440 m (149 m)	217 m (41 m)
E8	≤200 m	1	NA	609 m (56 m)	333 m (23 m)
	>200 m	1	NA	600 m (54 m)	332 m (23 m)
E9	≤200 m	1	NA	651 m (209 m)	371 m (36 m)
	>200 m	1	NA	696 m (162 m)	373 m (38 m)
E10	≤200 m	1	NA	820 m (125 m)	484 m (61 m)
	>200 m	1	NA	816 m (131 m)	480 m (60 m)
E11	≤200 m	1	NA	1,243 m (78 m)	690 m (33 m)
	>200 m	1	NA	1,308 m (108 m)	729 m (36 m)
E12	≤200 m	1	NA	907 m (185 m)	578 m (90 m)
	>200 m	1	NA	912 m (159 m)	578 m (77 m)
E13	≤200 m	1	NA	5,569 m (4,190 m)	2,701 m (4,433 m)
E16	>200 m	1	NA	3,778 m (8,655 m)	1,882 m (7,911 m)

Median ranges with standard deviation ranges in parentheses, TTS and AINJ = the greater of respective SPL and SEL ranges, behavioral response criteria are applied to explosive clusters >1
BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, NA = not applicable
E1 (0.1 - 0.25 lbs), E2 (>0.25 - 0.5 lbs), E3 (>0.5 - 2.5 lbs), E4 (>2.5 - 5 lbs), E5 (>5 - 10 lbs), E6 (>10 - 20 lbs), E7 (>20 - 60 lbs), E8 (>60 - 100 lbs), E9 (>100 - 250 lbs), E10 (>250 - 500 lbs), E11 (>500 - 675 lbs), E12 (>675 - 1,000 lbs), E13 (>1,000 - 1,740), E16 (10,000 lbs)
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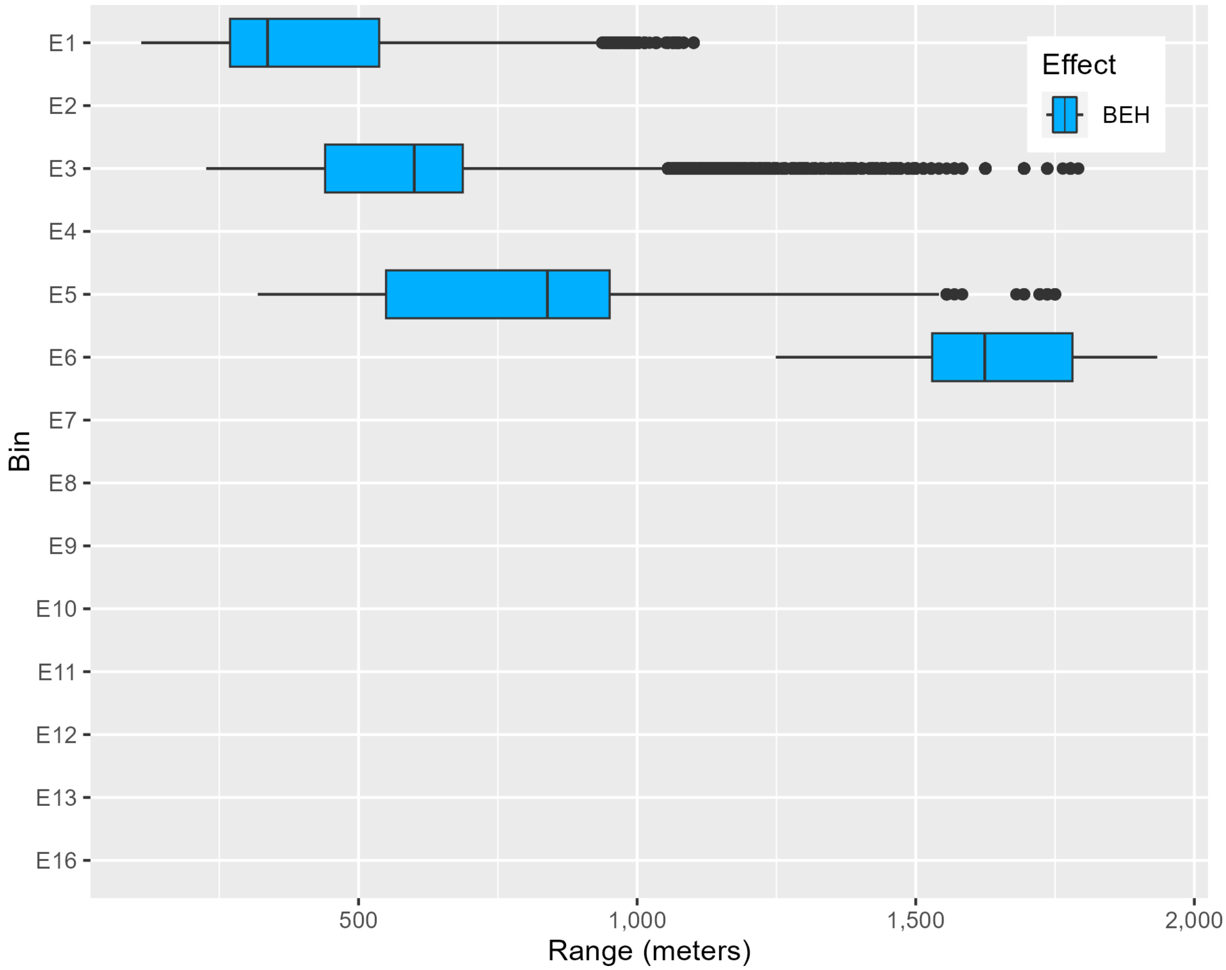

Figure 2.5-23: HF Cetacean Ranges to Behavioral Response for Explosives

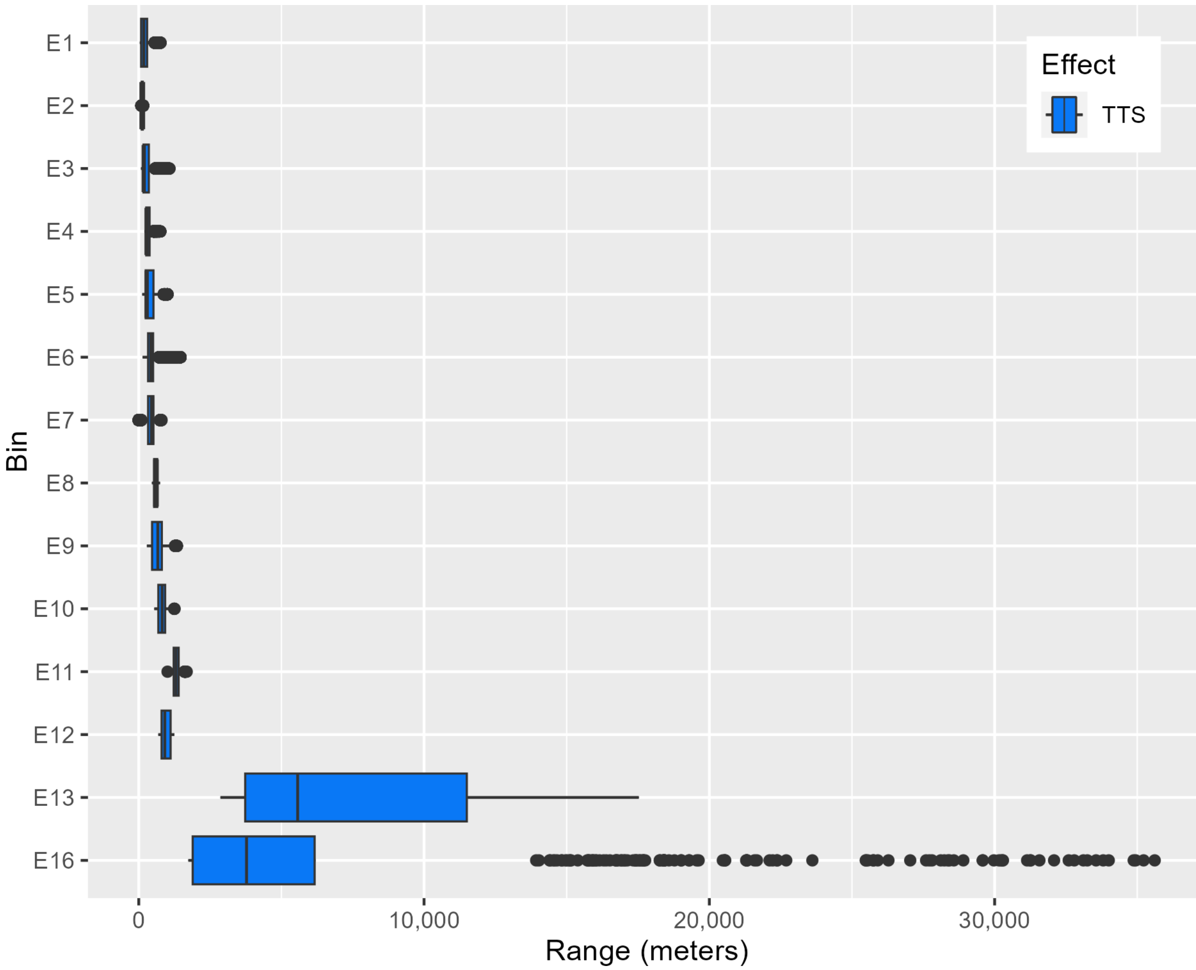

Figure 2.5-24: HF Cetacean Ranges to Temporary Threshold Shift for Explosives

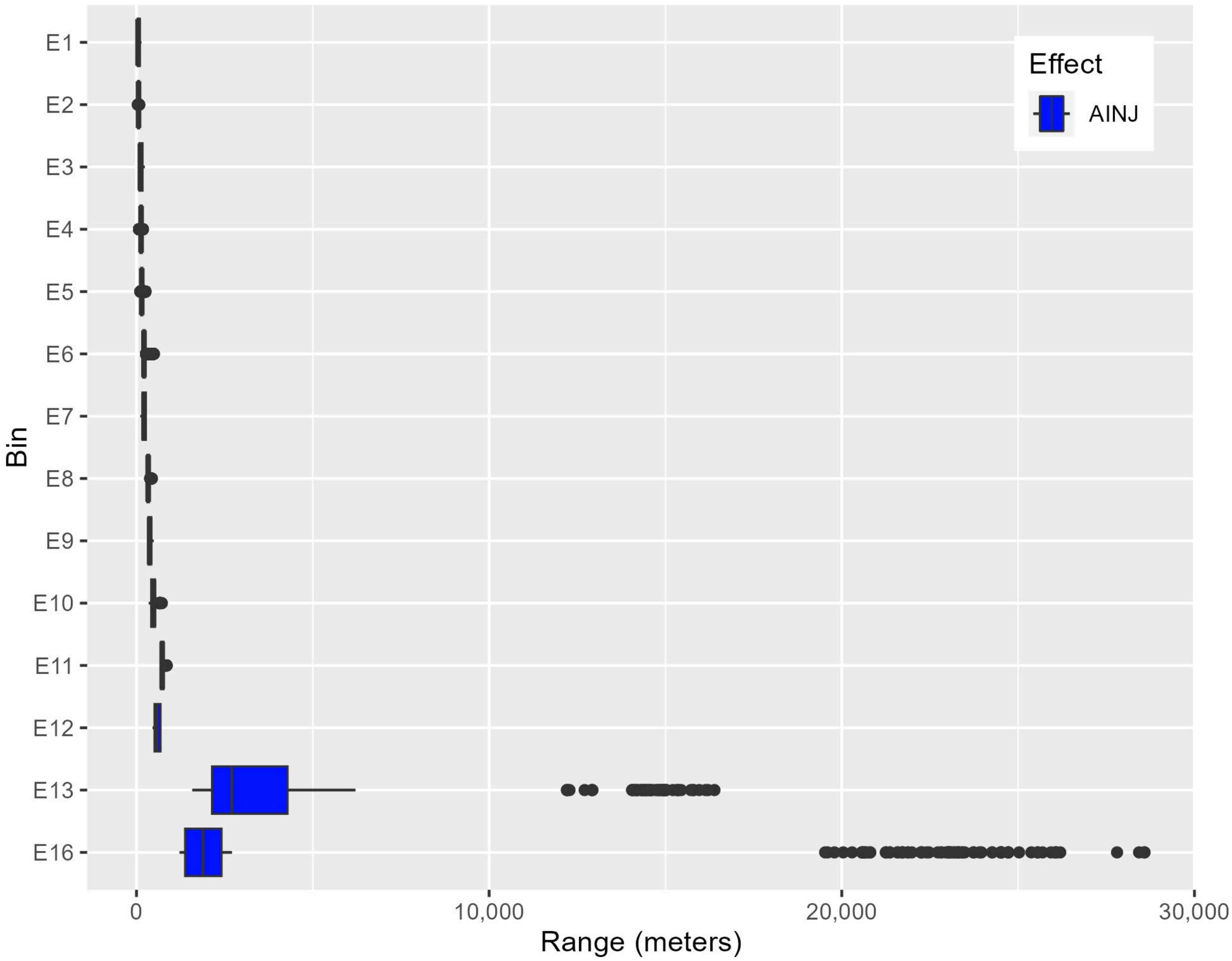

Figure 2.5-25: HF Cetacean Ranges to Auditory Injury for Explosives

Table 2.5-15: VHF Cetacean Ranges to Effects for Explosives

Bin	Depth	Cluster Size	BEH	TTS	AINJ
E1	≤200 m	1	NA	1,142 m (77 m)	721 m (37 m)
		5	1,861 m (1,411 m)	1,292 m (1,068 m)	721 m (37 m)
		25	2,760 m (1,916 m)	2,222 m (1,575 m)	899 m (585 m)
		50	4,056 m (2,398 m)	2,917 m (2,027 m)	924 m (695 m)
	>200 m	1	NA	1,500 m (414 m)	702 m (34 m)
		5	2,500 m (1,251 m)	2,000 m (734 m)	739 m (105 m)
		25	4,285 m (2,323 m)	2,986 m (1,585 m)	1,250 m (253 m)
		50	3,556 m (2,427 m)	2,750 m (1,577 m)	1,000 m (420 m)
E2	≤200 m	1	NA	1,528 m (133 m)	842 m (54 m)
	>200 m	1	NA	1,548 m (134 m)	842 m (58 m)
E3	≤200 m	1	NA	2,493 m (221 m)	1,542 m (107 m)
		5	2,806 m (1,868 m)	2,493 m (221 m)	1,542 m (107 m)
		25	3,171 m (2,069 m)	2,574 m (1,776 m)	1,542 m (107 m)
	>200 m	1	NA	2,361 m (253 m)	1,417 m (112 m)
		5	3,536 m (2,060 m)	2,750 m (1,364 m)	1,417 m (112 m)
		25	3,000 m (1,737 m)	2,500 m (1,430 m)	1,440 m (536 m)
E4	≤200 m	1	NA	3,389 m (441 m)	2,236 m (219 m)
	>200 m	1	NA	3,361 m (473 m)	2,250 m (229 m)
E5	≤200 m	1	NA	2,403 m (278 m)	1,572 m (148 m)
		5	4,036 m (2,138 m)	3,442 m (1,818 m)	1,750 m (787 m)
	>200 m	1	NA	2,388 m (251 m)	1,551 m (139 m)
		5	5,069 m (3,066 m)	3,917 m (2,154 m)	1,750 m (468 m)
		20	10,750 m (3,002 m)	7,979 m (2,065 m)	2,250 m (577 m)
E6	≤200 m	1	NA	3,974 m (547 m)	2,625 m (323 m)
		15	4,411 m (761 m)	3,974 m (547 m)	2,633 m (362 m)

Bin	Depth	Cluster Size	BEH	TTS	AINJ
	>200 m	1	NA	3,958 m (547 m)	2,650 m (311 m)
E7	≤200 m	1	NA	4,431 m (442 m)	2,972 m (271 m)
	>200 m	1	NA	4,567 m (530 m)	3,014 m (298 m)
E8	≤200 m	1	NA	8,126 m (2,140 m)	3,590 m (485 m)
	>200 m	1	NA	7,138 m (2,249 m)	3,444 m (401 m)
E9	≤200 m	1	NA	5,611 m (747 m)	3,458 m (428 m)
	>200 m	1	NA	5,458 m (779 m)	3,361 m (369 m)
E10	≤200 m	1	NA	7,133 m (1,055 m)	4,294 m (624 m)
	>200 m	1	NA	6,973 m (1,075 m)	4,184 m (574 m)
E11	≤200 m	1	NA	30,208 m (3,408 m)	18,139 m (3,274 m)
	>200 m	1	NA	27,625 m (4,500 m)	15,778 m (4,177 m)
E12	≤200 m	1	NA	8,361 m (828 m)	4,417 m (452 m)
	>200 m	1	NA	8,861 m (1,666 m)	4,958 m (662 m)
E13	≤200 m	1	NA	11,222 m (3,196 m)	4,931 m (1,169 m)
E16	>200 m	1	NA	6,639 m (6,673 m)	2,257 m (1,560 m)

Median ranges with standard deviation ranges in parentheses, TTS and AINJ = the greater of respective SPL and SEL ranges, behavioral response criteria are applied to explosive clusters >1
BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, NA = not applicable
E1 (0.1 - 0.25 lbs), E2 (>0.25 - 0.5 lbs), E3 (>0.5 - 2.5 lbs), E4 (>2.5 - 5 lbs), E5 (>5 - 10 lbs), E6 (>10 - 20 lbs), E7 (>20 - 60 lbs), E8 (>60 - 100 lbs), E9 (>100 - 250 lbs), E10 (>250 - 500 lbs), E11 (>500 - 675 lbs), E12 (>675 - 1,000 lbs), E13 (>1,000 - 1,740), E16 (10,000 lbs)
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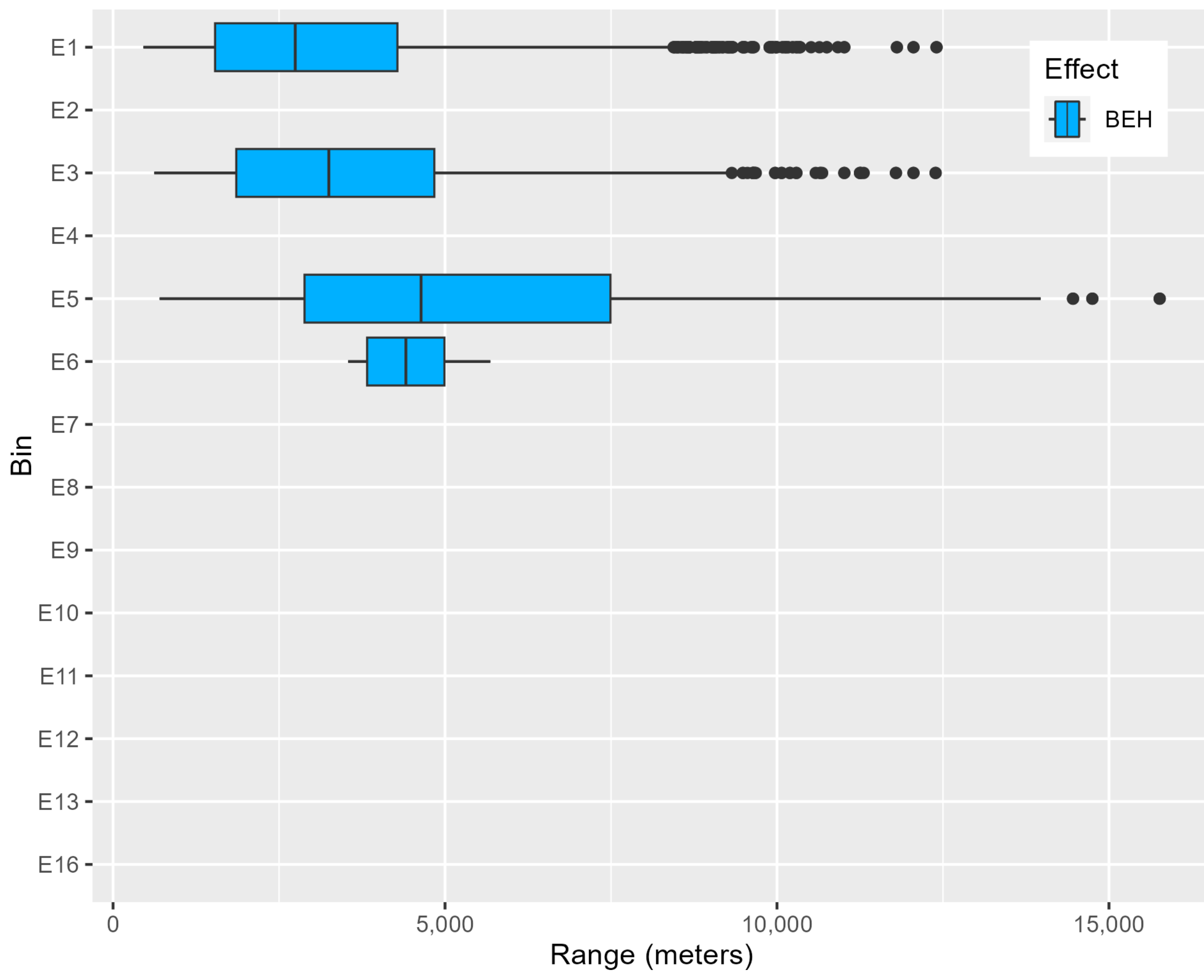

Figure 2.5-26: VHF Cetacean Ranges to Behavioral Response for Explosives

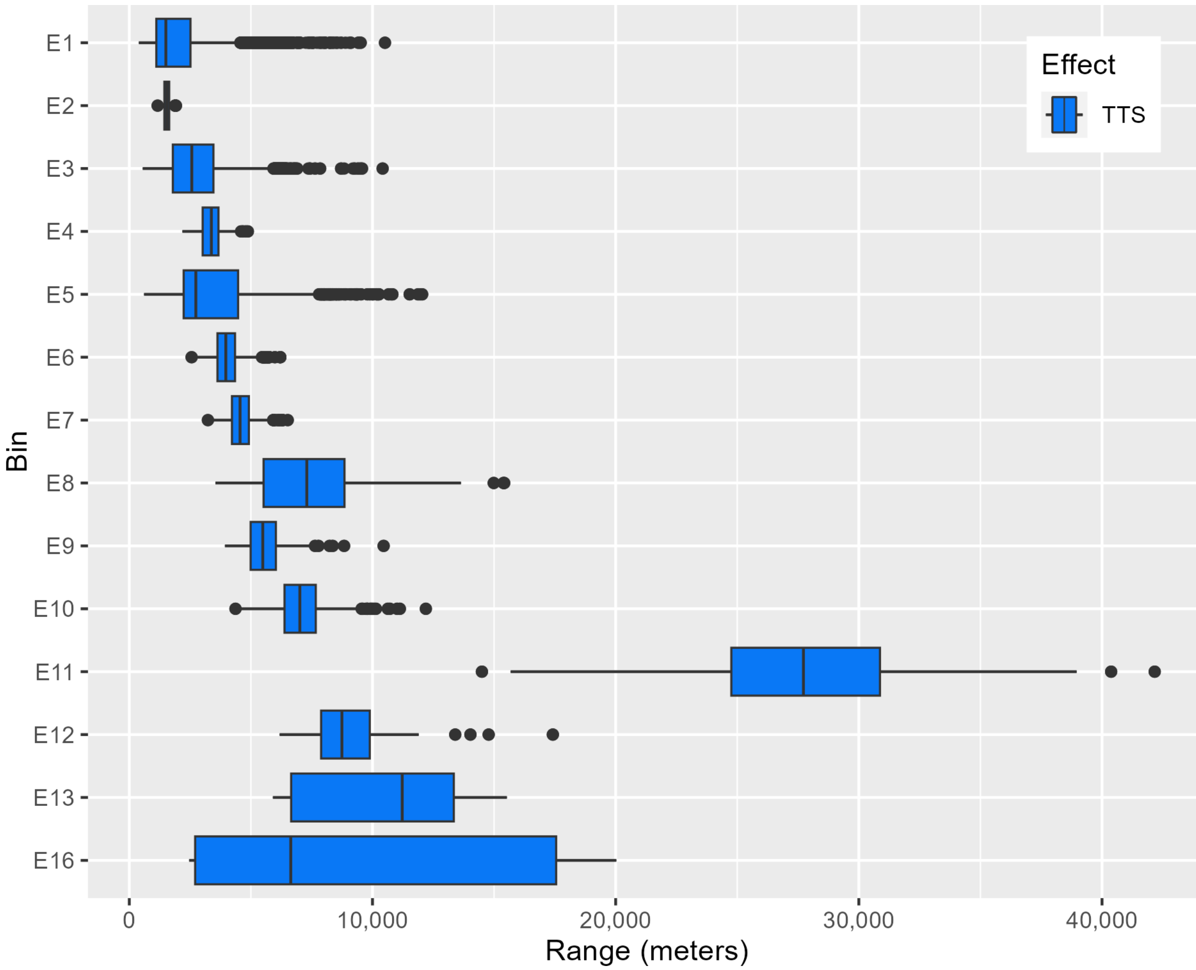

Figure 2.5-27: VHF Cetacean Ranges to Temporary Threshold Shift for Explosives

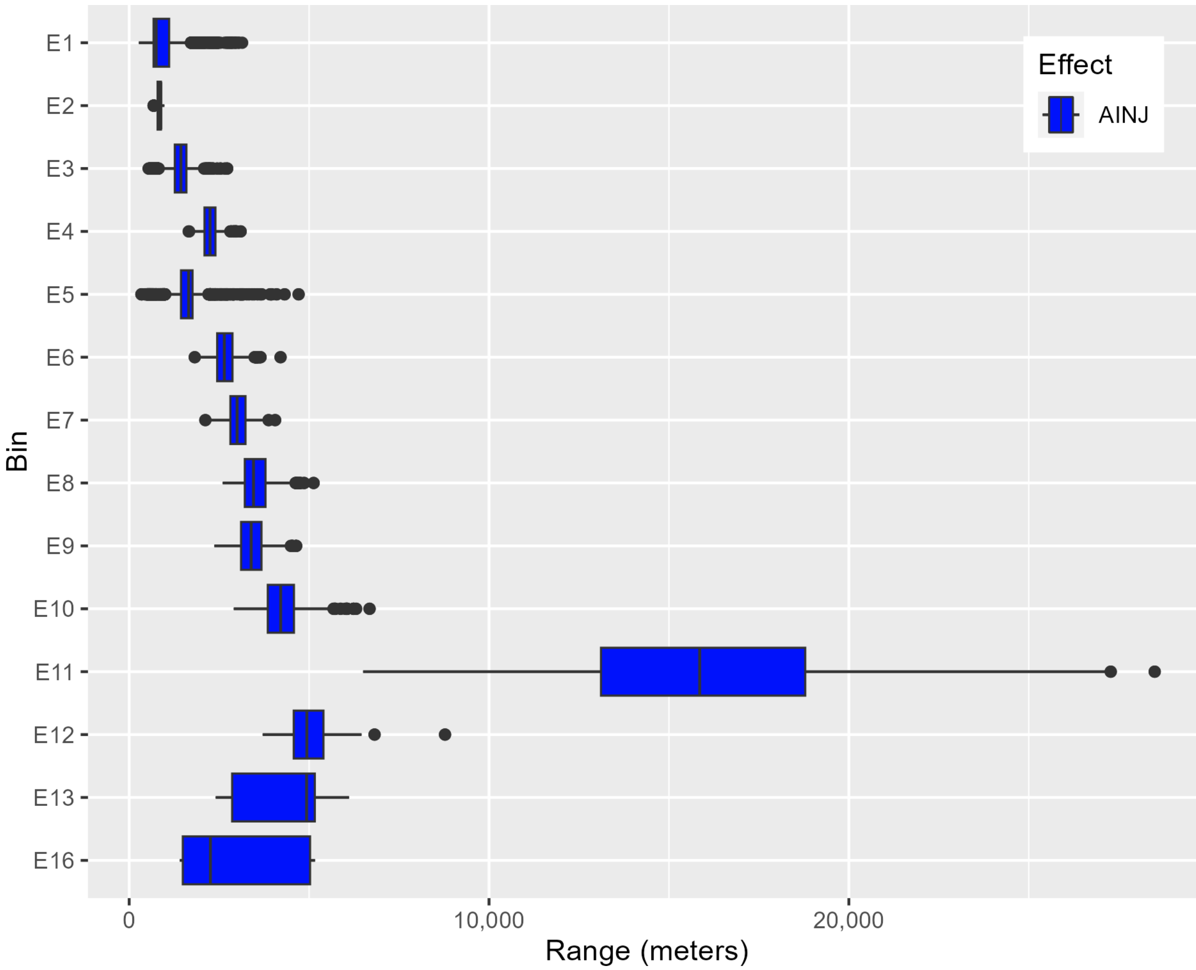

Figure 2.5-28: VHF Cetacean Ranges to Auditory Injury for Explosives

Table 2.5-16: Phocids in Water Ranges to Effects for Explosives

Bin	Depth	Cluster Size	BEH	TTS	AINJ
E1	≤200 m	1	NA	222 m (67 m)	55 m (10 m)
		5	684 m (210 m)	428 m (147 m)	110 m (28 m)
		25	1,148 m (419 m)	828 m (240 m)	197 m (62 m)
		50	1,264 m (577 m)	785 m (286 m)	259 m (51 m)
	>200 m	1	NA	260 m (41 m)	55 m (4 m)
		5	650 m (179 m)	480 m (86 m)	110 m (4 m)
		25	975 m (359 m)	725 m (207 m)	230 m (19 m)
		50	1,333 m (561 m)	1,000 m (297 m)	305 m (35 m)
E3	≤200 m	1	NA	480 m (216 m)	117 m (33 m)
		5	1,229 m (432 m)	849 m (243 m)	207 m (60 m)
		25	1,967 m (773 m)	1,444 m (465 m)	400 m (115 m)
	>200 m	1	NA	675 m (148 m)	120 m (14 m)
		5	1,065 m (397 m)	875 m (207 m)	240 m (21 m)
		25	2,229 m (889 m)	1,449 m (573 m)	417 m (106 m)
E4	≤200 m	1	NA	1,140 m (446 m)	274 m (36 m)
	>200 m	1	NA	900 m (119 m)	276 m (39 m)
E5	≤200 m	1	NA	767 m (449 m)	191 m (112 m)
		5	1,938 m (830 m)	1,282 m (428 m)	311 m (87 m)
	>200 m	1	NA	725 m (185 m)	181 m (12 m)
		5	1,569 m (852 m)	1,000 m (381 m)	370 m (61 m)
		20	3,542 m (1,172 m)	1,701 m (570 m)	650 m (78 m)
E6	≤200 m	1	NA	1,112 m (710 m)	336 m (177 m)
		15	3,584 m (735 m)	2,786 m (457 m)	1,048 m (152 m)
	>200 m	1	NA	1,000 m (578 m)	300 m (66 m)
E7	≤200 m	1	NA	1,110 m (366 m)	278 m (69 m)
	>200 m	1	NA	1,250 m (551 m)	330 m (123 m)

Bin	Depth	Cluster Size	BEH	TTS	AINJ
E9	≤200 m	1	NA	1,722 m (689 m)	465 m (163 m)
	>200 m	1	NA	1,500 m (655 m)	525 m (105 m)
E13	≤200 m	1	NA	4,139 m (776 m)	2,146 m (522 m)
E16	>200 m	1	NA	2,389 m (840 m)	1,361 m (528 m)

Median ranges with standard deviation ranges in parentheses, TTS and AINJ = the greater of respective SPL and SEL ranges, behavioral response criteria are applied to explosive clusters >1
BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, NA = not applicable
E1 (0.1 - 0.25 lbs), E2 (>0.25 - 0.5 lbs), E3 (>0.5 - 2.5 lbs), E4 (>2.5 - 5 lbs), E5 (>5 - 10 lbs), E6 (>10 - 20 lbs), E7 (>20 - 60 lbs), E8 (>60 - 100 lbs), E9 (>100 - 250 lbs), E10 (>250 - 500 lbs), E11 (>500 - 675 lbs), E12 (>675 - 1,000 lbs), E13 (>1,000 - 1,740), E16 (10,000 lbs)
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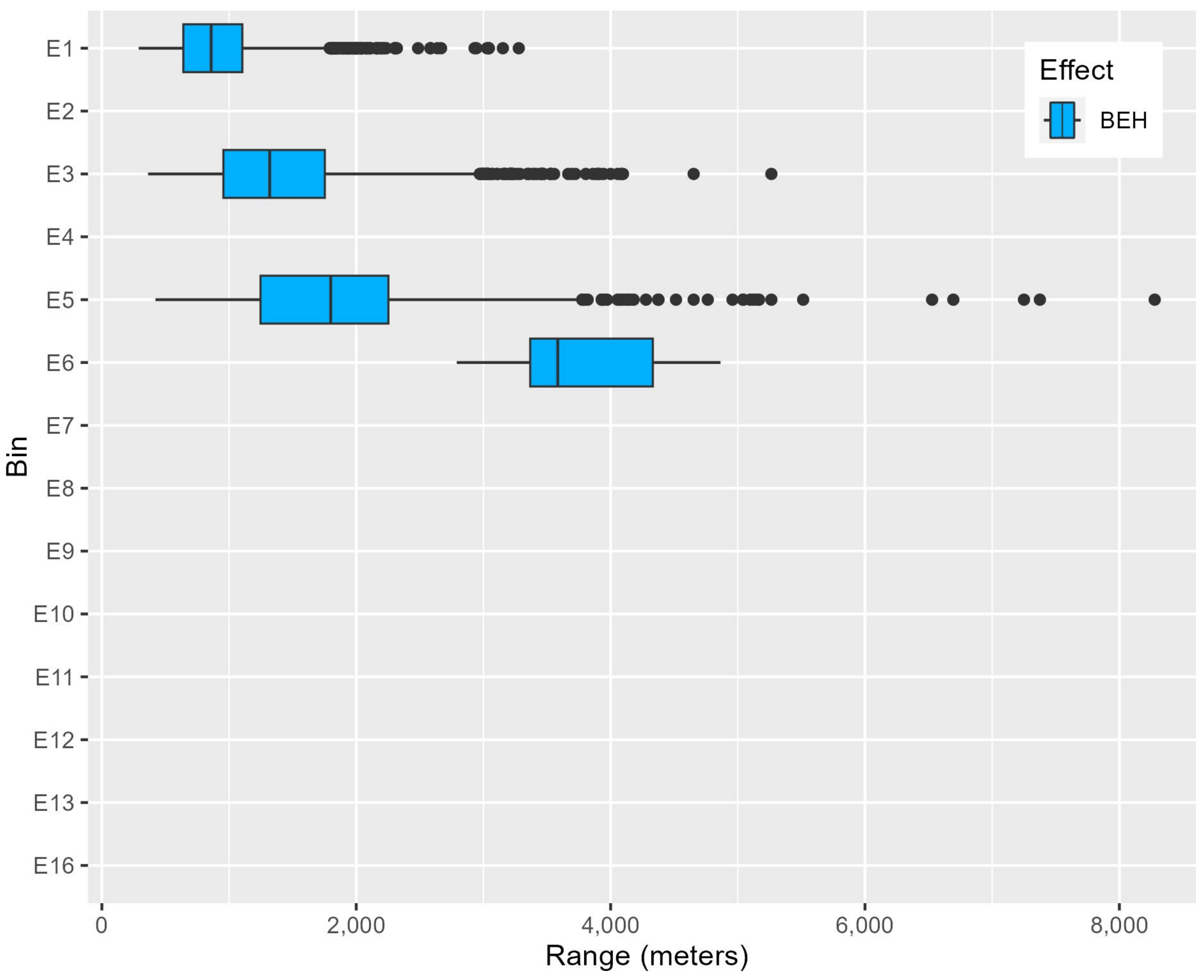

Figure 2.5-29: Phocids in Water Ranges to Behavioral Response for Explosives

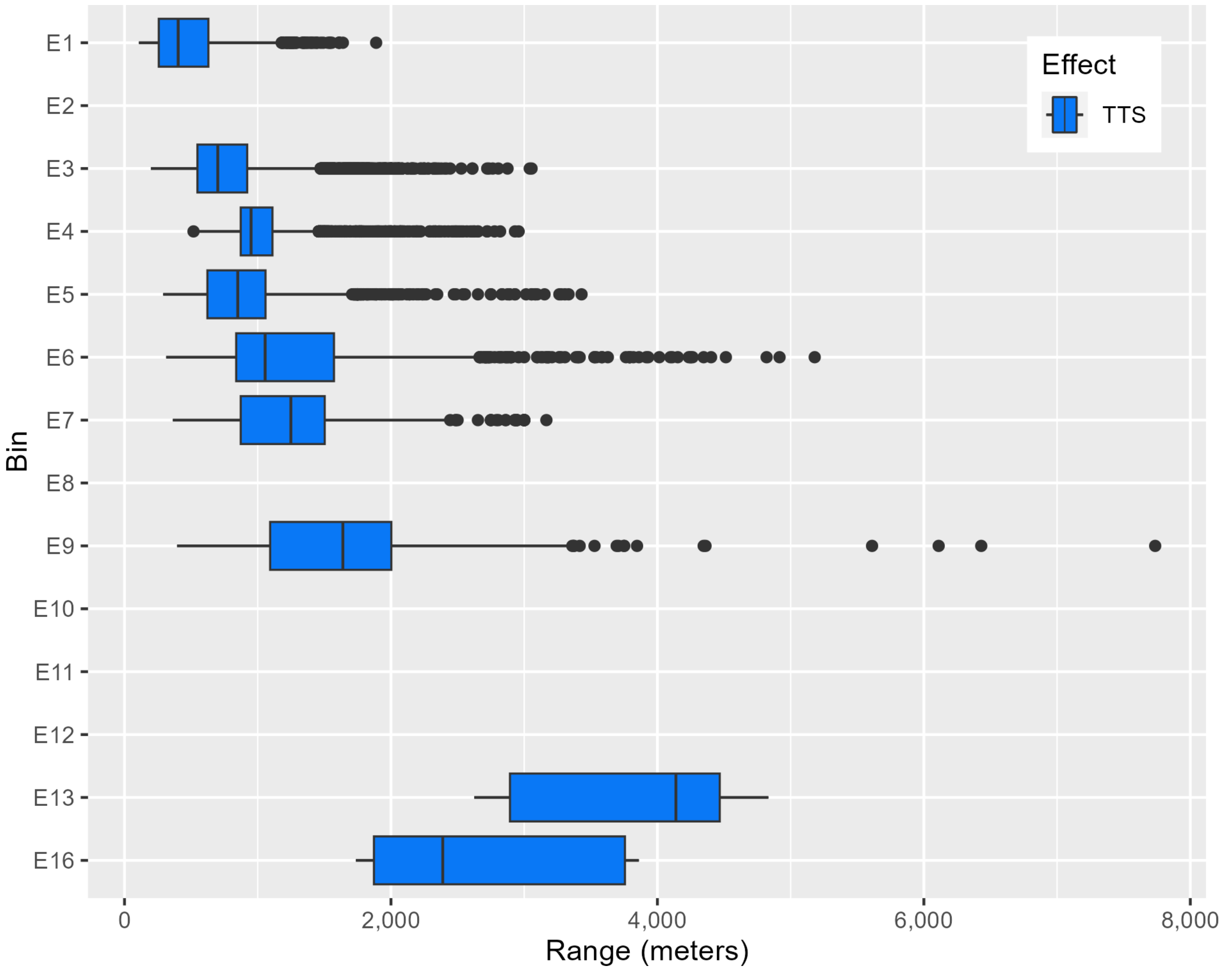

Figure 2.5-30: Phocids in Water Ranges to Temporary Threshold Shift for Explosives

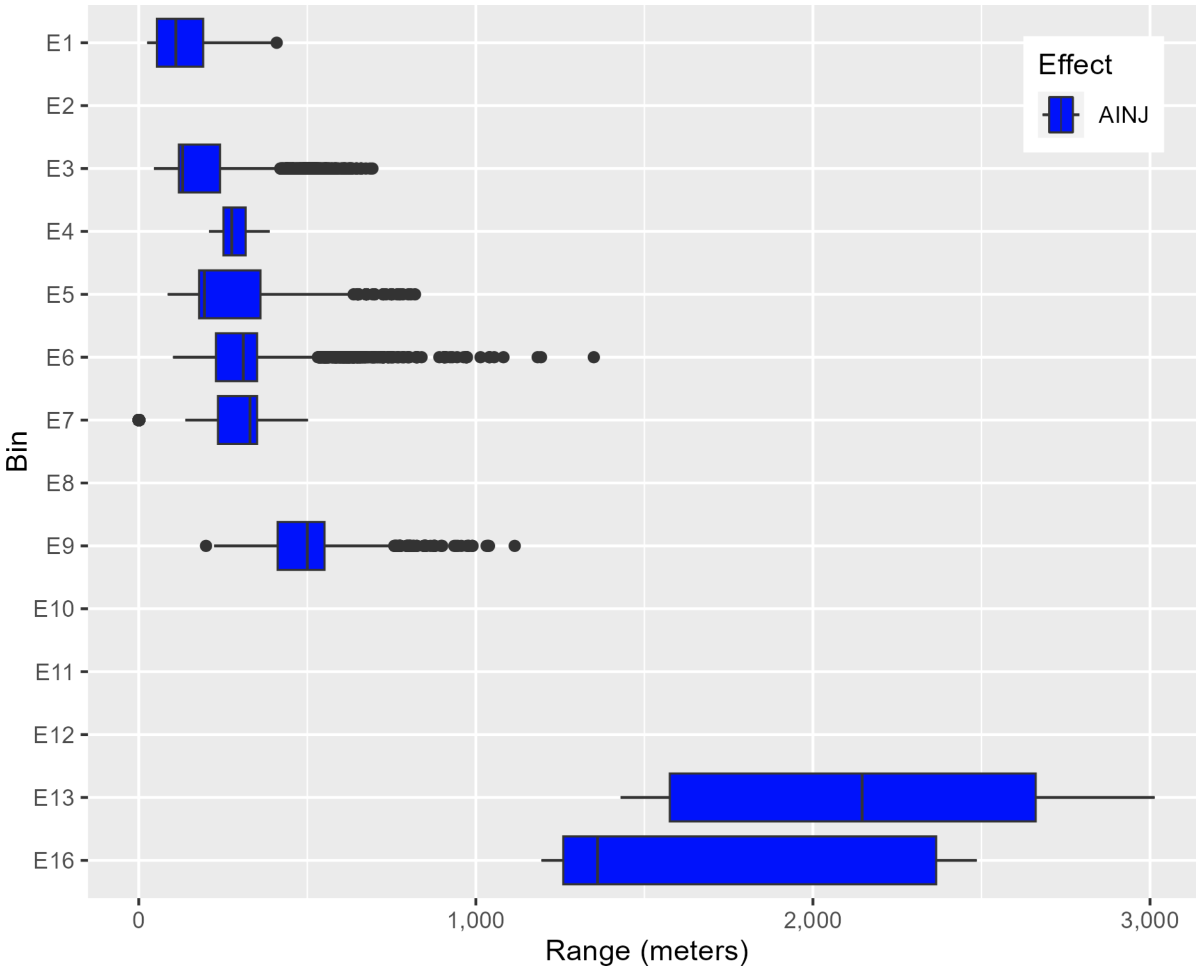

Figure 2.5-31: Phocids in Water Ranges to Auditory Injury for Explosives

Table 2.5-17: Otariids in Water Ranges to Effects for Explosives

Bin	Depth	Cluster Size	BEH	TTS	AINJ
E1	≤200 m	1	NA	150 m (48 m)	40 m (5 m)
		5	430 m (172 m)	288 m (104 m)	83 m (18 m)
		25	800 m (306 m)	561 m (200 m)	138 m (46 m)
		50	835 m (454 m)	550 m (229 m)	210 m (37 m)
	>200 m	1	NA	190 m (27 m)	40 m (2 m)
		5	450 m (81 m)	324 m (54 m)	85 m (4 m)
		25	589 m (144 m)	480 m (97 m)	170 m (19 m)
		50	742 m (128 m)	575 m (93 m)	230 m (30 m)
E3	≤200 m	1	NA	313 m (129 m)	80 m (22 m)
		5	771 m (286 m)	543 m (186 m)	140 m (42 m)
		25	1,324 m (575 m)	928 m (357 m)	260 m (93 m)
	>200 m	1	NA	400 m (116 m)	80 m (18 m)
		5	650 m (135 m)	500 m (91 m)	170 m (19 m)
		25	850 m (313 m)	656 m (168 m)	300 m (54 m)
E4	≤200 m	1	NA	778 m (194 m)	125 m (36 m)
	>200 m	1	NA	550 m (124 m)	116 m (15 m)
E5	≤200 m	1	NA	537 m (255 m)	140 m (36 m)
		5	1,315 m (469 m)	913 m (280 m)	221 m (62 m)
	>200 m	1	NA	430 m (79 m)	130 m (9 m)
		5	740 m (210 m)	575 m (136 m)	250 m (40 m)
E6	≤200 m	1	NA	821 m (382 m)	200 m (86 m)
		15	2,221 m (258 m)	1,767 m (186 m)	791 m (65 m)
	>200 m	1	NA	575 m (275 m)	180 m (36 m)
E7	≤200 m	1	NA	727 m (244 m)	200 m (47 m)
	>200 m	1	NA	625 m (209 m)	180 m (98 m)
E9	≤200 m	1	NA	940 m (361 m)	279 m (89 m)
	>200 m	1	NA	715 m (158 m)	319 m (51 m)
E13	≤200 m	1	NA	4,514 m (1,620 m)	2,701 m (1,249 m)
E16	>200 m	1	NA	3,708 m (7,259 m)	2,181 m (822 m)

Median ranges with standard deviation ranges in parentheses, TTS and AINJ = the greater of respective SPL and SEL ranges, behavioral response criteria are applied to explosive clusters >1
BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, NA = not applicable
E1 (0.1 - 0.25 lbs), E2 (>0.25 - 0.5 lbs), E3 (>0.5 - 2.5 lbs), E4 (>2.5 - 5 lbs), E5 (>5 - 10 lbs), E6 (>10 - 20 lbs), E7 (>20 - 60 lbs), E8 (>60 - 100 lbs), E9 (>100 - 250 lbs), E10 (>250 - 500 lbs), E11 (>500 - 675 lbs), E12 (>675 - 1,000 lbs), E13 (>1,000 - 1,740), E16 (10,000 lbs)
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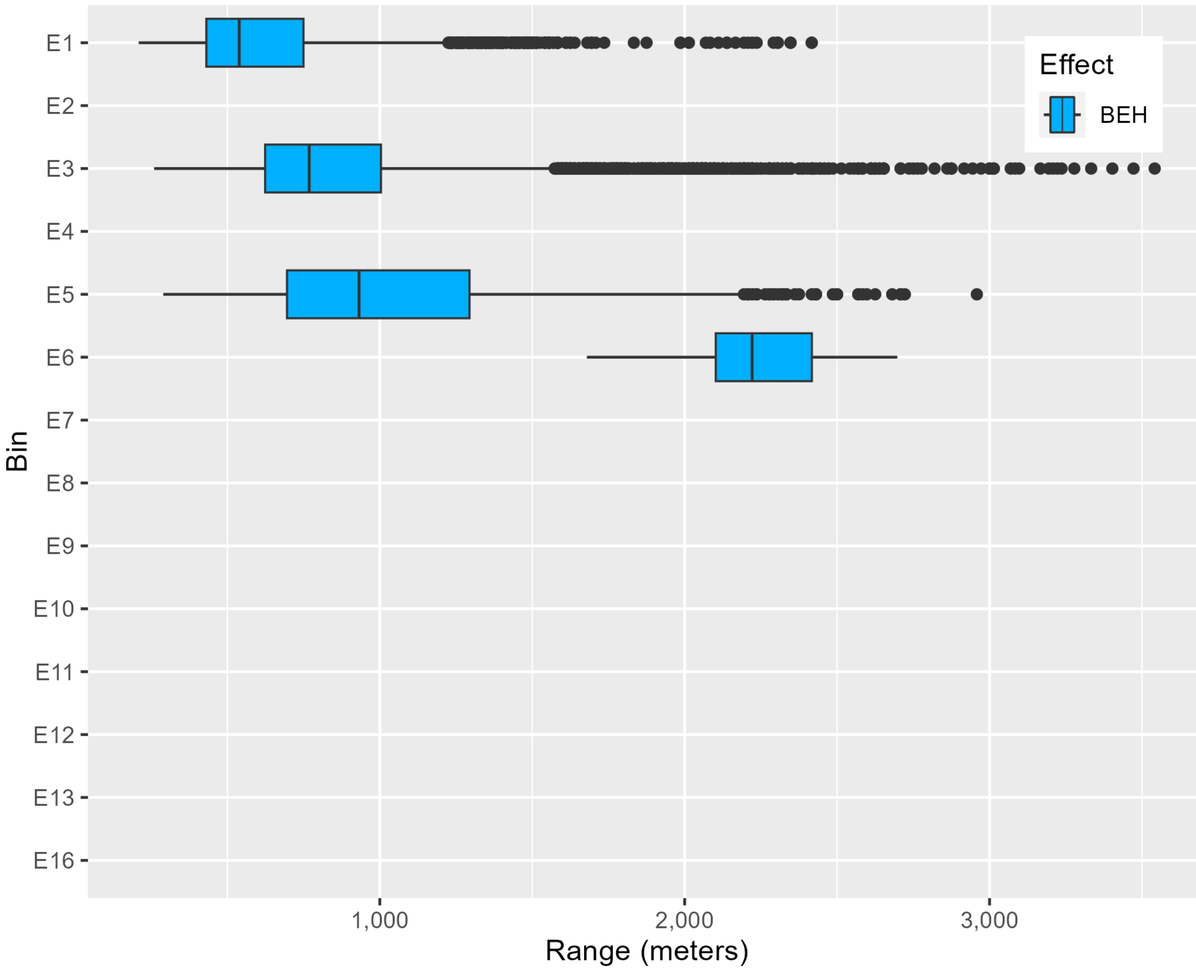

Figure 2.5-32: Otariids in Water Ranges to Behavioral Response for Explosives

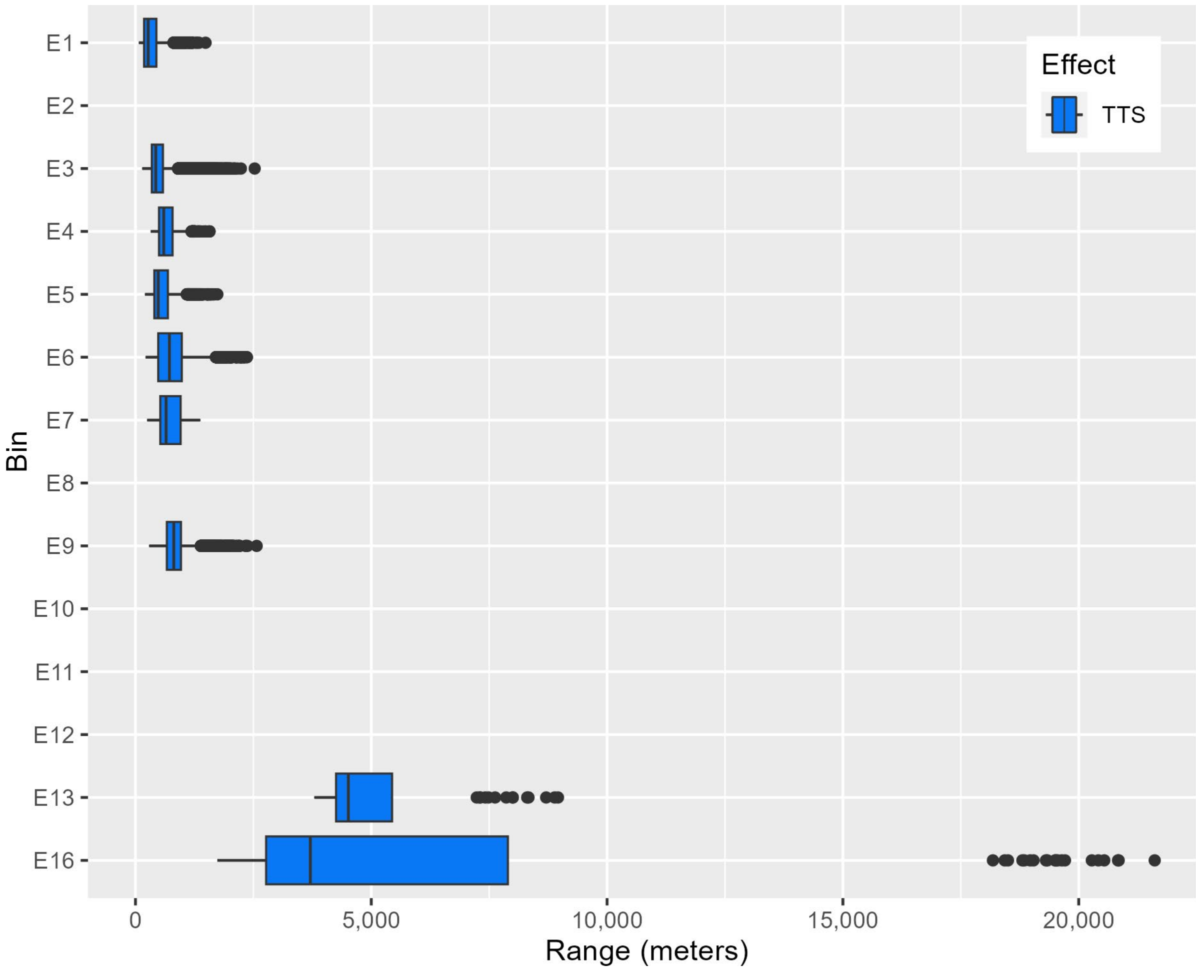

Figure 2.5-33: Otariids in Water Ranges to Temporary Threshold Shift for Explosives

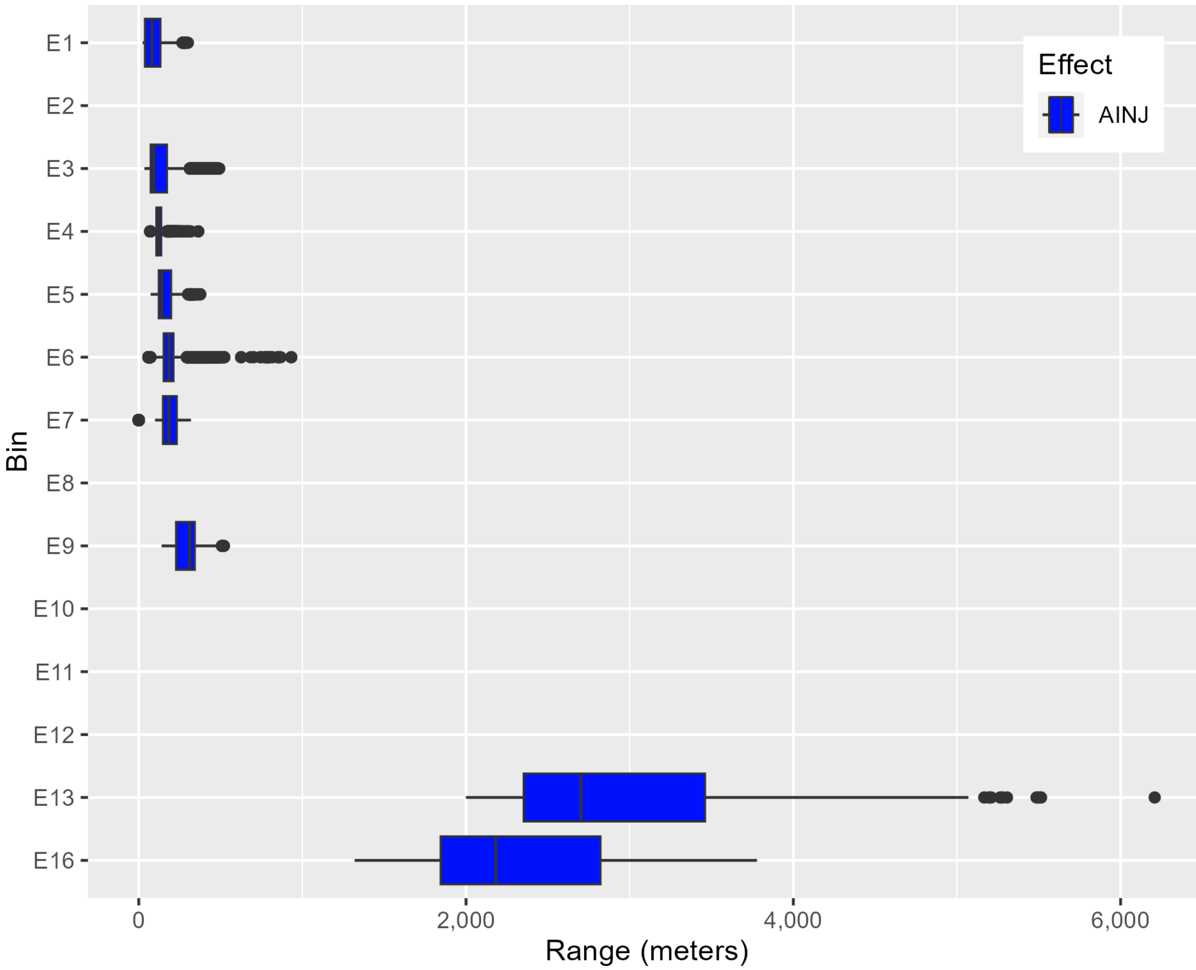

Figure 2.5-34: Otariids in Water Ranges to Auditory Injury for Explosives

Table 2.5-18: Explosive Ranges to Injury and Mortality for All Marine Mammal Hearing Groups as a Function of Animal Mass

Bin	Effect	10 kg	250 kg	1,000 kg	5,000 kg	25,000 kg	72,000 kg
E1	INJ	22 m (0 m)	21 m (1 m)	22 m (1 m)	21 m (2 m)	22 m (1 m)	21 m (1 m)
	MORT	3 m (0 m)	1 m (1 m)	0 m (0 m)	0 m (0 m)	0 m (0 m)	0 m (0 m)
E2	INJ	27 m (2 m)	27 m (2 m)	26 m (2 m)	25 m (2 m)	26 m (2 m)	26 m (1 m)
	MORT	6 m (1 m)	2 m (1 m)	1 m (0 m)	0 m (0 m)	0 m (0 m)	0 m (0 m)
E3	INJ	36 m (5 m)	36 m (6 m)	39 m (5 m)	43 m (3 m)	40 m (3 m)	45 m (1 m)
	MORT	7 m (1 m)	3 m (1 m)	1 m (1 m)	0 m (0 m)	0 m (0 m)	0 m (0 m)
E4	INJ	54 m (5 m)	56 m (6 m)	59 m (6 m)	60 m (6 m)	60 m (7 m)	59 m (5 m)
	MORT	19 m (4 m)	8 m (4 m)	3 m (1 m)	1 m (0 m)	1 m (0 m)	0 m (0 m)
E5	INJ	76 m (2 m)	76 m (4 m)	76 m (3 m)	76 m (3 m)	76 m (3 m)	76 m (2 m)
	MORT	16 m (2 m)	7 m (3 m)	3 m (1 m)	2 m (1 m)	0 m (0 m)	0 m (0 m)
E6	INJ	103 m (8 m)	101 m (8 m)	102 m (9 m)	103 m (8 m)	102 m (9 m)	102 m (8 m)
	MORT	40 m (8 m)	18 m (6 m)	9 m (1 m)	6 m (1 m)	3 m (1 m)	2 m (0 m)
E7	INJ	106 m (17 m)	106 m (17 m)	107 m (18 m)	111 m (15 m)	102 m (19 m)	107 m (12 m)
	MORT	19 m (2 m)	10 m (3 m)	5 m (1 m)	3 m (1 m)	2 m (1 m)	1 m (0 m)
E8	INJ	222 m (14 m)	160 m (7 m)	158 m (8 m)	164 m (4 m)	152 m (7 m)	165 m (3 m)
	MORT	64 m (10 m)	28 m (12 m)	14 m (3 m)	10 m (2 m)	5 m (1 m)	3 m (1 m)

Bin	Effect	10 kg	250 kg	1,000 kg	5,000 kg	25,000 kg	72,000 kg
E9	INJ	354 m (40 m)	192 m (11 m)	188 m (14 m)	206 m (12 m)	184 m (11 m)	211 m (8 m)
	MORT	162 m (20 m)	21 m (28 m)	11 m (1 m)	8 m (1 m)	4 m (1 m)	2 m (1 m)
E10	INJ	510 m (80 m)	242 m (21 m)	243 m (22 m)	258 m (25 m)	241 m (20 m)	268 m (20 m)
	MORT	262 m (36 m)	58 m (65 m)	14 m (4 m)	10 m (2 m)	5 m (1 m)	4 m (0 m)
E11	INJ	653 m (32 m)	366 m (25 m)	370 m (22 m)	360 m (21 m)	364 m (21 m)	370 m (19 m)
	MORT	346 m (14 m)	162 m (48 m)	87 m (9 m)	57 m (7 m)	26 m (3 m)	22 m (3 m)
E12	INJ	660 m (73 m)	338 m (153 m)	327 m (14 m)	344 m (34 m)	327 m (7 m)	353 m (2 m)
	MORT	365 m (38 m)	145 m (92 m)	18 m (1 m)	13 m (1 m)	7 m (1 m)	5 m (0 m)
E13	INJ	4,167 m (1,504 m)	2,135 m (1,522 m)	1,906 m (1,156 m)	2,073 m (1,404 m)	1,199 m (1,046 m)	953 m (182 m)
	MORT	1,831 m (783 m)	717 m (759 m)	573 m (572 m)	677 m (658 m)	335 m (410 m)	260 m (202 m)
E16	INJ	1,597 m (484 m)	1,000 m (628 m)	1,053 m (205 m)	1,069 m (341 m)	1,081 m (257 m)	975 m (4 m)
	MORT	1,024 m (225 m)	678 m (284 m)	665 m (214 m)	753 m (263 m)	529 m (277 m)	415 m (233 m)

Median ranges with standard deviation ranges in parentheses, INJ = the greater of respective ranges for 1% chance of gastro-intestinal tract injury and 1% chance of injury, MORT = mortality
E1 (0.1 - 0.25 lbs), E2 (>0.25 - 0.5 lbs), E3 (>0.5 - 2.5 lbs), E4 (>2.5 - 5 lbs), E5 (>5 - 10 lbs), E6 (>10 - 20 lbs), E7 (>20 - 60 lbs), E8 (>60 - 100 lbs), E9 (>100 - 250 lbs), E10 (>250 - 500 lbs), E11 (>500 - 675 lbs), E12 (>675 - 1,000 lbs), E13 (>1,000 - 1,740), E16 (10,000 lbs)
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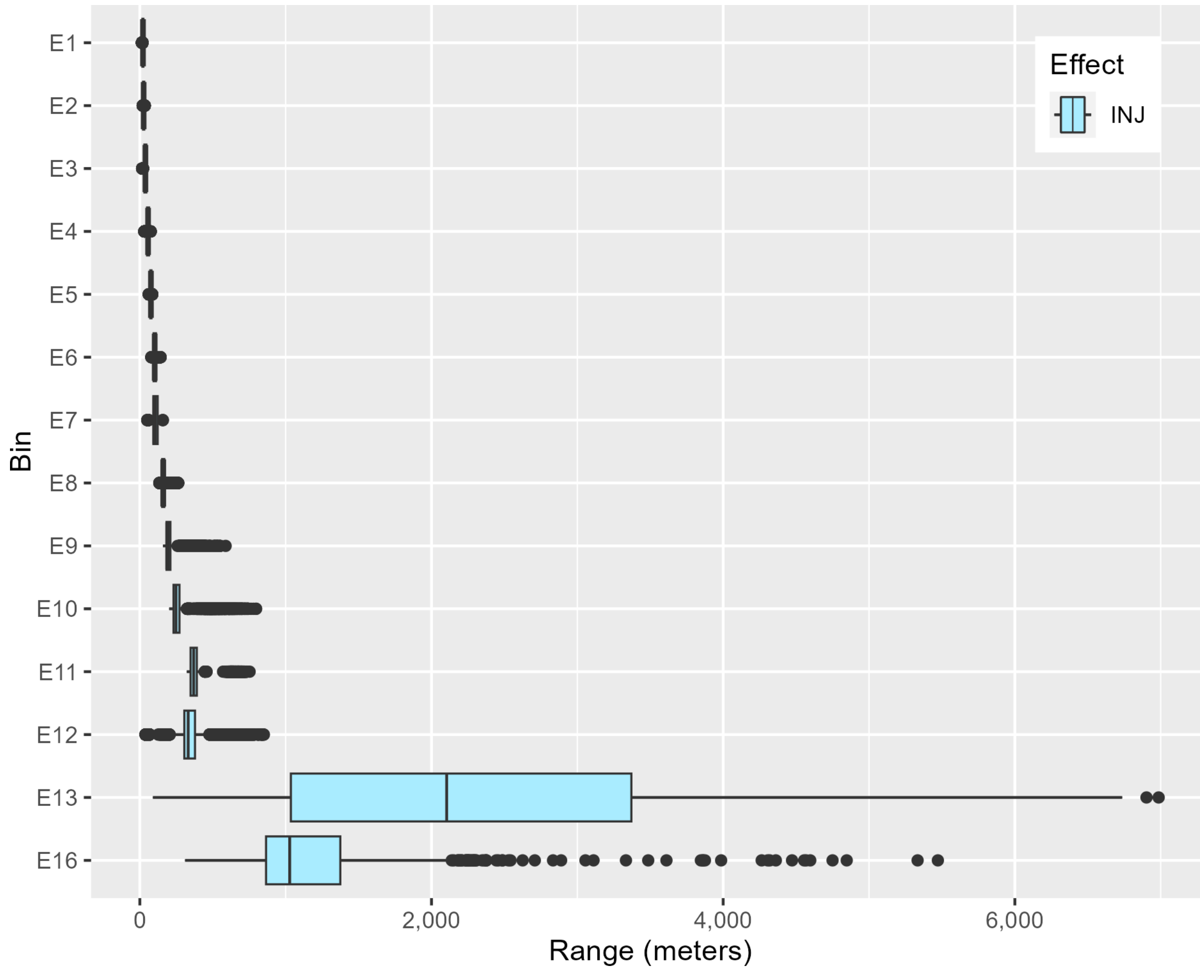


Figure 2.5-35: Explosive Ranges to Injury for All Marine Mammal Hearing Groups

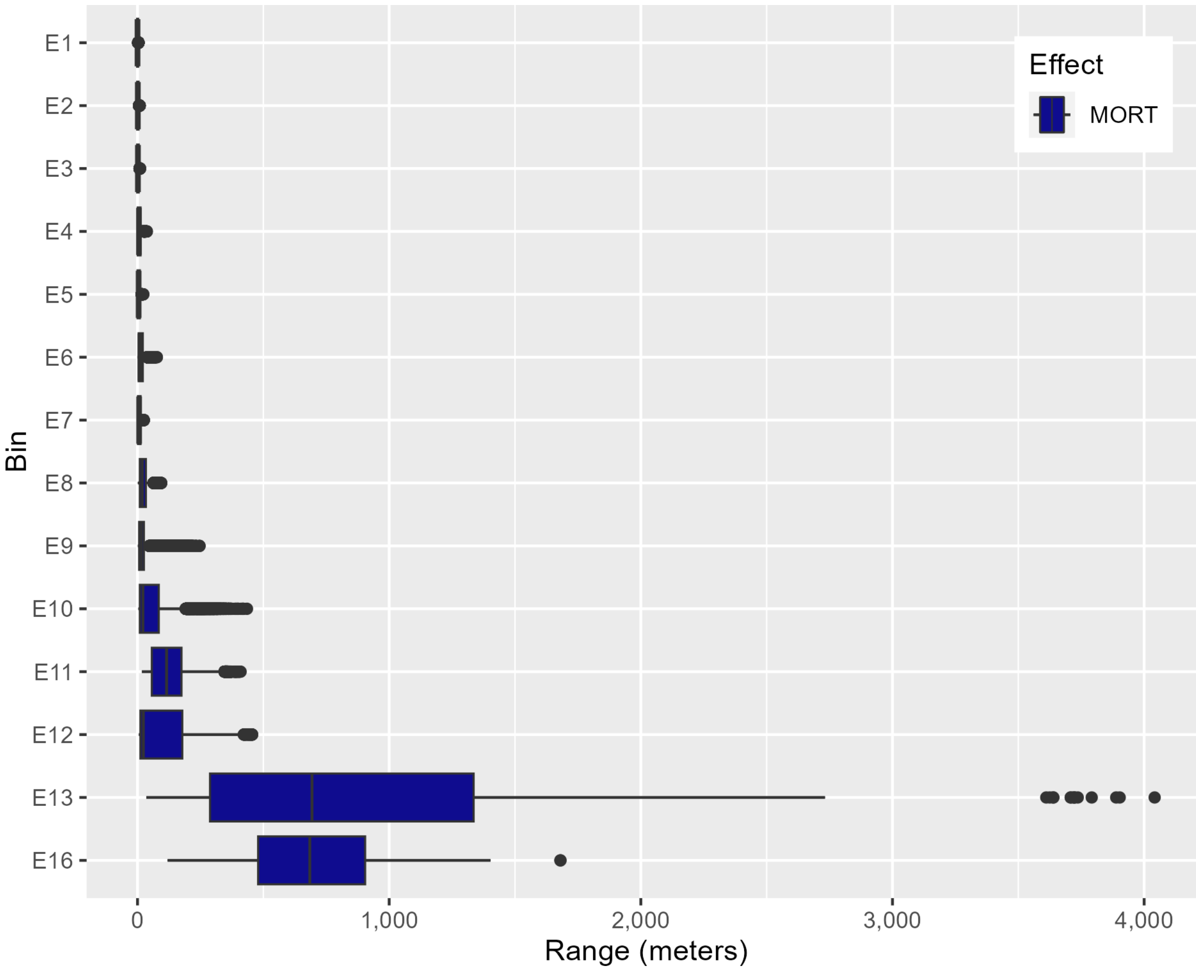


Figure 2.5-36: Explosive Ranges to Mortality for All Marine Mammal Hearing Groups

3 IMPACTS ON REPTILES FROM ACOUSTIC AND EXPLOSIVE STRESSORS

This analysis is presented as follows:

- The impacts that would be expected due to each type of acoustic stressor and explosives used in the Proposed Action are described in Section 3.1 (Impacts Due to Each Acoustic Substressor and Explosives)
- The approach to modeling and quantifying impacts is summarized in Section 3.2 (Quantifying Impacts on Reptiles from Acoustic and Explosive Stressors).
- Impacts on ESA-listed species in the Study Area, including predicted instances of harm or harassment, are presented in Section 3.3 (ESA-Listed Species Impact Assessments).

3.1 IMPACTS DUE TO EACH ACOUSTIC SUBSTRESSOR AND EXPLOSIVES

Assessing whether a sound may disturb or injure a reptile involves understanding the characteristics of the acoustic sources, the reptiles that may be present in the vicinity of the sources, and the effects that sound may have on the physiology and behavior of reptiles. Many other factors besides just the received level of sound may affect an animal's reaction, such as the duration of the sound-producing activity, the animal's physical condition, prior experience with the sound, activity at the time of exposure (e.g., feeding, traveling, resting), the context of the exposure (e.g., in a semi-enclosed bay vs. open ocean), and proximity of the animal to the source of the sound.

The *Reptile Acoustic Background* section summarizes what is currently known about acoustic effects to reptiles. For all acoustic substressors and explosives, the reader is referred to that section for background information on the types of effects that are discussed in the following analysis. In this analysis, impacts are categorized as mortality, non-auditory injury, temporary hearing loss (temporary threshold shift [TTS]), auditory injury (AINJ, including permanent threshold shift [PTS] and auditory neural injury), other physiological response (including stress), masking (occurs when a noise interferes with the detection, discrimination, or recognition of other sounds), and behavioral responses.

3.1.1 IMPACTS FROM SONARS AND OTHER TRANSDUCERS

Sonars and other transducers (collectively referred to as sonars in this analysis) emit sound waves into the water to detect objects, safely navigate, and communicate. Sonars are considered non-impulsive and vary in source level, frequency, duration (the total time that a source emits sound including any silent periods between pings), duty cycle (the portion of time a sonar emits sound when active, from infrequent to continuous), beam characteristics (narrow to wide, directional to omnidirectional, downward or forward facing), and movement (stationary or on a moving platform). Additional characteristics and occurrence of sonars used under the Proposed Action are described in the *Acoustic Stressors* and *Activity Descriptions* sections.

Reptiles are likely only susceptible to hearing loss when exposed to high levels of sound within their limited hearing range (most sensitive from 100–400 Hz and limited over 1 kHz). Only sources within the hearing range of reptiles (<2 kHz) are considered. As discussed in the *Reptile Acoustic Background* section, sea turtles and sea snakes have similar hearing capabilities, mechanisms, and likely usage. Therefore, the types of impacts on sea snakes are assessed to be comparable to those for sea turtles.

Potential impacts from exposures to sonar are discussed in the *Reptile Acoustic Background* section and include TTS, AINJ, masking, behavioral reactions, and physiological response.

Military readiness activities that involve the use of sonars could occur throughout the Study Area, although use would generally occur in Navy range complexes and testing ranges, or around inshore locations, and specified ports and piers identified in the *Proposed Activities* section. Impacts from sonar to reptiles within the Study Area would be limited to systems with energy below 2 kHz, primarily from low-frequency sonars but could also include some broadband and lower mid-frequency sources (less than 2 kHz). The use of these systems could occur throughout the Study Area but would be concentrated in the Hawaii Study Area and SOCAL Range Complex. Some low-frequency sonars could also be utilized in nearshore waters (e.g., San Clemente Island nearshore under training and Pearl Harbor under testing activities) though these systems are typically operated farther offshore. Overall, low-frequency sources are operated less often than higher frequency sources throughout the Study Area. Although the general impacts from sonar during testing would be similar in severity to those described during training, there is a higher quantity of sonar usage under testing activities and therefore there may be slightly more impacts during testing activities.

The most probable impacts from exposure to sonar is hearing loss, masking, behavioral reactions, and physiological response. Sonar-induced acoustic resonance and bubble formation phenomena are very unlikely to occur under realistic conditions, as discussed in the *Reptile Acoustic Background* section. Non-auditory injury and mortality from sonar are not possible under realistic exposure conditions. Any impact on hearing can reduce the distance over which a reptile detects environmental cues, such as the sound of waves, or the presence of a vessel or predator. A reptile could respond to sounds detected within its hearing range if it is close enough to the source. Use of sonar would typically be transient and temporary, and there is no evidence to suggest that any behavioral response would persist after a sound exposure. In addition, a stress response may accompany any behavioral response. Although masking of biologically relevant sounds by the limited number of sonars and other transducers operated in reptile hearing range is possible, this may only occur in certain circumstances. Reptiles most likely use sound to detect nearby broadband, continuous environmental sounds, such as the sounds of waves crashing on the beach. Reptiles may rely on senses other than hearing such as vision or magnetic orientation and could potentially reduce the effects of masking. The use characteristics of most low-frequency sonars include limited bandwidth, beam directionality, beam width, duration of use, and relatively low source levels and low duty cycle. These factors greatly limit the potential for a reptile to detect these sources and the potential for masking of broadband, continuous environmental sounds.

Conclusions regarding impacts from the use of sonars during military readiness activities for ESA-listed species are provided in Section 3.3 (ESA-Listed Species Impact Assessments).

3.1.2 IMPACTS FROM AIR GUNS

Air guns use bursts of pressurized air to create intermittent, broadband, impulsive sounds. Air gun use by the Navy is limited and is unlike large-scale seismic surveys that use an array with multiple air guns firing simultaneously or sequentially. Air gun use would occur nearshore in the SOCAL Range Complex under Intelligence, Surveillance, Reconnaissance testing activities, and greater than 3 NM from shore in the Hawaii, Northern and SOCAL Range Complexes under Acoustic and Oceanographic Research testing activities.

Sounds from air guns are impulsive, broadband, dominated by lower frequencies, and are within the hearing range of reptiles. As discussed in the *Reptile Acoustic Background* section, sea turtles and sea snakes have similar hearing capabilities, mechanisms, and likely usage. Therefore, the types of impacts on sea snakes are assessed to be comparable to those for sea turtles. Potential impacts from air guns could include TTS, AINJ, behavioral reactions, physiological response, and masking. Ranges to auditory effects for reptiles exposed to air guns are in Section 3.4.2 (Range to Effects for Air Guns). The visual observation distances described in the *Mitigation* section are designed to avoid or substantially reduce the potential for AINJ due to air guns. As shown in Section 3.4.2 (Range to Effects for Air Guns), ranges to AINJ and TTS are relatively short. Furthermore, the mitigation zone (200 yds.) extends beyond these ranges and will help prevent or reduce any potential for AINJ and TTS in sea turtles.

Limited research and observations from air gun studies (see the *Reptile Acoustic Background* section) suggest that if reptiles are exposed to repetitive impulsive sounds in close-proximity, they may react by increasing swim speed, avoiding the source, or changing their position in the water column. There is no evidence to suggest that any behavioral response would persist after the sound exposure. Due to the low duration of an individual air gun shot, approximately 0.1 second, and the low duty cycle of sequential shots, the potential for masking from air guns would be low.

Conclusions regarding impacts from the use of air guns during military readiness activities for ESA-listed species are provided in Section 3.3 (ESA-Listed Species Impact Assessments).

3.1.3 Impacts from Pile Driving

Port Damage Repair training activities at Port Hueneme, California could occur throughout the year and are made up of multiple events, each which could occur up to 12 times per year. Each training events is comprised of up to seven separate modules, each which could occur up to three iterations during a single event (for a maximum of 21 modules). Training events would last a total of 30 days, of which pile driving is only anticipated to occur for a maximum of 14 days. Sound from pile driving activities could occur over several hours in each day, though breaks in pile driving are taken frequently to reposition the drivers between piles. Depending on where the activity occurs at Port Hueneme, transmission of pile driving noise may be reduced by pier structures. As a standard operating procedure, the Navy performs soft starts at reduced energy during an initial set of strikes from an impact hammer. Soft starts may "warn" reptiles and cause them to move away from the sound source before impact pile driving increases to full operating capacity. Potential impacts did not consider any benefits from soft starts, nor was the possibility that reptiles could avoid the construction area.

Sounds from an impact hammer are impulsive, broadband, and dominated by lower frequencies. A vibratory hammer produces sounds that are similar in frequency range as the impact hammer, except the levels are much lower, especially when installing or extracting piles from soft substrate (i.e., sandy bottom), and the sound is continuous while operating. The sounds produced from impact and vibratory pile driving and removal are within the hearing range of reptiles. As discussed in the *Reptile Acoustic Background* section, sea turtles and sea snakes have similar hearing capabilities, mechanisms, and likely usage. Therefore, the types of impacts on sea snakes are assessed to be comparable to those for sea turtles. Section 3.4.3 shows the predicted ranges to AINJ, TTS, and behavioral response for sea turtles from exposure to impact and vibratory pile driving. The mitigation zone (100 yds.) will help prevent or reduce any potential impacts on sea turtles.

The working group that prepared the *ANSI Sound Exposure Guidelines* (Popper et al., 2014) provide parametric descriptors of sea turtle behavioral responses to impact pile driving. Popper et al. (2014) estimate the risk of sea turtles responding to impact pile driving is high, moderate, and low while at near (tens of meters), intermediate (hundreds of meters), and far (thousands of meters) distances from the source, respectively. Based on prior observations of sea turtle reactions to sound, if a behavioral reaction were to occur, the responses can include increases in swim speed, change of position in the water column, or avoidance of the sound (see the *Reptile Acoustic Background* section). There is no evidence to suggest that any behavioral response would persist after a sound exposure, and it is likely that a stress response would accompany any behavioral response or TTS.

The vibratory hammer produces sounds that could cause some masking in reptiles, but the effect would be temporary, only lasting the duration that piles are driven or extracted. Due to the low source level of vibratory pile extraction, the zone for potential masking would only extend a few hundred meters from where the source is operating. For impact pile driving, the rate of strikes (60 per minute) has the potential to result in some masking. Port Hueneme is a military port with potentially high ambient noise levels due to vessel traffic and port activities. Given these factors, significant masking is unlikely to occur in reptiles due to exposure to sound from impact pile driving or vibratory pile driving/extraction.

If reptiles are exposed to sounds from pile driving or extraction, they could potentially react with short-term behavioral reactions and physiological (stress) responses (see the *Reptiles Acoustic Background* section).

Conclusions regarding impacts from pile driving activities during military readiness activities for ESA-listed species are provided in Section 3.3 (ESA-Listed Species Impact Assessments).

3.1.4 Impacts from Vessel Noise

Reptiles may be exposed to vessel-generated noise throughout the Study Area. Military readiness activities with vessel-generated noise would be conducted as described in the *Proposed Activities* section and *Activity Descriptions* sections. Specifically, Navy vessel traffic in Hawaii is heaviest south of Pearl Harbor, and in Southern California, Navy vessel traffic is heaviest around San Diego and roughly within 50 NM of shore, though these activities could occur throughout the Study Area, as described in the *Acoustic Habitat* section. The four amphibious approach lanes on the coast of central California bordering NOCAL and PSMR near Mill Creek Beach, Morro Bay, Pismo Beach, and Vandenberg Space Force Base are sources of nearshore vessel noise as well. Navy traffic also has clear routes from Hawaii to the Mariana Islands, Japan and San Diego, and from San Diego north to the Pacific Northwest. Vessel movements involve transits to and from ports to various locations within the Study Area, and many ongoing and proposed activities within the Study Area involve maneuvers by various types of surface ships, boats, and submarines (collectively referred to as vessels), as well as unmanned vehicles. Activities involving vessel movements occur intermittently and are variable in duration, ranging from a few hours up to two weeks. Surface combatant ships (e.g., destroyers, guided missile cruisers, and littoral combat ships) and submarines especially are designed to be quiet to evade enemy detection. Characteristics of vessel noise are described in the *Acoustic Habitat* section.

Due to the acoustic characteristics of vessel noise (i.e., moderate- to low-level source levels), vessel noise is unlikely to cause any direct injury. Furthermore, vessels are transient and would result in brief periods of exposure. Vessels produce continuous broadband noise within the hearing range of reptiles. As discussed in the *Reptile Acoustic Background* section, sea turtles and sea snakes have similar hearing capabilities, mechanisms, and likely usage. Therefore, the types of impacts on sea snakes are assessed to be comparable to those for sea turtles.

Based on best available science summarized in the *Reptile Acoustic Background* section, potential impacts on reptiles include masking, behavioral reactions, and physiological response. Vessel source levels are below the sound levels that would cause hearing loss or AINJ. For louder vessels, such as Navy supply ships, reptiles would typically exhibit a brief startle and avoidance reaction if they react at all. Any of these reactions to vessels are not likely to disrupt important behavioral patterns. The size and severity of these impacts would be insignificant, and not rise to the level of measurable impacts. While it is likely that sea turtles may exhibit some behavioral response to vessels, numerous sea turtles bear scars that appear to have been caused by propeller cuts or collisions with vessel hulls that may have been exacerbated by a sea turtle surfacing reaction or lack of reaction to vessels (Hazel et al., 2007; Lutcavage et al., 1997).

Acoustic masking, especially from larger, non-combatant vessels, is possible. Vessels produce continuous broadband noise, with larger vessels producing sound that is dominant in the lower frequencies (as described in the *Acoustic Habitat* section) where reptile hearing is most sensitive. Smaller vessels emit more energy in higher frequencies, much of which would not be detectable by reptiles. Existing high ambient noise levels in ports and harbors with non-military vessel traffic and in shipping lanes with commercial vessel traffic would limit the potential for masking by military vessels in those areas. In offshore areas with lower ambient noise, the duration of any masking effects in a particular location would depend on the time in transit by a vessel through an area. Exposure to vessel noise could result in short-term behavioral reactions, physiological response, masking, or no response (see the *Reptile Acoustic Background* section). Impacts from vessel noise would be temporary and localized, and such responses would not be expected to compromise the general health or condition of individual reptiles. Therefore, long-term consequences for populations are not expected.

Conclusions regarding impacts from activities that produce vessel noise during military readiness activities for ESA-listed species are provided in Section 3.3 (ESA-Listed Species Impact Assessments).

3.1.5 Impacts from Aircraft Noise

Reptiles may be exposed to aircraft-generated noise throughout the Study Area. Military readiness activities with aircraft would be conducted as described in the *Proposed Activities* and *Activity Descriptions* sections. Both manned and unmanned fixed- and rotary-wing (e.g., helicopters) aircraft are used for a variety of military readiness activities throughout the Study Area. Tilt-rotor impacts would be like fixed-wing or rotary-wing aircraft impacts depending which mode the aircraft is in. Most of these sounds would be concentrated around airbases and fixed ranges within each of the range complexes. Aircraft noise can also occur in the waters immediately surrounding aircraft carriers at sea during takeoff and landing or directly below hovering rotary-wing aircraft that are near the water surface.

Aircraft produce extensive airborne noise from either turbofan or turbojet engines. An infrequent type of aircraft noise is the sonic boom, produced when the aircraft exceeds the speed of sound. Rotary-wing aircraft produce low-frequency sound and vibration (Pepper et al., 2003). Transmission of sound from a moving airborne source to a receptor underwater is influenced by numerous factors, but significant acoustic energy is primarily transmitted into the water directly below the aircraft in a narrow cone, as discussed in detail in the *Acoustic Primer* section.

Aircraft noise is within the hearing range of reptiles and activities that produce aircraft noise can occur in areas potentially inhabited by reptiles. As discussed in the *Reptile Acoustic Background* section, sea turtles and sea snakes have similar hearing capabilities, mechanisms, and likely usage. Therefore, the types of impacts on sea snakes are assessed to be comparable to those for sea turtles.

In most cases, exposure of a reptile to fixed-wing aircraft presence and noise would be brief as the aircraft quickly passes overhead. Animals would have to be at or near the surface at the time of an overflight to be exposed to appreciable sound levels. Supersonic flight at sea is typically conducted at altitudes exceeding 30,000 ft., limiting the number of occurrences of supersonic flight being audible at the water's surface. Because most overflight exposures from fixed-wing aircraft or transiting rotary-wing aircraft would be brief and aircraft noise would be at low received levels, only startle reactions, if any, are expected in response to low altitude flights. Similarly, the brief duration of most overflight exposures would limit any potential for masking of relevant sounds, and reptiles may dive or move to a different area to reduce potential masking impacts (see the *Reptile Acoustic Background* section).

Daytime and nighttime activities involving rotary-wing aircraft may occur for extended periods of time, up to a couple of hours in some areas. During these activities, rotary-wing aircrafts would typically transit throughout an area and may hover over the water. Longer duration activities and periods of time where rotary-wing aircraft hover may increase the potential for behavioral reactions, startle reactions, and stress. Low-altitude flights of rotary-wing aircraft during some activities, which often occur under 100 ft. altitude, may elicit a stronger startle response due to the proximity of a rotary-wing aircraft to the water; the slower airspeed and longer exposure duration; and the downdraft created by a rotary-wing aircraft's rotor. Most fixed-wing aircraft and rotary-wing aircraft activities are transient in nature, although rotary-wing aircraft can also hover for extended periods. The likelihood that a reptile would occur or remain at the surface while an aircraft transits directly overhead would be low. Rotary-wing aircraft that hover in a fixed location for an extended period can increase the potential for exposure. However, impacts from military readiness activities would be highly localized and concentrated in space and duration.

Reptiles may respond to both the physical presence and to the noise generated by aircraft, making it difficult to attribute causation to one or the other stimulus. In addition to noise produced, all low-flying aircraft make shadows, which can cause animals at the surface to react. Rotary-wing aircraft may also produce strong downdrafts, a vertical flow of air that becomes a surface wind, which can also affect an animal's behavior at or near the surface. The amount of sound entering the ocean from aircraft would be very limited in duration, sound level, and affected area. Overall, if reptiles were to respond to aircraft noise, only short-term behavioral or physiological response would be expected. Therefore, impacts on individuals would be unlikely and long-term consequences for populations are not expected.

Conclusions regarding impacts from activities that produce aircraft noise during military readiness activities for ESA-listed species are provided in Section 3.3 (ESA-Listed Species Impact Assessments).

3.1.6 Impacts from Weapons Noise

Reptiles may be exposed to sounds caused by the firing of weapons, objects in flight, and inert impact of non-explosive munitions on the water surface. Military readiness activities using weapons and deterrents would be conducted as described in the *Proposed Activities* and *Activity Descriptions* sections. The locations where gunnery and other munitions may be used are shown in the *Munitions* data section. Most weapons noise is attributable to Gunnery activities. The overall proposed use of large caliber gunnery has decreased since the prior analysis, whereas medium caliber gunnery would be similar. Most activities involving large caliber naval gunfire or other munitions fired or launched from a vessel are conducted more than 12 NM from shore. The Action Proponents will implement mitigation to avoid or reduce potential impacts from weapon firing noise during Large-Caliber Gunnery activities, as discussed in the *Mitigation* section. For explosive munitions, only associated firing noise is considered in the analysis of weapons noise. The noise produced by the detonation of explosive weapons is analyzed separately.

In general, weapons noise includes impulsive sounds generated in close vicinity to or at the water surface, except for items that are launched underwater, and are within the hearing range of reptiles. Weapons noise would be brief, lasting from less than a second for a blast or inert impact, to a few seconds for other launch and object travel sounds. As discussed in the *Reptile Acoustic Background* section, sea turtles and sea snakes have similar hearing capabilities, mechanisms, and likely usage. Therefore, the types of impacts on sea snakes are assessed to be comparable to those for sea turtles.

Most incidents of impulsive sounds produced by weapon firing, launch, or inert object impacts would be single events. Activities that have multiple detonations such as some naval gunfire exercises could create some masking for reptiles in the area over the short duration of the event. It is expected that these sounds may elicit brief startle reactions or diving, with avoidance being more likely with the repeated exposure to sounds during gunfire events. It is likely that reptile behavioral responses would cease following the exposure event, and the risk of a corresponding sustained stress response would be low. Similarly, exposures to impulsive noise caused by these activities would be so brief that risk of masking relevant sounds would be low. These activities would not typically occur in nearshore habitats where reptiles may use their limited hearing to sense broadband, coastal sounds. Behavioral reactions, startle reactions, and physiological response due to weapons noise are likely to be brief and minor, if they occur at all due to the low probability of co-occurrence between weapon activity and individual reptiles.

Sound due to missile and target launches is typically at a maximum at initiation of the booster rocket and rapidly fades as the missile or target travels downrange. These sounds would be transient and of short duration, lasting no more than a few seconds at any given location. Many missiles and targets are launched from aircraft, which would produce minimal noise in the water due to the altitude of the aircraft at launch. Missiles and targets launched by ships or near the water surface may expose reptiles to levels of sound that could produce brief startle reactions, avoidance, or diving. Due to the short-term, transient nature of launch noise, animals are unlikely to be exposed multiple times within a short period. Reactions by reptiles to these specific stressors have not been recorded; however, reptiles would be expected to react to weapons noise as they would other transient sounds. Behavioral reactions would likely be short term (minutes) and are unlikely to lead to long-term consequences for individuals or species.

Conclusions regarding impacts from activities that produce weapons noise during military readiness activities for ESA-listed species are provided in Section 3.3 (ESA-Listed Species Impact Assessments).

3.1.7 Impacts from Explosives

Reptiles may be exposed to sound and energy from explosions in the water and near the water surface associated with the proposed activities. Activities using explosives would be conducted as described in the *Proposed Activities* and *Activity Descriptions* sections. Most explosive activities would occur in the SOCAL Range Complex, the Hawaii Range Complex, and PMSR, although activities with explosives would also occur in other areas as described in the *Activity Descriptions* section. Most activities involving in-water explosives associated with large caliber naval gunfire, or the launching of targets, missiles, bombs, or other munitions, are conducted more than 12 NM from shore. Small Ship Shock Trials could occur in the SOCAL Range Complex greater than 12 NM from shore as shown in the *Proposed Activities* section. Sinking Exercises are conducted greater than 50 NM from shore as shown in the *Proposed Activities* section. Certain activities with explosives may be conducted close to shore at locations identified in the Activity Descriptions section and Appendix H (Description of Systems and Ranges) of the HCTT EIS/OEIS.

This includes certain Mine Warfare and Expeditionary Warfare activities. In the Hawaii Range Complex explosive activities could occur at specified ranges and designated locations around Oahu, including the Puuloa Underwater Range and designated locations in and near Pearl Harbor. In the SOCAL Range Complex, explosive activities could occur near San Clemente Island, in the Silver Strand Training Complex, and in other designated mine training areas along the Southern California coast.

Characteristics, quantities, and net explosive weights of in-water explosives used during military readiness activities are provided in the *Acoustic Stressors* section. The use of in-water explosives would increase from the prior analysis for training activities and would decrease slightly for testing. There is an overall reduction in the use of most of the largest explosive bins (bin E8 [> 60–100 pounds (lb.) net explosive weight (NEW)] and above) for training, and a decrease in two of the largest explosive bins (bin E10 [> 250–500 lb. NEW] and E11 [> 500–650 lb. NEW]) under testing activities. There would be notable increases in the smaller explosive bins (E7 [> 20–60 lb. NEW] and below) under training and testing activities, except for bin E1 (0.1–0.25 lb. NEW) which would decrease under testing activities. Small Ship Shock Trials (bin E16 [> 7,250–14,500 lb. NEW]) not previously analyzed are currently proposed under testing activities. Although the general impacts from explosives during training would be similar in severity to those described during testing, there is a higher quantity of explosives used under training activities and therefore there may be slightly more impacts.

The types of activities with detonations below the surface include Mine Warfare, activities using explosive torpedoes, and ship shock trials, as well as specific training and testing activities. Most explosive munitions used during military readiness activities, however, would occur at or just above the water surface (greater than 90 percent by count). These include those used during surface warfare activities, such as explosive gunnery, bombs, and missiles. Certain nearshore activities use explosives in the surf zone up to the beach, where most explosive energy is released in the air (refer to Appendix H, Description of Systems and Ranges, for location details). In the below quantitative analysis, impacts on reptiles are over-estimated because in-air near surface and surf zone explosions are modeled as underwater explosions, with all energy assumed to remain in the water. Sound and energy from in-air detonations at higher altitudes would be reflected at the water surface and therefore are not analyzed further in this section and would have no effect on reptiles.

Characteristics, quantities, and net explosive weights of in-water explosives used during military readiness activities are provided in the *Acoustic Stressors* section. Explosives produce loud, impulsive, broadband sounds. Potential impacts from exposures to explosives are discussed in the *Reptile Acoustic Background* section and include masking, behavioral reactions, hearing loss, AINJ, non-auditory injury, and mortality. Estimated behavioral reactions, auditory impacts, non-auditory impacts, and mortality were modeled. Impact ranges for reptiles exposed to explosive sound and energy are shown in Section 3.4.4 (Range to Effects for Explosives). As discussed in the *Mitigation* section, the Action Proponents will implement mitigation to relocate, delay, or cease detonations when a sea turtle is sighted within or entering a mitigation zone to avoid or reduce potential explosive impacts. The visual observation distances described in the *Mitigation* section are designed to cover the distance to mortality and reduce the potential for injury due to explosives.

As discussed in the *Reptile Acoustic Background* section, sea turtles and sea snakes have similar hearing capabilities, mechanisms, and likely usage. Therefore, the types of impacts on sea snakes are assessed to be comparable to those for sea turtles. Impacts including TTS, AINJ, and non-auditory injury can reduce the fitness of an individual animal, causing a reduction in foraging success, reproduction, or increased susceptibility to predators. This reduction in fitness would be temporary for recoverable impacts, such as TTS. There may be long-term consequences to some individuals, however, no population-level impact is expected due to the low number of potential injuries or mortalities for any reptile species relative to total population size. Recovery from a hearing threshold shift begins almost immediately after the noise exposure ceases. Full recovery from a temporary threshold shift is expected to take a few minutes to a few days, depending on the severity of the initial shift (see *Criteria and Thresholds TR*). If any hearing loss remains after recovery, that remaining hearing threshold shift is permanent. Because explosions produce broadband sounds with low-frequency content, hearing loss due to explosive sound could occur across a reptile's hearing range, reducing the distance over which relevant sounds may be detected for the duration of the threshold shift.

A reptile's behavioral response to a single detonation or explosive cluster is expected to be limited to a short-term startle response or other behavioral responses, as the duration of noise from these events is very brief. Limited research and observations from air gun studies (see the *Reptile Acoustic Background* section) suggest that if sea turtles are exposed to repetitive impulsive sounds in close-proximity, they may react by increasing swim speed, avoiding the source, or changing their position in the water column. There is no evidence to suggest that any behavioral response would persist after the sound exposure. Because the duration of most explosive events is brief, the potential for masking is low. The *ANSI Sound Exposure Guidelines* (Popper et al., 2014) consider masking to not be a concern for sea turtles exposed to explosions and is also likely the case for sea snakes.

A physiological response is likely to accompany any injury, hearing loss, or behavioral reaction. A stress response is a suite of physiological changes that are meant to help an organism mitigate the impact of a stressor. While the stress response is a normal function for an animal dealing with natural stressors in their environment, chronic stress responses can reduce an individual's fitness. However, explosive activities are generally displaced over space and time and would not likely result in repeated exposures to individuals over a short period of time (hours to days).

Conclusions regarding impacts from the use of explosives during military readiness activities for ESA-listed species are provided in Section 3.3 (ESA-Listed Species Impact Assessments).

3.2 Quantifying Impacts on Reptiles from Acoustic and Explosive Stressors

The following section provides an overview of key components of the modeling methods used to quantify impacts in this analysis. As a note, the quantitative impact analyses below are only performed for sea turtles. The following technical reports go into more detail on the quantitative process and show specific data inputs to the models.

- The modeling methods used to quantify impacts are described in detail in the *Quantitative Analysis TR*. Impacts due to sonar, air guns, and explosives were quantified using the Navy Acoustic Effects Model. Impacts due to pile driving were modeled outside of the Navy Acoustic Effects Model using a static area-density model.
- The development of criteria and thresholds used to predict impacts is shown in the *Criteria and Thresholds TR.*
- The spatial density models for each sea turtle species are described in the *Density TR*. The density models have been updated with new data since the prior analysis. The density technical report includes figures that show a species-by-species comparison (where applicable) of the density estimates used in the prior analysis to the updated estimates used for the current analysis. Areas

where densities changed are characterized as either no to minimal change, an increase, or a decrease.

- The dive profile for each species is shown in *the Dive Profile TR*. There are no substantive changes from the prior analysis.

3.2.1 The Navy's Acoustic Effects Model

The Navy Acoustic Effects Model was developed by the Navy to conduct a comprehensive acoustic impact analysis for use of sonars, air guns, and explosives in the marine environment. This model considers the physical environment, including bathymetry, seafloor composition/sediment type, wind speed, and sound speed profiles, to estimate propagation loss. The propagation information combined with data on the locations, numbers, and types of military readiness activities and marine resource densities provides estimated numbers of effects to each stock.

Individual sea turtles are represented as "animats," which function as dosimeters and record acoustic energy from all active underwater sources during a simulation of a training or testing event. Each animat's depth changes during the simulation according to the typical depth pattern observed for each species. During any individual modeled event, impacts on individual animats are considered over 24-hour periods.

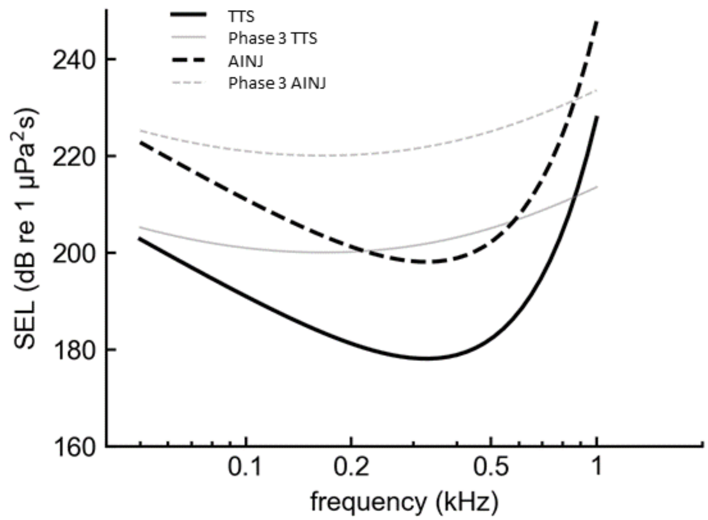
Because limited data are available on sea snake hearing, and most activities using acoustic substressors and explosives would not occur in sea snake habitat, impacts on sea snakes due to military readiness activities are qualitatively analyzed.

The model estimates the number of instances in which an effect threshold was exceeded over the course of a year, it does not estimate the number of times an individual in a population may be impacted over a year. Some sea turtles may be impacted multiple times, while others may not experience any impact.

3.2.2 Quantifying Impacts on Hearing

The auditory criteria and thresholds used in this analysis have been updated since the prior assessment of impacts due to military readiness activities in the Study Area. The auditory criteria and thresholds used in this analysis incorporate the latest and best available science and is discussed in the *Criteria and Thresholds TR*.

The best way to illustrate frequency-dependent susceptibility to auditory effects is an exposure function. Exposure functions for TTS and AINJ incorporate both the shape of the auditory weighting function and its weighted threshold value for either TTS or AINJ. Exposure functions that are updated for this analysis are shown in Figure 3.2-1.



Note: TTS = temporary threshold, AINJ = auditory injury.

Figure 3.2-1: Sea Turtle Exposure Function for Non-Impulsive TTS and AINJ

Estimated auditory impacts increased due to the following changes to the TTS and AINJ thresholds:

- The weighted non-impulsive SEL thresholds decreased by 22 dB (re 1 μPa^{2}s).
- The weighted impulsive SEL thresholds decreased by 20 dB (re 1 μPa^{2}s).
- The impulsive peak SPL thresholds decreased by 2 dB (re 1 μPa).

Table 3.2-1 lists the values for all auditory impact thresholds. For a detailed description of how these thresholds were determined, see the *Criteria and Thresholds TR*.

In contrast to the prior analysis, sea turtle avoidance of repeated high-level exposures from sonar was not applied in this analysis.

Table 3.2-1: Phase 3 and Phase 4 TTS and AINJ Onset Levels for Sonar (Non-Impulsive) and Explosive (Impulsive) Sound Sources in Sea Turtles.

	Phase 3		Phase 4	
	TTS	AINJ	TTS	AINJ
Non-impulsive onset SEL (dB re 1 μPa^{2}s weighted)[1]	200	220	178	198
Impulsive onset SEL (dB re 1 μPa^{2}s weighted) [1]	189	204	169	184
Impulsive onset Peak SPL (dB re 1 μPa)	226	232	224	230

Note: TTS = temporary threshold, AINJ = auditory injury, SEL = sound exposure level, SPL = sound pressure level.
[1]The weighted non-impulsive thresholds by themselves only indicate the TTS/AINJ threshold at the most susceptible frequency (the exposure function shape for non-impulsive sources is shown in Figure 3.2-1).

3.2.3 Quantifying Behavioral Impacts

The behavioral thresholds for sonars, air guns, and pile driving are the same as the prior assessment of impacts due to military readiness activities in the Study Area and is discussed in the *Criteria and Thresholds TR*. For exposures to single and multiple explosions, SEL-based thresholds were developed that are consistent with how marine mammal behavioral response thresholds were developed for exposures to single and multiple explosions. Table 3.2-2 lists the behavioral response thresholds for sea turtles used in this analysis.

Table 3.2-2: Behavioral Response Thresholds for Sea Turtles

Source	dB SPL rms (unweighted)	dB SEL (cumulative; weighted)
Air guns	175	-
Pile driving	175	-
Sonar ≤ 2 kHz	175	-
Explosives[1]	-	164

Note: SPL = sound pressure level, SEL = sound exposure level, rms = root mean square. Weighted cumulative SEL thresholds in dB re 1 μPa^{2}s and unweighted SPL rms thresholds in dB re 1 μPa. The root mean square and sound exposure level calculations are based on the duration defined by the 5% and 95% points along the cumulative energy curve and captures 90% of the cumulative energy in the impulse.
[1]For a single explosion the behavioral response threshold is set to the impulsive TTS onset threshold of 169 dB re 1 μPa^{2}s SEL

3.2.4 Quantifying Non-Auditory Injury due to Explosives

The criterion for mortality is based on severe lung injury derived from Goertner (1982) and the criteria for non-auditory injury are based on slight lung injury or gastrointestinal tract injury. Mortality and slight lung injury impacts on sea turtles will be predicted using thresholds for both juvenile and adult weights (see *Criteria and Thresholds TR*). An additional criterion for non-auditory injury is onset of gastrointestinal tract injury, which is the same for all species and age classes for explosive impacts. The onset (i.e., 1%) thresholds will be used to calculate impacts and model ranges to effect to inform mitigation assessment. This differs from the prior analysis where the 50% criterion (the level at which 50% of animals would be expected to have the response) was used to estimate the number of mortalities and non-auditory injuries. The updated threshold is more conservative (i.e., overpredicts numbers of effects) and will result in a small increase in the predicted non-auditory injuries and mortalities for the same event compared to prior analyses. Thresholds are provided in Table 3.2-3 for use in non-auditory injury assessment for sea turtles exposed to underwater explosives.

Table 3.2-3: Thresholds for Estimating Ranges to Potential Effect for Non-Auditory Injury.

Onset effect for mitigation consideration	Threshold
Onset Mortality - Impulse	$103M^{1/3}\left(1+\frac{D}{10.1}\right)^{1/6}$ Pa-s
Onset Injury - Impulse (Non-auditory)	$47.5M^{1/3}\left(1+\frac{D}{10.1}\right)^{1/6}$ Pa-s
Onset Injury - Peak Pressure (Non-auditory)	237 dB re 1 μPa peak

Note: M is animal mass (kg), and D is animal depth (m).

3.3 ESA-Listed Species Impact Assessments

The following sections analyze impacts on reptiles under the Proposed Action and show model-predicted estimates of take for sea turtles. The methods used to quantify impacts for each substressor are described above in Section 3.1 (Impacts Due to Each Acoustic Substressor and Explosives). The methods used to assess significance of individual impacts and risks to reptiles are described above in Section 3.2 (Quantifying Impacts on Reptiles from Acoustic and Explosive Stressors). For each sea turtle species, a multi-sectioned table (Table 3.3-1 through Table 3.3-6) quantifies impacts as follows:

Section 1

The first section shows the number of instances of each effect type that could occur due to each substressor (sonar, air guns, or explosives) over a maximum year of activity. Impacts are shown by type of activities (training excluding the U.S. Coast Guard, U.S. Coast Guard training activities only, or testing activities).

The number of instances of effect is not the same as the number of individuals that could be affected, as some individuals could be affected multiple times, whereas others may not be affected at all. The instances of effect are those predicted by the Navy's Acoustic Effects Model and are not further reduced to account for activity-based mitigation that would reduce effects near some sound sources and explosives as described in the *Mitigation* section.

In the modeling, instances of effect are calculated within 24-hour periods of each individually modeled event. Impacts are assigned to the highest order threshold exceeded at the animat, which is a dosimeter in the model that represents an animal of a particular species. Non-auditory injuries are assumed to outrank auditory effects, and auditory effects are assumed to outrank behavioral responses. In all instances, any auditory impact or injury are assumed to represent a concurrent behavioral response. For example, if a behavioral response and TTS are predicted for the same animat in a modeled event, the effect is counted as a TTS in the table.

For most activities, total impacts are based on multiplying the average expected impacts at a location by the number of times that activity is expected to occur. This is a reasonable method to estimate impacts for activities that occur every year and multiple times per year. There are two exceptions to that approach in this analysis: Civilian Port Defense (a training activity using sonar) and Small Ship Shock Trial (a testing activity using explosives). These two activities do not occur every year, have a very small number of total events over seven years, and could occur at one of many locations. Notably, Civilian Port Defense is the only proposed activity at certain port locations. Instead of using averaged impacts across locations for these two activities, the maximum impacts on any species at any of the possible locations is used. While this approach results in unrealistically high estimates of impacts for some species for these two activities, it ensures that this analysis appropriately assesses potential impacts where these rare events may occur.

The summation of instances of effect includes all fractional values caused by averaging multiple modeled iterations of individual events. Impacts are only rounded to whole numbers at the level of substressor and type of activities. Rounding follows standard rounding rules, in which values less than 0.5 round down to the lower whole number, and values equal to or greater than 0.5 round up to the higher whole number. A zero value (0) indicates that the sum of impacts is greater than true zero but less than 0.5. A dash (-) indicates that no impacts are predicted (i.e., a "true" zero). This would occur when there is no overlap of an animat in the modeling with a level of acoustic exposure that would result in any possibility of take during any activity. Non-auditory injury and mortality are only associated with use of explosives; thus, these types of effects are also true zeroes for any other acoustic substressor. A one in parentheses (1) indicates that predicted impacts round to zero in a maximum year of activity, but a single impact is predicted over seven years when summing the fractional risks across years. This is explained further below.

The summation of impacts across seven years is shown in Section 3.3.6 (Impact Summary Tables). The seven-year sum accounts for any variation in the annual levels of activities. The seven-year sum includes any fractional impact values predicted in any year, which is then rounded following standard rounding rules. That is, the seven-year impacts are not the result of summing the rounded annual impacts. If a seven-year sum was larger than the annual impacts multiplied by seven, the annual maximum impacts were increased by dividing the seven-year sum of impacts by seven then rounding up to the nearest integer. For example, this could happen if maximum annual impacts are 1.34 (rounds to 1 annually) and seven-year impacts are 8.60 (rounds to 9), where 9 divided by 7 years (9 ÷ 7 = 1.29) is greater than the estimated annual maximum of 1. In this instance, the maximum annual impacts would be adjusted from one to two based on rounding up 1.29 to 2. In multiple instances, this approach resulted in increasing the maximum annual impacts predicted by the Navy's Acoustic Effects Model.

Section Two

The second section shows the percent of total impacts that would occur within seasons and general geographic areas. The general geographic areas are SOCAL, PMSR, NOCAL, HRC, and the high seas (transit lanes between the California and Hawaii portions of the Study Area).

Section Three

The third section shows which activities are most impactful to a stock. Activities that cause five percent or more of total impacts on a species are shown.

Section Four (when applicable)

The fourth section shows impacts in critical habitats where they are designated for ESA-listed species. If a species does not have designated ESA critical habitat in the Study Area, then Section 4 (Impacts on Fishes from Acoustic and Explosive Stressors) is not shown in the tables.

3.3.1 Green Sea Turtle (*Chelonia mydas*) - Threatened

Green sea turtles from the Central North Pacific and East Pacific Ocean distinct population segments (DPS) are in the Study Area and are ESA-listed as threatened. There is no critical habitat designated for the green sea turtle in the Study Area, but critical habitat has been proposed by NMFS (88 FR 46376). Model-predicted impacts are presented in Table 3.3-1 and Table 3.3-2.

Hatchling and post-hatchling green sea turtles occur in offshore open ocean areas where they forage and develop in floating algal mats. Juvenile green sea turtles leave the open-ocean habitat and retreat to protected lagoons and open coastal areas that are rich in seagrass or marine algae, where they spend most of their lives. Green sea turtles likely to occur in the Study Area come from eastern Pacific Ocean and Hawaiian nesting populations. Some green turtles nesting on beaches in Mexico forage in the waters off California, thus requiring migration to complete their life cycle. Green sea turtles nest on beaches within the Hawaii Range Complex, and feed and migrate throughout all waters of the Study Area. In the SOCAL Range complex they occur predominantly in coastal and inshore waters.

Green sea turtles from the Central North Pacific and East Pacific Ocean DPS may be exposed to sonar, air guns, vessel noise, aircraft noise, weapons noise, and explosives associated with military readiness activities throughout the year. Green sea turtles would not overlap with pile driving activities in Port Hueneme, therefore, impacts from pile driving to green sea turtles are not further analyzed. Analysis of the impacts from vessel noise, aircraft noise, and weapons noise on green turtles relies on the information under the respective acoustic substressor in Section 3.1 (Impacts Due to Each Acoustic Substressor and Explosives).

Results from the Navy Acoustics Effects Model (Table 3.3-1 and Table 3.3-2) shows that green sea turtles in the Study Area may exhibit behavioral reactions, TTS, and AINJ from sonar, air guns, and explosives, and non-auditory injury and mortality from explosives over the course of a year.

For the East Pacific DPS of green sea turtles, the largest contributor of impacts from sonar are due to Acoustic and Oceanographic Research testing activities, with more impacts during the cold season. Impacts from air gun use are due to Acoustic and Oceanographic Research for testing activities with impacts occurring equally during the warm and cold seasons. The largest contributors of impacts from explosives are Underwater Demolition Qualification and Certification for training activities and Mine Countermeasure and Neutralization testing activities, with more impacts during the cold season. No impacts on the East Pacific DPS of green sea turtles are estimated to occur within proposed critical habitat.

For the Central North Pacific DPS of green sea turtles, the largest contributors of impacts from sonar are Acoustic and Oceanographic Research testing activities, with slightly more impacts during the warm season. Impacts from air gun use are due to Acoustic and Oceanographic Research testing activities with impacts during the cold season only. The largest contributor of impacts from explosives is Obstacle Loading for training activities, with more impacts during the warm season, and Underwater Demolition Qualification and Certification for training activities with more impacts during the warm season. Overall, most BEH, TTS, AINJ, and non-auditory injury impacts on the Central North Pacific DPS of green sea turtles are estimated to occur within proposed critical habitat. The largest contributor of impacts in proposed critical habitat is from the use of explosives during Obstacle Loading training activities during the warm season.

At the PMRF on Kauaʻi, Hawaii, green sea turtles from the Central North Pacific DPS utilize the beaches of PMRF for nesting and the nearshore waters for foraging. Activities that could impact green sea turtles include vessel noise (from amphibious landings) and weapons noise (from launches and live-fire training exercises). Standard operating procedures are implemented for these activities and include surveying beaches one hour prior to landings and launches, and in the event a sea turtle is observed basking on the beach, activities would be delayed until the animal leaves on its own accord. Beaches will also be surveyed for sea turtle nests, and if found, will be marked and avoided. Implementation of these measures would limit potential impacts which are likely to be temporary (lasting up to several hours) or short term (lasting several days to several weeks) and could include behavioral response, TTS, and AINJ.

Estimated behavioral and TTS impacts from sonar, air guns, and explosives are expected to be short term and would not result in substantial changes to behavior, growth, survival, annual reproductive success, lifetime reproductive success, or species recruitment, for an individual and would not result in population-level impacts. Low levels of estimated AINJ from sonar and explosives, and injuries and mortalities from explosives may have deleterious effects on the fitness of an individual turtle but are not expected to impact the fitness of enough individuals to cause population level effects.

Based on the analysis presented above, the use of sonars and activities that produce vessel, aircraft, and weapons noise during training activities <u>may affect, but are not likely to adversely affect,</u> green sea turtles in the East Pacific DPS. The use of explosives during training activities <u>may affect, and are likely to adversely affect,</u> green sea turtles in the East Pacific DPS. Activities that involve the use of pile driving are

<u>not applicable</u> to green sea turtles in the East Pacific DPS because there is no geographic overlap of this stressor with species occurrence. Air gun activities are not conducted during training.

Based on the analysis presented above, activities that produce vessel, aircraft, and weapons noise during testing activities <u>may affect, but are not likely to adversely affect,</u> green sea turtles in the East Pacific DPS. The use of sonars, air guns, and explosives during testing activities <u>may affect, and are likely to adversely affect,</u> green sea turtles in the East Pacific DPS. Pile diving activities are not conducted during testing.

Based on the analysis presented above, the use of sonars and activities that produce vessel, aircraft, and weapons noise during training activities <u>may affect, but are not likely to adversely affect,</u> green sea turtles in the Central North Pacific DPS. The use of explosives during training activities <u>may affect, and are likely to adversely affect,</u> green sea turtles in the Central North Pacific DPS. Activities that involve the use of pile driving are <u>not applicable</u> to green sea turtles in the Central North Pacific DPS because there is no geographic overlap of this stressor with species occurrence. Air gun activities are not conducted during training.

Based on the analysis presented above, activities that produce vessel, aircraft, and weapons noise during testing activities <u>may affect, but are not likely to adversely affect,</u> green sea turtles in the Central North Pacific DPS. The use of sonars, air guns, and explosives during testing activities <u>may affect, and are likely to adversely affect,</u> green sea turtles in the Central North Pacific DPS. Pile diving activities are not conducted during testing.

<u>Critical Habitat</u>

Green turtle critical habitat proposed by NMFS is along the coasts of California and the Hawaiian Archipelago. It is comprised of three different habitat types which are reproductive (Central North Pacific DPS only), migratory (East Pacific DPS only), and benthic foraging/resting. Pile driving activities in Port Hueneme do not overlap with any proposed critical habitat types. The impacts on these habitats would be considered insignificant, with no discernible effect on the conservation function of the physical and biological features.

The use of sonar, air guns, and explosives, and activities that produce vessel, aircraft, and weapons noise have a pathway to impact the physical and biological features of the reproductive and migratory portions of the proposed critical habitat from the mean high-water line to 20 m depth and the mean-high water line to 10 km offshore respectively. Activities that use sonars, air guns, and explosives, and activities that produce vessel noise, aircraft noise, and weapons noise are typically transient, and most sonar sources are outside of sea turtle hearing range which is most sensitive from 100–400 Hz and limited over 1 kHz. For reproductive habitat, training and testing activities would not obstruct nearshore waters adjacent to nesting beaches in the Hawaiian Archipelago, which are proposed as critical habitat by USFWS, for transit, mating, or internesting. For migratory habitat, activities would not restrict transit between benthic foraging/resting areas including North San Diego Bay and 10 km offshore, and reproductive areas from the Mexico border. The physical and biological features of benthic foraging/resting habitat from the mean high-water line to 20 m depth are underwater refugia and food resources of sufficient condition, distribution, diversity, abundance, and density to support survival, development, growth, and/or reproduction. The physical and biological features of benthic foraging/resting habitat would not be impacted by the sound from the use of sonars, air guns, and explosives, and activities that produce vessel, aircraft, and weapons noise.

The use of sonars and explosives, and activities that produce vessel, aircraft, and weapons noise during training activities may affect, but are not likely to adversely affect, proposed critical habitat for green sea turtles in the East Pacific DPS. Activities that involve the use of pile driving are not applicable to green sea turtle critical habitats because there is no geographic overlap of this stressor with those critical habitats. Air gun activities are not conducted during training.

The use of sonars, air guns, and explosives, and activities that produce vessel, aircraft, and weapons noise during testing activities may affect, but are not likely to adversely affect, proposed critical habitat for green sea turtles in the East Pacific DPS. Pile diving activities are not conducted during testing.

The use of sonars and explosives, and activities that produce vessel, aircraft, and weapons noise during training activities may affect, but are not likely to adversely affect, proposed critical habitat for green sea turtles in the Central North Pacific DPS. Activities that involve the use of pile driving are not applicable to green sea turtle critical habitats because there is no geographic overlap of this stressor with those critical habitats. Air gun activities are not conducted during training.

The use of sonars, air guns, and explosives, and activities that produce vessel, aircraft, and weapons noise during testing activities may affect, but are not likely to adversely affect, proposed critical habitat for green sea turtles in the Central North Pacific DPS. Pile diving activities are not conducted during testing.

Table 3.3-1: Estimated Effects to Green Sea Turtles (East Pacific DPS) over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Air gun	Navy Testing	-	(1)	-	-	-
Explosive	Navy Training	9	8	1	(1)	0
Explosive	Navy Testing	2	7	1	0	0
Sonar	Navy Testing	29	552	7	-	-
Maximum Annual Total		**40**	**568**	**9**	**1**	**0**

Season	Percent of Total Effects
	SOCAL
Warm	38%
Cold	62%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Acoustic and Oceanographic Research (ONR)	Navy Testing	90%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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Table 3.3-2: Estimated Effects to Green Sea Turtles (Central North Pacific DPS) over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Air gun	Navy Testing	-	(1)	-	-	-
Explosive	Navy Training	2,019	1,061	41	2	1
Explosive	Navy Testing	32	58	4	(1)	0
Explosive	Army Training	(1)	(1)	-	-	-
Sonar	Navy Testing	15	45	0	-	-
Maximum Annual Total		**2,067**	**1,166**	**45**	**3**	**1**
	Percent of Total Effects					

Source	Category	BEH	TTS	AINJ	INJ	MORT
Season			**HRC**			
Warm			53%			
Cold			47%			

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Obstacle Loading	Navy Training	83%
Underwater Demolition Qualification and Certification	Navy Training	8%

Area Type	Area Name (Active Months)	BEH	TTS	AINJ	INJ	MORT
Critical Habitat	Critical Habitat (All)	1,636	950	39	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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3.3.2 Hawksbill Sea Turtle (*Eretmochelys imbricata*) - Endangered

Hawksbill sea turtles are ESA-listed as endangered throughout their range with no designated DPSs. There is no critical habitat designated for the hawksbill sea turtle in the Study Area. Model-predicted impacts are presented in Table 3.3-3.

The hawksbill sea turtle is the most tropical of the world's sea turtles, rarely occurring above 35° N or below 30° south (Witzell, 1983) and therefore they only occur in the Hawaii Study Area and High Seas portions of the Study Area. After hatching, hawksbill sea turtles migrate to pelagic habitats where they take shelter in floating algal mats. After 1 to 5 years, juveniles migrate to shallower coastal feeding grounds, including their preferred coral reef habitats, where they mature to adulthood and spend the remainder of their lives. Within the Study Area, nesting occurs only in the Hawaiian Islands, with known nesting activities only at Hawaii, Maui, and Molokai Islands (Brunson et al., 2022). The Hawaiian population of hawksbills migrate relatively short distances and stay within the island chain.

Hawksbill sea turtles may be exposed to sonar, air guns, vessel noise, aircraft noise, weapons noise, and explosives associated with military readiness activities throughout the year. Pile driving activities in Port Hueneme do not overlap with hawksbill sea turtle presence in the Hawaii Study Area and High Seas portions of the Study Area. Analysis of the impacts from vessel noise, aircraft noise, and weapons noise on hawksbill sea turtles relies on the information under the respective acoustic substressor in Section 3.1 (Impacts Due to Each Acoustic Substressor and Explosives).

Results from the Navy Acoustics Effects Model (Table 3.3-3) shows that hawksbill sea turtles in the Study Area may exhibit behavioral reactions, TTS, and AINJ from sonar and explosives over the course of a year. No impacts were estimated to occur from the use of air guns during training activities.

For hawksbill sea turtles, the largest contributor of impacts from sonar are due to Acoustic and Oceanographic Research for testing activities, with more impacts during the warm season. The largest contributor of impacts from explosives are due to Obstacle Loading for training activities, with more impacts during the warm season, and Underwater Demolition Qualification and Certification for training activities with more impacts during the warm season.

Estimated behavioral and TTS impacts from sonar and explosives are expected to be short term and would not result in substantial changes to behavior, growth, survival, annual reproductive success, lifetime reproductive success, or species recruitment, for an individual and would not result in population-level impacts. Low levels of estimated AINJ from explosives may have deleterious effects on the fitness of an individual turtle but are not expected to impact the fitness of enough individuals to cause population level effects.

Based on the analysis presented above, the use of sonars and activities that produce vessel, aircraft, and weapons noise during training activities may affect, but are not likely to adversely affect, hawksbill sea turtles. The use of explosives during training activities may affect, and are likely to adversely affect, hawksbill sea turtles. Activities that involve the use of pile driving are not applicable to hawksbill sea turtles because there is no geographic overlap of this stressor with species occurrence. Air gun activities are not conducted during training.

Based on the analysis presented above, the use of air guns and activities that produce vessel, aircraft, and weapons noise during testing activities may affect, but are not likely to adversely affect, hawksbill sea turtles. The use of sonars and explosives during testing activities may affect, and are likely to adversely affect, hawksbill sea turtles. Pile diving activities are not conducted during testing.

Table 3.3-3: Estimated Effects to Hawksbill Sea Turtles over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Explosive	Navy Training	18	10	(1)	-	-
Explosive	Navy Testing	0	1	0	-	-
Explosive	Army Training	-	(1)	-	-	-
Sonar	Navy Testing	1	6	0	-	-
Maximum Annual Total		**19**	**18**	**1**	**-**	**-**

Season	Percent of Total Effects	
	HRC	High Seas
Warm	56%	0%
Cold	42%	1%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Obstacle Loading	Navy Training	69%
Acoustic and Oceanographic Research (ONR)	Navy Testing	16%
Underwater Demolition Qualification and Certification	Navy Training	7%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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3.3.3 Loggerhead Sea Turtle (*Caretta caretta*) - Endangered

Loggerhead sea turtles from the North Pacific Ocean DPS are in the Study Area and are ESA-listed as endangered throughout their range. There is no critical habitat designated for the loggerhead sea turtle in the Study Area. Model-predicted impacts are presented in Table 3.3-4.

Loggerhead sea turtles occur in U.S. waters in habitats ranging from coastal estuaries to waters far beyond the continental shelf (Dodd, 1988; Martin et al., 2020). The species can be found hundreds of kilometers out to sea, as well as in inshore areas, such as bays, lagoons, salt marshes, creeks, ship channels, and the mouths of large rivers. Coral reefs, rocky areas, and shipwrecks are often used as feeding areas. The nearshore zone provides crucial foraging habitat, as well as habitat during the nesting season and overwintering habitat. Offshore, juvenile loggerheads forage in or migrate through the North Pacific Subtropical Gyre as they move between North American developmental habitats and nesting beaches in Japan. The highest densities of loggerheads can be found just north of Hawaii in the North Pacific Transition Zone (Briscoe et al., 2021; Polovina et al., 2000). The loggerhead sea turtle does not nest on Southern California beaches but is known to forage off the coast of the BCPM and may occur offshore of Southern California during anomalously warm water temperatures.

Loggerhead sea turtles may be exposed to sonar, air guns, vessel noise, aircraft noise, weapons noise, and explosives associated with military readiness activities throughout the year. Loggerhead sea turtles would not overlap with pile driving activities in Port Hueneme, therefore, impacts from pile driving to loggerhead sea turtles are not further analyzed. Analysis of the impacts from vessel noise, aircraft noise, and weapons noise on loggerhead sea turtles relies on the information under the respective acoustic substressor in Section 3.1 (Impacts Due to Each Acoustic Substressor and Explosives).

Results from the Navy Acoustics Effects Model (Table 3.3-4) shows that loggerhead sea turtles in the Study Area may exhibit behavioral reactions, TTS, and AINJ from sonar and explosives, and non-auditory injury from explosives over the course of a year. No impacts were estimated to occur from the use of air guns during training activities.

For loggerhead sea turtles, the largest contributors of impacts from sonar are Acoustic and Oceanographic Research for testing activities, with more impacts during the warm season, and Vehicle Testing for testing activities, with more impacts during the warm season. The largest contributor of impacts from explosives are Mine Neutralization Explosive Ordnance Disposal for training activities with impacts during the warm season only.

Estimated behavioral and TTS impacts from sonar and explosives are expected to be short term and would not result in substantial changes to behavior, growth, survival, annual reproductive success, lifetime reproductive success, or species recruitment, for an individual and would not result in population-level impacts. Low levels of estimated AINJ from sonar and explosives, and injuries from explosives may have deleterious effects on the fitness of an individual turtle but are not expected to impact the fitness of enough individuals to cause population level effects.

Based on the analysis presented above, activities that produce vessel, aircraft, and weapons noise during training activities <u>may affect, but are not likely to adversely affect,</u> loggerhead sea turtles in the North Pacific DPS. The use of sonars and explosives during training activities <u>may affect, and are likely to adversely affect,</u> loggerhead sea turtles in the North Pacific DPS. Activities that involve the use of pile driving are <u>not applicable</u> to loggerhead sea turtles in the North Pacific DPS because there is no geographic overlap of this stressor with species occurrence. Air gun activities are not conducted during training.

Based on the analysis presented above, the use of air guns and activities that produce vessel, aircraft, and weapons noise during testing activities <u>may affect, but are not likely to adversely affect,</u> loggerhead sea turtles in the North Pacific DPS. The use of sonars and explosives during testing activities <u>may affect, and are likely to adversely affect,</u> loggerhead sea turtles in the North Pacific DPS. Pile diving activities are not conducted during testing.

Table 3.3-4: Estimated Effects to Loggerhead Sea turtles over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Explosive	Navy Training	36	60	3	(1)	0
Explosive	Navy Testing	31	82	3	1	0
Explosive	USCG Training	0	0	-	-	-
Explosive	Army Training	(1)	1	-	-	-
Sonar	Navy Training	1	(1)	-	-	-

Source	Category	BEH	TTS	AINJ	INJ	MORT
Sonar	Navy Testing	55	516	3	-	-
Maximum Annual Total		**124**	**660**	**9**	**2**	**0**

Season	Percent of Total Effects			
	SOCAL	PMSR	HRC	High Seas
Warm	56%	11%	14%	2%
Cold	0%	0%	16%	2%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Acoustic and Oceanographic Research (ONR)	Navy Testing	67%
Vehicle Testing	Navy Testing	7%
Mine Neutralization Explosive Ordnance Disposal	Navy Training	6%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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3.3.4 Olive Ridley Sea Turtle (*Lepidochelys olivacea*) – Threatened, Endangered

Olive ridley sea turtles that nest along the Pacific coast of Mexico are listed as endangered under the ESA, while all other populations are listed under the ESA as threatened. Olive ridley sea turtles do not have designated DPSs, and do not have designated critical habitat in the Study Area. Model-predicted impacts are presented in Table 3.3-5.

The olive ridley has a circumtropical distribution, occurring in the Atlantic, Pacific, and Indian Oceans (National Marine Fisheries Service & U.S. Fish and Wildlife Service, 2014). In the eastern Pacific, olive ridleys typically occur in tropical and subtropical waters, as far south as Peru and as far north as California, but occasionally have been documented as far north as Alaska. The olive ridley is mainly a pelagic sea turtle but they also inhabit coastal areas.

Olive ridley sea turtles may be exposed to sonar, air guns, vessel noise, aircraft noise, weapons noise, and explosives associated with military readiness activities throughout the year. Olive ridley sea turtles would not overlap with pile driving activities in Port Hueneme, therefore, impacts from pile driving to olive ridley sea turtles are not further analyzed. Analysis of the impacts from vessel noise, aircraft noise, and weapons noise on olive ridley sea turtles relies on the information under the respective acoustic substressor in Section 3.1 (Impacts Due to Each Acoustic Substressor and Explosives).

Results from the Navy Acoustics Effects Model (Table 3.3-5) shows that olive ridley sea turtles in the Study Area may exhibit behavioral reactions, TTS, and AINJ from sonar and explosives over the course of a year. No impacts were estimated to occur from the use of air guns during training activities.

For olive ridley sea turtles, the largest contributors of impacts from sonar are due to Acoustic and Oceanographic Research for testing activities, with more impacts during the cold season, and Vehicle Testing for testing activities, with more impacts during the warm season. The largest contributor of impacts from explosives are due to Naval Surface Fire Support Exercise for training activities, with impacts occurring equally during the warm and cold seasons.

Estimated behavioral and TTS impacts from sonar and explosives are expected to be short term and would not result in substantial changes to behavior, growth, survival, annual reproductive success, lifetime reproductive success, or species recruitment, for an individual and would not result in population-level impacts. Low levels of estimated AINJ from sonar and explosives may have deleterious effects on the fitness of an individual turtle but are not expected to impact the fitness of enough individuals to cause population level effects.

Based on the analysis presented above, the use of sonars and activities that produce vessel, aircraft, and weapons noise during training activities may affect, but are not likely to adversely affect, olive ridley sea turtles. The use of explosives during training activities may affect, and are likely to adversely affect, olive ridley sea turtles. Activities that involve the use of pile driving are not applicable to olive ridley sea turtles because there is no geographic overlap of this stressor with species occurrence. Air gun activities are not conducted during training.

Based on the analysis presented above, the use of air guns and activities that produce vessel, aircraft, and weapons noise during testing activities may affect, but are not likely to adversely affect, olive ridley sea turtles. The use of sonars and explosives during testing activities may affect, and are likely to adversely affect, olive ridley sea turtles. Pile diving activities are not conducted during testing.

Table 3.3-5: Estimated Effects to Olive Ridley Sea Turtles over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Explosive	Navy Training	2	5	(1)	0	-
Explosive	Navy Testing	(1)	2	(1)	-	-
Explosive	USCG Training	0	-	-	-	-
Explosive	Army Training	(1)	2	(1)	-	-
Sonar	Navy Testing	27	194	1	-	-
Maximum Annual Total		**31**	**203**	**4**	**0**	**-**

Season	Percent of Total Effects: HRC	Percent of Total Effects: High Seas
Warm	44%	5%
Cold	46%	5%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Acoustic and Oceanographic Research (ONR)	Navy Testing	83%
Vehicle Testing	Navy Testing	12%

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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3.3.5 Leatherback Sea Turtle (*Dermochlys coriacea*) - Endangered

Leatherback sea turtles are ESA-listed as endangered throughout their range with no designated DPSs. There is designated critical habitat for the leatherback sea turtle in the Study Area. Model-predicted impacts are presented in Table 3.3-6.

The leatherback sea turtle is distributed worldwide in tropical and temperate waters of the Atlantic, Pacific, and Indian Oceans. Pacific leatherbacks are split into western and eastern Pacific subpopulations based on their distribution and biological and genetic characteristics. Only western Pacific leatherbacks are expected to be found within the Study Area (National Marine Fisheries Service, 2018b). The leatherback sea turtle occurs in offshore areas surrounding the Hawaiian Islands beyond the 100 m isobath and rarely occur inshore of this isobath. Leatherback sea turtles are regularly seen off the western coast of the United States, with the greatest densities found in waters off central California where sea surface temperatures are highest during the summer and fall. These warmer temperatures and other oceanographic conditions create favorable habitat for leatherback sea turtle prey.

Leatherback sea turtles may be exposed to sonar, air guns, vessel noise, aircraft noise, weapons noise, and explosives associated with military readiness activities throughout the year. Leatherback sea turtles would not overlap with pile driving activities in Port Hueneme, therefore, impacts from pile driving to leatherback sea turtles are not further analyzed. Analysis of the impacts from vessel noise, aircraft noise, and weapons noise on green turtles relies on the information under the respective acoustic substressor in Section 3.1 (Impacts Due to Each Acoustic Substressor and Explosives).

Results from the Navy Acoustics Effects Model (Table 3.3-6) shows that leatherback sea turtles in the Study Area may exhibit behavioral reactions, TTS, and AINJ from sonar and explosives over the course of a year. No impacts were estimated to occur from the use of air guns during training activities.

For leatherback sea turtles, the largest contributor of impacts from sonar are due to Acoustic and Oceanographic Research for testing activities, with more impacts during the cold season. The largest contributor of impacts from explosives are due to Small Ship Shock Trial for testing activities, with impacts during the cold season only. The largest contributor of impacts in designated critical habitat is from the use of sonar during Acoustic and Oceanographic Research for testing activities during the cold season.

Estimated behavioral and TTS impacts from sonar and explosives are expected to be short term and would not result in substantial changes to behavior, growth, survival, annual reproductive success, lifetime reproductive success, or species recruitment, for an individual and would not result in population-level impacts. Low levels of estimated AINJ from sonar and explosives may have deleterious effects on the fitness of an individual turtle but are not expected to impact the fitness of enough individuals to cause population level effects.

Based on the analysis presented above, the use of sonars and activities that produce vessel, aircraft, and weapons noise during training activities <u>may affect, but are not likely to adversely affect,</u> leatherback sea turtles. The use of explosives during training activities <u>may affect, and are likely to adversely affect,</u> leatherback sea turtles. Activities that involve the use of pile driving are <u>not applicable</u> to leatherback sea turtles because there is no geographic overlap of this stressor with species occurrence. Air gun activities are not conducted during training.

Based on the analysis presented above, the use of air guns and activities that produce vessel, aircraft, and weapons noise during testing activities <u>may affect, but are not likely to adversely affect,</u> leatherback sea turtles. The use of sonars and explosives during testing activities <u>may affect, and are likely to adversely affect,</u> leatherback sea turtles. Pile diving activities are not conducted during testing.

<u>Critical Habitat</u>

Critical habitat designated for the leatherback sea turtle includes approximately 16,910 square miles (43,798 square km) along the California coast from Point Arena to Point Arguello east of the 3,000-meter depth contour; and 25,004 square miles (64,760 square km) from Cape Flattery, Washington to Cape Blanco, Oregon east of the 2,000-meter depth contour. The designated areas comprise approximately 41,914 square miles (108,558 square km) of marine habitat and include waters from the ocean surface down to a maximum depth of 262 feet (80 m) (National Marine Fisheries Service, 2012). The physical and biological features essential for the conservation of leatherback sea turtles in marine waters off the U.S. West Coast is the occurrence of prey species, primarily *scyphomedusae* of the order *Semaeostomeae* (e.g., *Chrysaora*, *Aurelia*, *Phacellophora*, and *Cyanea*), of sufficient condition, distribution, diversity, abundance, and density necessary to support individual as well as population growth, reproduction, and development of leatherback sea turtles. This critical habitat designation overlaps with the California portion of the Study Area and noise from sonars, air guns, explosives and vessels, aircraft, and weapons firing. Pile driving activities in Port Hueneme do not overlap with critical habitat designated for the leatherback sea turtle in the California portion of the Study Area. Although use of explosives could kill individuals of identified prey species, these impacts would be localized and infrequent. Noise due to other acoustic stressors would not affect prey condition, distribution, diversity, abundance, or density.

The use of sonars and explosives, and activities that produce vessel, aircraft, and weapons noise during training activities may affect, but are not likely to adversely affect, designated critical habitat for leatherback sea turtles. Activities that involve the use of pile driving are not applicable to leatherback sea turtle critical habitats because there is no geographic overlap of this stressor with those critical habitats. Air gun activities are not conducted during training.

The use of sonars, air guns, and explosives, and activities that produce vessel, aircraft, and weapons noise during testing activities may affect, but are not likely to adversely affect, designated critical habitat for leatherback sea turtles. Pile diving activities are not conducted during testing.

Table 3.3-6: Estimated Effects to Leatherback Sea turtles over a Maximum Year of Proposed Activities

Source	Category	BEH	TTS	AINJ	INJ	MORT
Explosive	Navy Training	3	2	(1)	-	-
Explosive	Navy Testing	2	5	(1)	0	-
Explosive	Army Training	(1)	(1)	(1)	0	-
Sonar	Navy Training	0	0	-	-	-
Sonar	Navy Testing	39	334	2	-	-
Maximum Annual Total		**45**	**342**	**5**	**0**	**-**

Season	Percent of Total Effects			
	SOCAL	NOCAL	HRC	High Seas
Warm	13%	14%	15%	4%
Cold	17%	16%	17%	4%

Activities Causing 5 Percent or More of Total Effects	Category	Percent of Total Effects
Acoustic and Oceanographic Research (ONR)	Navy Testing	87%
Vehicle Testing	Navy Testing	10%

Area Type	Area Name (Active Months)	BEH	TTS	AINJ	INJ	MORT
Critical Habitat	CA Coastal Marine Waters (All)	0	16	0	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
For BEH, TTS, AINJ, INJ, MORT annual effects: Dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Asterisk (*) indicates no reliable abundance estimate is available.
See beginning of Section 2.4 for full explanation of table sections.
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3.3.6 Impact Summary Tables

The tables in in this section show impacts on all species for the following:

- Maximum annual and seven-year total impacts due to sonar use during Navy training activities and during Navy testing activities. Stocks for which no take is requested are not shown. The maximum annual impacts per species are the same values presented in each species impact assessment above. See Table 3.3-7 through Table 3.3-10.
- Maximum annual and seven-year total impacts due to air gun use during Navy testing activities. Stocks for which no take is requested are not shown. Note that no air gun use is proposed during training activities. See Table 3.3-11 and Table 3.3-12.

- Maximum annual and seven-year total impacts due to explosives during Navy training activities, during Navy testing activities (including Ship Shock Trials), during Coast Guard training activities, and during Army training activities. Stocks for which no take is requested are not shown. Consistent with previous analyses, the impacts due to a maximum year of Ship Shock Trials (one event) are also shown separately. See Table 3.3-13 through Table 3.3-20.
- Maximum annual and seven-year total impacts due to Small Ship Shock Trials, part of Navy testing. Stocks for which no take is requested are not shown. Note that these results are included in the overall explosive results but broken out in these tables for clarity. See Table 3.3-21.

The seven-year impacts are created by summing seven years of impacts considering any variation in the annual levels of activities and including any fractional values. The final summed seven-year value is then rounded following standard rounding rules. That is, the seven-year impacts are not the result of summing the rounded annual results. If a seven-year sum was larger than multiplying the rounded maximum annual value by seven, the Navy increased the annual maximum value above the value predicted by the model results. This was done by dividing the seven-year sum of impacts by seven then rounding up, rather than following standard rounding rules, to estimate the annual impacts. For example, this could happen if maximum annual results are 1.34 (rounds to 1 annually) and seven-year results are 8.60 (rounds to 9), where 9 over seven years is greater than seven times 1. In this instance, the maximum annual impacts would be adjusted from one to two based on rounding up the quotient of dividing the seven-year impacts by seven. In no cases does implementing this approach result in reducing the impacts predicted by the Navy's Acoustic Effects Model.

3.3.6.1 Sonar Impact Summary Tables

Table 3.3-7: Estimated Effects to Sea Turtles from Sonar and Other Active Transducers Over One Year of Maximum Navy Training

Species	Stock or Population	BEH	TTS	AINJ
ESA-Listed				
Leatherback sea turtle	Primary	0	0	-
Loggerhead sea turtle	North Pacific DPS	1	(1)	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury
A dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Stocks are not shown if no effects are estimated.
Nsd = No stock designation under MMPA.
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Table 3.3-8 Estimated Effects to Sea Turtles from Sonar and Other Active Transducers Over Seven Years of Navy Training

Species	Stock or Population	BEH	TTS	AINJ
ESA-Listed				
Leatherback sea turtle	Primary	0	0	-
Loggerhead sea turtle	North Pacific DPS	5	1	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury
A dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Stocks are not shown if no effects are estimated.
Nsd = No stock designation under MMPA.
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Table 3.3-9: Estimated Effects to Sea Turtles from Sonar and Other Active Transducers Over One Year of Maximum Navy Testing

Species	Stock or Population	BEH	TTS	AINJ
ESA-Listed				
Green sea turtle	East Pacific DPS	29	552	7
	Central North Pacific DPS	15	45	0
Hawksbill sea turtle	Primary	1	6	0
Leatherback sea turtle	Primary	39	334	2
Loggerhead sea turtle	North Pacific DPS	55	516	3
Olive ridley sea turtle	Primary	27	194	1

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury
A dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Stocks are not shown if no effects are estimated.
Nsd = No stock designation under MMPA.
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Table 3.3-10: Estimated Effects to Sea Turtles from Sonar and Other Active Transducers Over Seven Years of Navy Testing

Species	Stock or Population	BEH	TTS	AINJ
ESA-Listed				
Green sea turtle	East Pacific DPS	202	3,419	44
	Central North Pacific DPS	96	278	0
Hawksbill sea turtle	Primary	3	35	0
Leatherback sea turtle	Primary	190	2,069	14
Loggerhead sea turtle	North Pacific DPS	321	3,204	18
Olive ridley sea turtle	Primary	134	1,202	7

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury
A dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Stocks are not shown if no effects are estimated.
Nsd = No stock designation under MMPA.
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3.3.6.2 Air Gun Impact Summary Tables

Table 3.3-11: Estimated Effects to Sea Turtles from Air Guns Over One Year of Maximum Navy Testing

Species	Stock or Population	BEH	TTS	AINJ
ESA-Listed				
Green sea turtle	East Pacific DPS	-	(1)	-
	Central North Pacific DPS	-	(1)	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury
A dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Stocks are not shown if no effects are estimated.
Nsd = No stock designation under MMPA.
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Table 3.3-12: Estimated Effects to Sea Turtles from Air Guns Over Seven Years of Navy Testing

Species	Stock or Population	BEH	TTS	AINJ
ESA-Listed				
Green sea turtle	East Pacific DPS	-	2	-
	Central North Pacific DPS	-	1	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury
A dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Stocks are not shown if no effects are estimated.
Nsd = No stock designation under MMPA.
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3.3.6.3 Explosives Impact Summary Tables

Table 3.3-13: Estimated Effects to Sea Turtles from Explosives Over One Year of Maximum Navy Training

Species	Stock or Population	BEH	TTS	AINJ	INJ	MORT
ESA-Listed						
Green sea turtle	East Pacific DPS	9	8	1	1	0
	Central North Pacific DPS	2,019	1,061	41	2	1
Hawksbill sea turtle	Primary	18	10	(1)	-	-
Leatherback sea turtle	Primary	3	2	(1)	-	-
Loggerhead sea turtle	North Pacific DPS	36	60	3	1	0
Olive ridley sea turtle	Primary	2	5	(1)	0	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
A dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Stocks are not shown if no effects are estimated.
Nsd = No stock designation under MMPA.
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Table 3.3-14: Estimated Effects to Sea Turtles from Explosives Over Seven Years of Navy Training

Species	Stock or Population	BEH	TTS	AINJ	INJ	MORT
ESA-Listed						
Green sea turtle	East Pacific DPS	61	51	4	1	0
	Central North Pacific DPS	14,059	7,334	284	10	5
Hawksbill sea turtle	Primary	122	70	2	-	-
Leatherback sea turtle	Primary	19	10	1	-	-
Loggerhead sea turtle	North Pacific DPS	234	397	17	2	0
Olive ridley sea turtle	Primary	13	29	1	0	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
A dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Stocks are not shown if no effects are estimated.
Nsd = No stock designation under MMPA.
version.20241108

Table 3.3-15: Estimated Effects to Sea Turtles from Explosives Over One Year of Maximum Navy Testing

Species	Stock or Population	BEH	TTS	AINJ	INJ	MORT
ESA-Listed						
Green sea turtle	East Pacific DPS	2	7	1	0	0
	Central North Pacific DPS	32	58	4	1	0
Hawksbill sea turtle	Primary	0	1	0	-	-
Leatherback sea turtle	Primary	2	5	(1)	0	-

Species	Stock or Population	BEH	TTS	AINJ	INJ	MORT
Loggerhead sea turtle	North Pacific DPS	31	82	3	1	0
Olive ridley sea turtle	Primary	(1)	2	(1)	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
A dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Stocks are not shown if no effects are estimated.
Nsd = No stock designation under MMPA.
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Table 3.3-16: Estimated Effects to Sea Turtles from Explosives Over Seven Years of Navy Testing

Species	Stock or Population	BEH	TTS	AINJ	INJ	MORT
ESA-Listed						
Green sea turtle	East Pacific DPS	12	33	6	0	0
	Central North Pacific DPS	222	321	19	1	0
Hawksbill sea turtle	Primary	0	3	0	-	-
Leatherback sea turtle	Primary	10	15	2	0	-
Loggerhead sea turtle	North Pacific DPS	207	300	14	5	0
Olive ridley sea turtle	Primary	2	9	2	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
A dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Stocks are not shown if no effects are estimated.
Nsd = No stock designation under MMPA.
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Table 3.3-17: Estimated Effects to Sea Turtles from Explosives Over One Year of Maximum Coast Guard Training

Species	Stock or Population	BEH	TTS	AINJ	INJ	MORT
ESA-Listed						
Loggerhead sea turtle	North Pacific DPS	0	0	-	-	-
Olive ridley sea turtle	Primary	0	-	-	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
A dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Stocks are not shown if no effects are estimated.
Nsd = No stock designation under MMPA.
version.20241108

Table 3.3-18: Estimated Effects to Sea Turtles from Explosives Over Seven Years of Coast Guard Training

Species	Stock or Population	BEH	TTS	AINJ	INJ	MORT
ESA-Listed						
Loggerhead sea turtle	North Pacific DPS	0	0	-	-	-
Olive ridley sea turtle	Primary	0	-	-	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
A dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Stocks are not shown if no effects are estimated.
Nsd = No stock designation under MMPA.
version.20241108

Table 3.3-19: Estimated Effects to Sea Turtles from Explosives Over One Year of Maximum Army Training

Species	Stock or Population	BEH	TTS	AINJ	INJ	MORT
ESA-Listed						
Green sea turtle	Central North Pacific DPS	(1)	(1)	-	-	-
Hawksbill sea turtle	Primary	-	(1)	-	-	-
Leatherback sea turtle	Primary	(1)	(1)	(1)	0	-
Loggerhead sea turtle	North Pacific DPS	(1)	1	-	-	-
Olive ridley sea turtle	Primary	(1)	2	(1)	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
A dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Values in parentheses are rounded up from less than 0.5 based on the 7-year rounding rules discussed in Section 2.4.
Stocks are not shown if no effects are estimated.
Nsd = No stock designation under MMPA.
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Table 3.3-20: Estimated Effects to Sea Turtles from Explosives Over Seven Years of Army Training

Species	Stock or Population	BEH	TTS	AINJ	INJ	MORT
ESA-Listed						
Green sea turtle	Central North Pacific DPS	2	1	-	-	-
Hawksbill sea turtle	Primary	-	1	-	-	-
Leatherback sea turtle	Primary	1	2	1	0	-
Loggerhead sea turtle	North Pacific DPS	2	6	-	-	-
Olive ridley sea turtle	Primary	1	12	2	-	-

BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
A dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Stocks are not shown if no effects are estimated.
Nsd = No stock designation under MMPA.
version.20241108

Table 3.3-21: Estimated Effects to Sea Turtles from Small Ship Shock Trials over a Maximum Year of Navy Testing (1 Event)

Species	Stock	TTS	AINJ	INJ	MORT
ESA-Listed					
Green sea turtle	East Pacific DPS	2	-	-	-
Leatherback sea turtle	Primary	3	-	-	-
Loggerhead sea turtle	North Pacific DPS	42	1	0	0

TTS = Temporary Threshold Shift, AINJ = Auditory Injury, INJ = Non-Auditory Injury, MORT = Mortality
A dash (-) indicates a (true zero), and zero (0) indicates a rounded value less than 0.5.
Stocks are not shown if no effects are estimated.
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3.4 Range to Effects

The following section provides the range (distance) over which specific physiological or behavioral effects are expected to occur based on the acoustic and explosive criteria in the *Criteria and Thresholds TR*, and the acoustic and explosive propagation calculations from the Navy Acoustic Effects Model described in the *Quantitative Analysis TR*. The ranges to effects are shown for representative sonar systems, air guns, and explosive bins from E1 (0.1–0.25 lb. NEW) to E16 (>7,500–14,500 lb. NEW). Ranges are determined by modeling the distance that noise from a source will need to propagate to reach exposure level thresholds specific to a hearing group that will cause behavioral response, TTS, AINJ, non-auditory injury, and mortality. Ranges to effects were calculated for sea turtle species only and are utilized to help predict impacts from acoustic and explosive sources and assess the benefit of mitigation zones.

Tables present median and standard deviation ranges to effects for each hearing group, source or bin, bathymetric depth intervals of ≤200 m and >200 m to represent areas on an off the continental shelf, exposure duration (sonar), and representative cluster size (air guns and explosives). Ranges to effects consider propagation effects of sources modeled at different locations (i.e., analysis points), seasons, source depths, and radials (i.e., each analysis point considers propagation effects in different x-y directions by modeling 18 radials in azimuthal increments of 20° to obtain 360° coverage around an analysis point).

Boxplots visually present the distribution, variance, and outlier ranges for a given combination of a source or bin, hearing group, and effect. On the boxplots, outliers are plotted as dots, the lowest and highest non-outlier ranges are the extent of the left and right horizontal lines respectively that extend from the sides of a colored box, and the 25th, 50th (i.e., median), and 75th percentiles are the left edge, center line, and right edge of a colored box respectively.

3.4.1 Range to Effects for Sonars and Other Transducers

The six representative sonar systems with ranges to effects are not applicable to reptiles since they produce sound at frequencies greater than the upper hearing range of reptiles (i.e., > 2 kHz).

3.4.2 Range to Effects for Air Guns

Ranges to effects for air guns were determined by modeling the distance that sound would need to propagate to reach exposure level thresholds specific to a hearing group that would cause behavioral response, TTS, and AINJ, as described in the *Criteria and Thresholds TR*. The air gun ranges to effects for TTS and AINJ that are in the tables are based on the metric (i.e., SEL or SPL) that produced longer ranges.

Table 3.4-1: Sea Turtle Ranges to Effects for Air Guns

Bin	Depth	Cluster Size	BEH	TTS	AINJ
Air Gun	≤200 m	1	NA	2 m (0 m)	1 m (0 m)
		10	20 m (1 m)	60 m (3 m)	11 m (0 m)
	>200 m	1	NA	2 m (0 m)	1 m (0 m)
		10	20 m (1 m)	60 m (3 m)	11 m (0 m)

Median ranges with standard deviation ranges in parentheses, TTS and AINJ = the greater of respective SPL and SEL ranges
BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, NA = not applicable
Table Created: 05 Aug 2024 4:03:02 PM

3.4.3 Range to Effects for Pile Driving

Pile driving activities in Port Hueneme are not applicable to reptiles due to a lack of geographic overlap.

3.4.4 Range to Effects for Explosives

Ranges to effects for explosives were determined by modeling the distance that noise from an explosion would need to propagate to reach exposure level thresholds specific to a hearing group that would cause behavioral response, TTS, AINJ, non-auditory injury, and mortality, as described in the *Criteria and Thresholds TR*.

The Navy Acoustic Effects Model cannot account for the highly non-linear effects of cavitation and surface blow off for shallow underwater explosions, nor can it estimate the explosive energy entering the water from a low-altitude detonation. Thus, for this analysis, in-air sources detonating at or near (within 10 m) the surface are modeled as if detonating completely underwater at a source depth of 0.1 m, with all energy reflected into the water rather than released into the air. Therefore, the amount of explosive and acoustic energy entering the water, and consequently the estimated ranges to effects, are likely to be overestimated. In the tables below, near surface explosions can occur for bathymetric depth intervals of ≤200 m and >200 m.

The tables below provide the ranges for a representative cluster size for each bin. Ranges for behavioral response are only provided if more than one explosive cluster occurs. Single explosions at received sound levels below TTS and AINJ thresholds are most likely to result in a brief alerting or orienting response. Due to the lack of subsequent explosions, a significant behavioral response is not expected for a single explosive cluster. For events with multiple explosions, sound from successive explosions can be expected to accumulate and increase the range to the onset of an impact based on SEL thresholds. Modeled ranges to TTS and AINJ based on peak pressure for a single explosion generally exceed the modeled ranges based on SEL even when accumulated for multiple explosions. Peak pressure-based ranges are estimated using the best available science; however, data on peak pressure at far distances from explosions are very limited. The explosive ranges to effects for TTS and AINJ that are in the tables are based on the metric (i.e., SEL or SPL) that produced longer ranges.

For non-auditory injury in the tables, the larger of the range to slight lung injury or gastrointestinal tract injury was used as a conservative estimate, and the boxplots present ranges for both metrics for comparison. Animals within water volumes encompassing the estimated range to non-auditory injury would be expected to receive minor injuries at the outer ranges, increasing to more substantial injuries, and finally mortality as an animal approaches the detonation point.

Table 3.4-2: Sea Turtle Ranges to Effects for Explosives

Bin	Depth	Cluster Size	BEH	TTS	AINJ
E1	≤200 m	1	NA	71 m (2 m)	43 m (4 m)
		5	100 m (153 m)	71 m (2 m)	43 m (4 m)
		25	324 m (319 m)	134 m (208 m)	43 m (4 m)
		50	247 m (142 m)	141 m (96 m)	43 m (4 m)
	>200 m	1	NA	71 m (2 m)	43 m (4 m)
		5	90 m (81 m)	71 m (2 m)	43 m (4 m)
		25	230 m (178 m)	90 m (103 m)	43 m (4 m)
		50	440 m (223 m)	270 m (148 m)	43 m (4 m)
E2	≤200 m	1	NA	100 m (11 m)	56 m (7 m)
	>200 m	1	NA	101 m (11 m)	57 m (7 m)
E3	≤200 m	1	NA	156 m (17 m)	82 m (9 m)
		5	542 m (433 m)	286 m (298 m)	82 m (9 m)

Bin	Depth	Cluster Size	BEH	TTS	AINJ
		25	1,044 m (523 m)	656 m (379 m)	82 m (9 m)
	>200 m	1	NA	270 m (118 m)	81 m (8 m)
		5	520 m (268 m)	270 m (175 m)	81 m (8 m)
		25	432 m (126 m)	270 m (79 m)	81 m (8 m)
E4	≤200 m	1	NA	757 m (331 m)	127 m (14 m)
	>200 m	1	NA	433 m (64 m)	123 m (15 m)
E5	≤200 m	1	NA	249 m (37 m)	130 m (19 m)
		5	901 m (444 m)	465 m (273 m)	130 m (19 m)
	>200 m	1	NA	250 m (172 m)	126 m (18 m)
		5	929 m (557 m)	550 m (327 m)	126 m (18 m)
		20	2,500 m (635 m)	1,583 m (490 m)	320 m (145 m)
E6	≤200 m	1	NA	1,207 m (815 m)	210 m (206 m)
		15	4,133 m (1,046 m)	3,232 m (643 m)	996 m (118 m)
	>200 m	1	NA	632 m (296 m)	209 m (21 m)
E7	≤200 m	1	NA	601 m (323 m)	179 m (30 m)
	>200 m	1	NA	949 m (483 m)	176 m (34 m)
E8	≤200 m	1	NA	1,186 m (137 m)	314 m (67 m)
	>200 m	1	NA	1,191 m (154 m)	308 m (66 m)
E9	≤200 m	1	NA	1,683 m (843 m)	345 m (322 m)
	>200 m	1	NA	1,500 m (827 m)	342 m (51 m)
E10	≤200 m	1	NA	2,276 m (445 m)	511 m (126 m)
	>200 m	1	NA	2,243 m (445 m)	499 m (117 m)
E11	≤200 m	1	NA	4,528 m (1,177 m)	957 m (106 m)
	>200 m	1	NA	4,472 m (1,363 m)	915 m (117 m)
E12	≤200 m	1	NA	2,758 m (452 m)	583 m (91 m)
	>200 m	1	NA	2,396 m (355 m)	604 m (96 m)

Median ranges with standard deviation ranges in parentheses, TTS and AINJ = the greater of respective SPL and SEL ranges, behavioral response criteria are applied to explosive clusters >1
BEH = Significant Behavioral Response, TTS = Temporary Threshold Shift, AINJ = Auditory Injury, NA = not applicable
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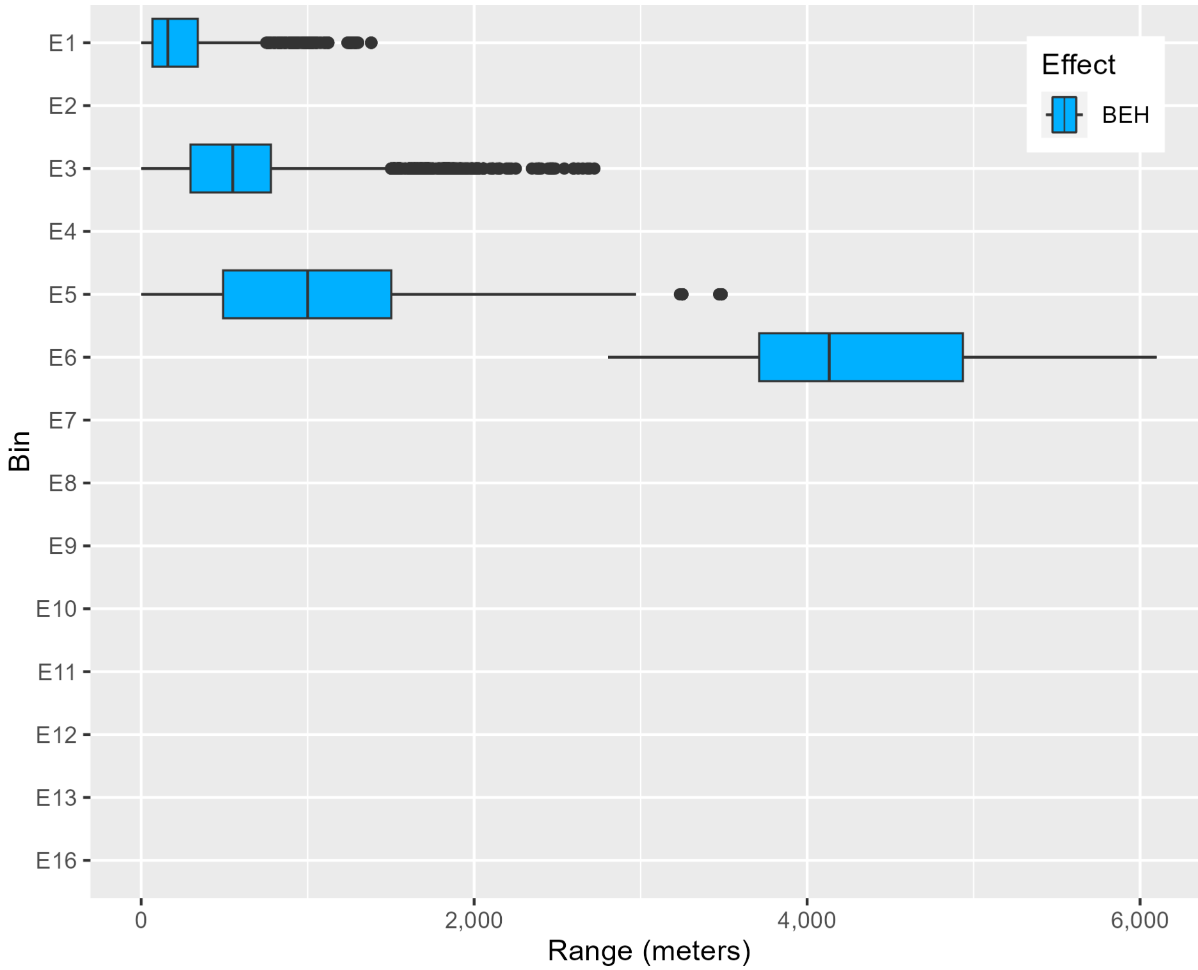

Figure 3.4-1: Sea Turtle Ranges to Behavioral Response for Explosives

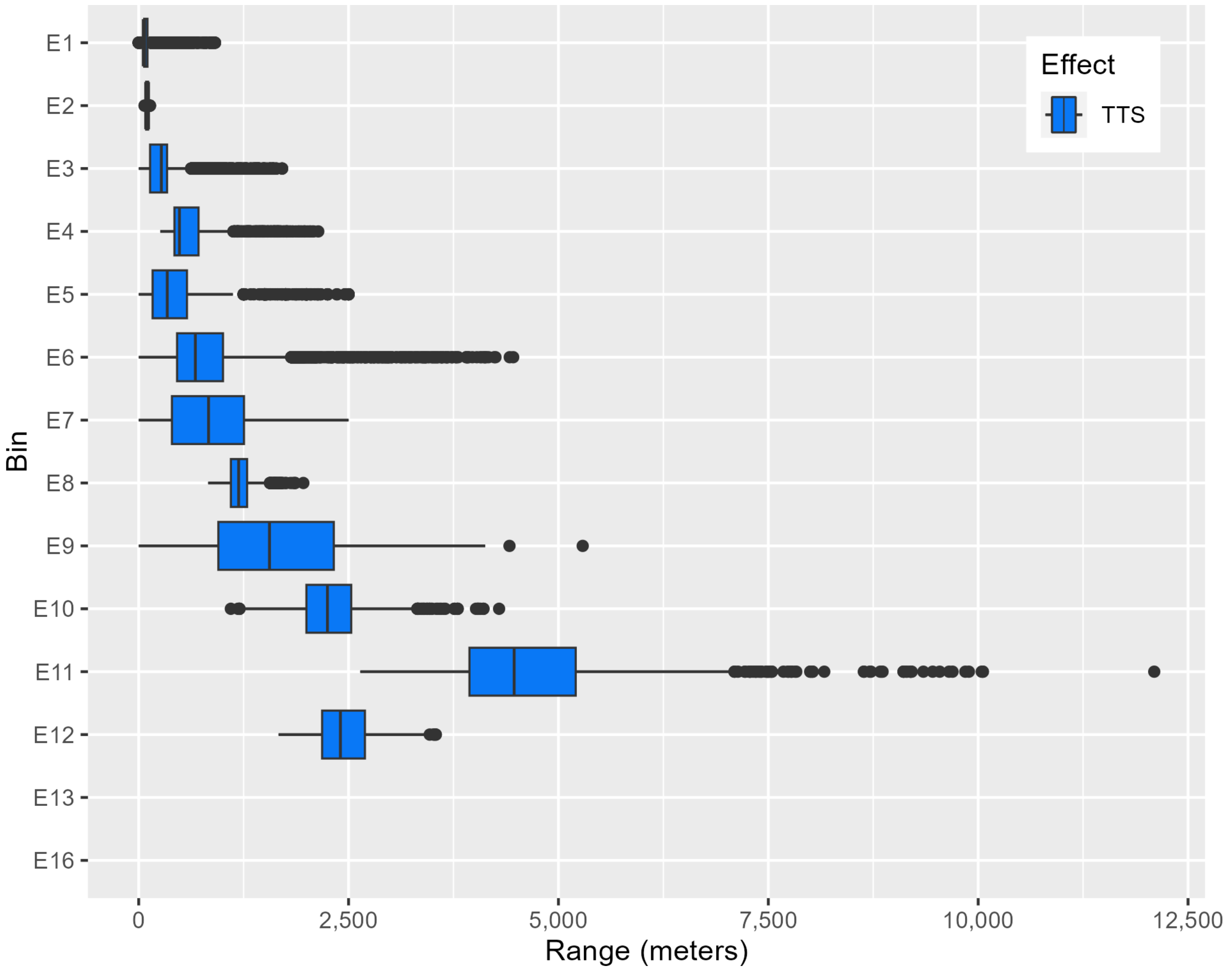

Figure 3.4-2: Sea Turtle Ranges to Temporary Threshold Shift for Explosives

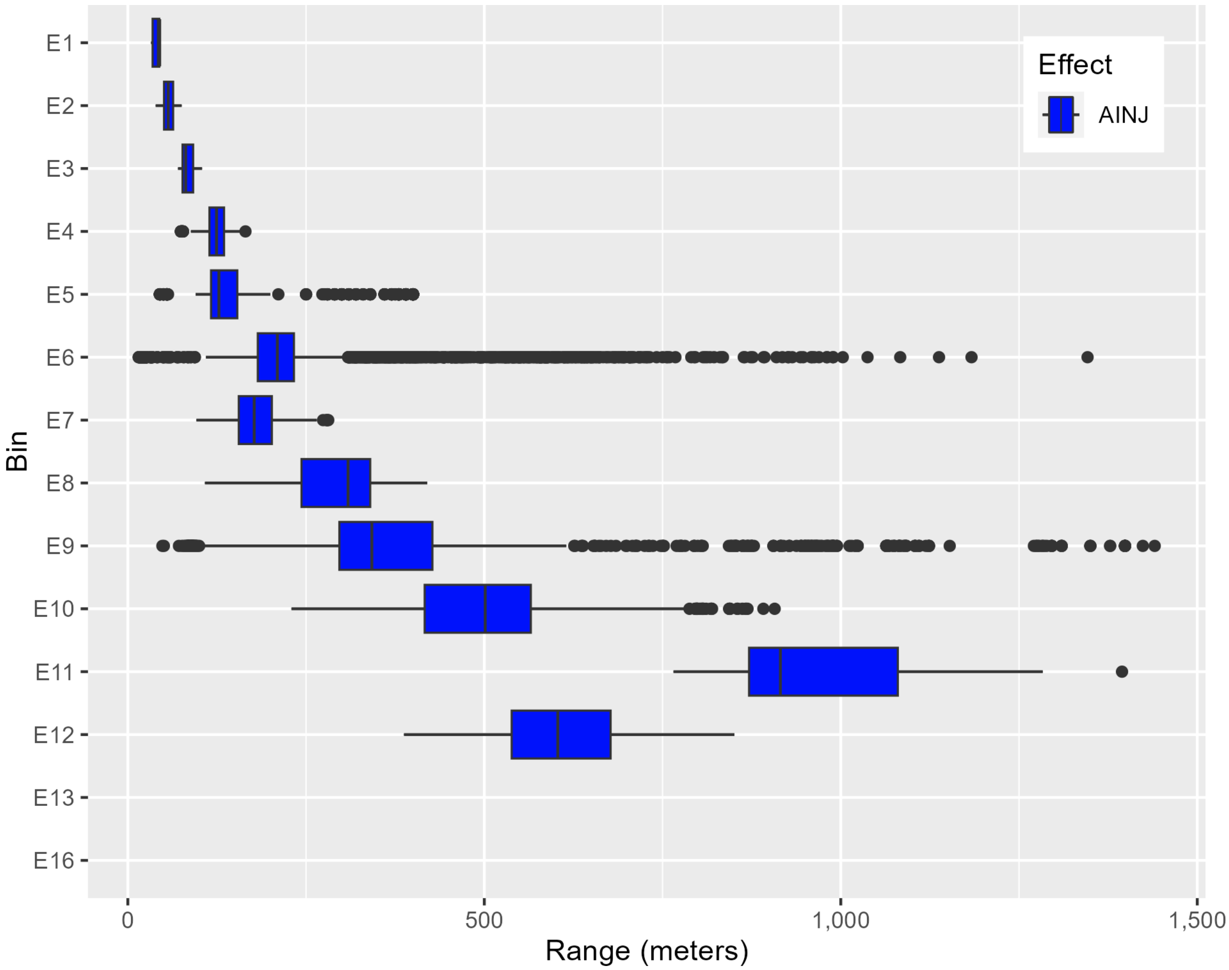

Figure 3.4-3: Sea Turtle Ranges to Auditory Injury for Explosives

Table 3.4-3: Explosive Ranges to Injury and Mortality for Sea Turtles as a Function of Animal Mass

Bin	Effect	10 kg	250 kg	1,000 kg
E1	INJ	22 m (0 m)	22 m (1 m)	21 m (0 m)
	MORT	3 m (0 m)	1 m (0 m)	0 m (0 m)
E2	INJ	28 m (2 m)	27 m (2 m)	26 m (1 m)
	MORT	6 m (1 m)	2 m (1 m)	1 m (0 m)
E3	INJ	33 m (5 m)	34 m (7 m)	42 m (2 m)
	MORT	7 m (1 m)	4 m (1 m)	2 m (0 m)
E4	INJ	52 m (6 m)	53 m (6 m)	57 m (4 m)
	MORT	11 m (3 m)	4 m (3 m)	2 m (1 m)
E5	INJ	69 m (2 m)	68 m (3 m)	65 m (2 m)
	MORT	15 m (2 m)	8 m (1 m)	4 m (0 m)
E6	INJ	98 m (9 m)	98 m (8 m)	97 m (7 m)
	MORT	38 m (7 m)	19 m (4 m)	12 m (1 m)
E7	INJ	90 m (15 m)	86 m (17 m)	108 m (13 m)
	MORT	18 m (2 m)	10 m (2 m)	7 m (1 m)
E8	INJ	208 m (13 m)	144 m (13 m)	166 m (3 m)
	MORT	58 m (9 m)	31 m (7 m)	18 m (2 m)
E9	INJ	334 m (38 m)	173 m (24 m)	212 m (9 m)
	MORT	147 m (19 m)	22 m (9 m)	13 m (2 m)
E10	INJ	480 m (71 m)	228 m (64 m)	266 m (19 m)
	MORT	244 m (31 m)	57 m (22 m)	16 m (6 m)
E11	INJ	586 m (30 m)	351 m (31 m)	396 m (33 m)
	MORT	323 m (9 m)	177 m (22 m)	109 m (1 m)
E12	INJ	640 m (73 m)	318 m (131 m)	352 m (2 m)
	MORT	344 m (36 m)	132 m (59 m)	20 m (2 m)

Median ranges with standard deviation ranges in parentheses, INJ = the greater of respective ranges for 1% chance of gastro-intestinal tract injury and 1% chance of injury
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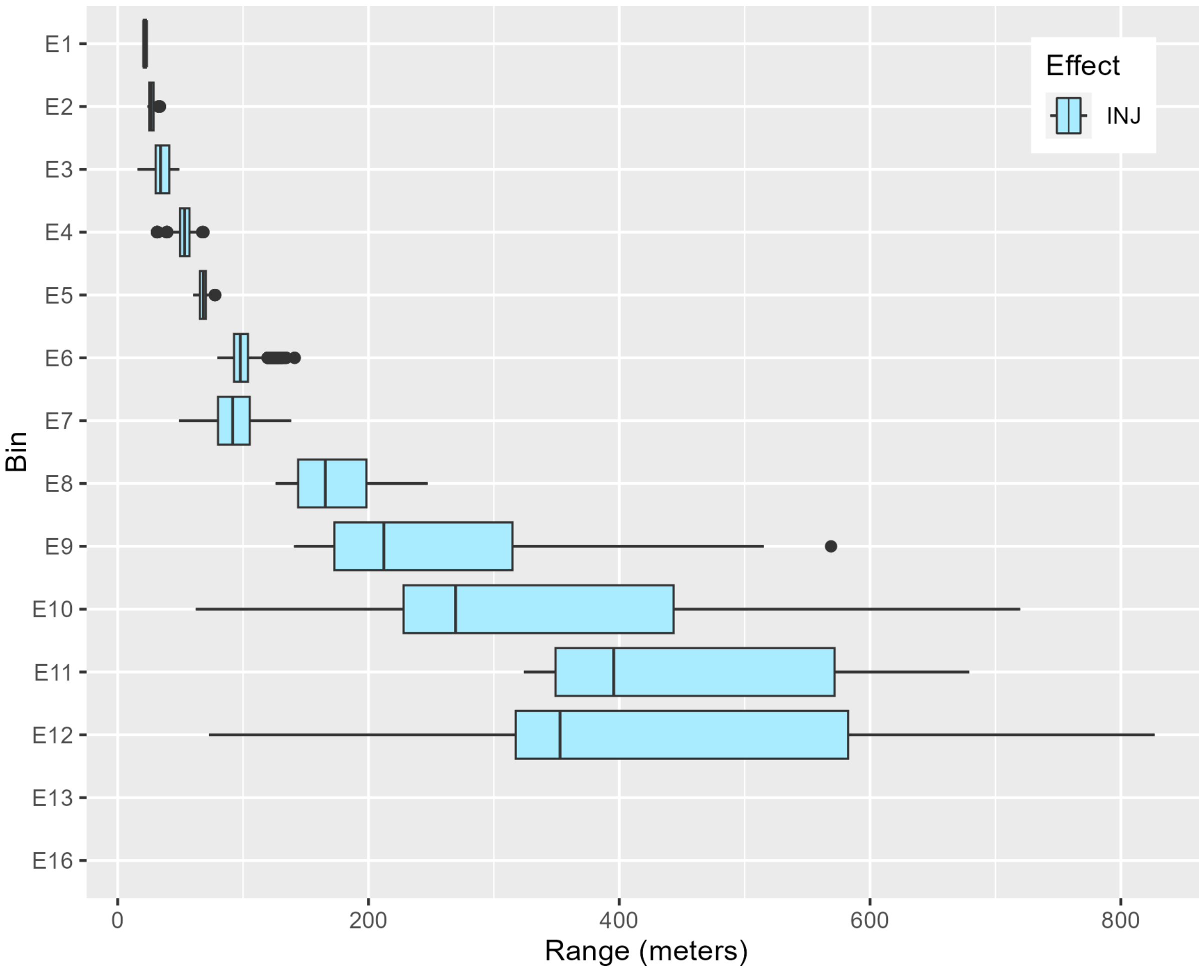

Figure 3.4-4: Explosive Ranges to Injury for Sea Turtles

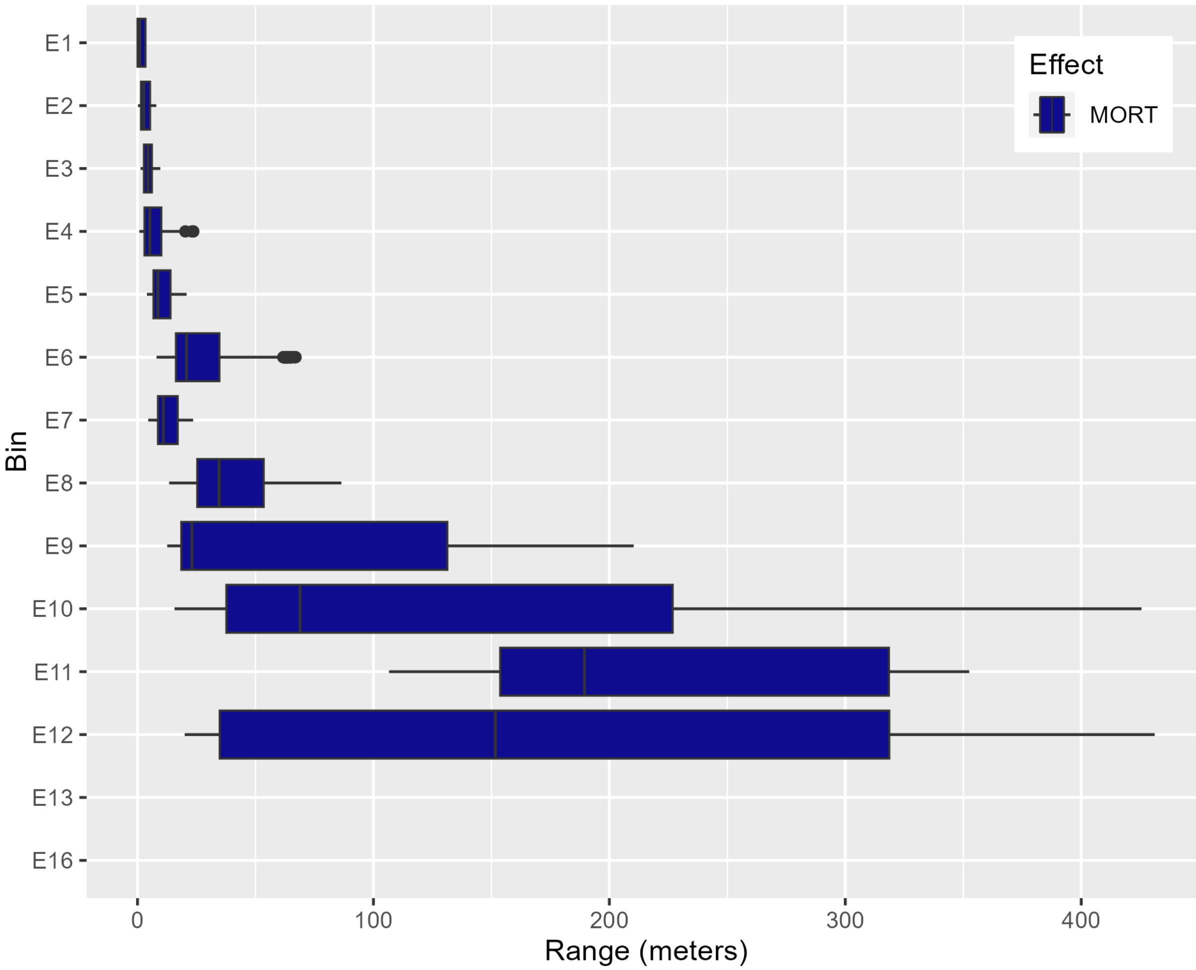

Figure 3.4-5: Explosive Ranges to Mortality for Sea Turtles

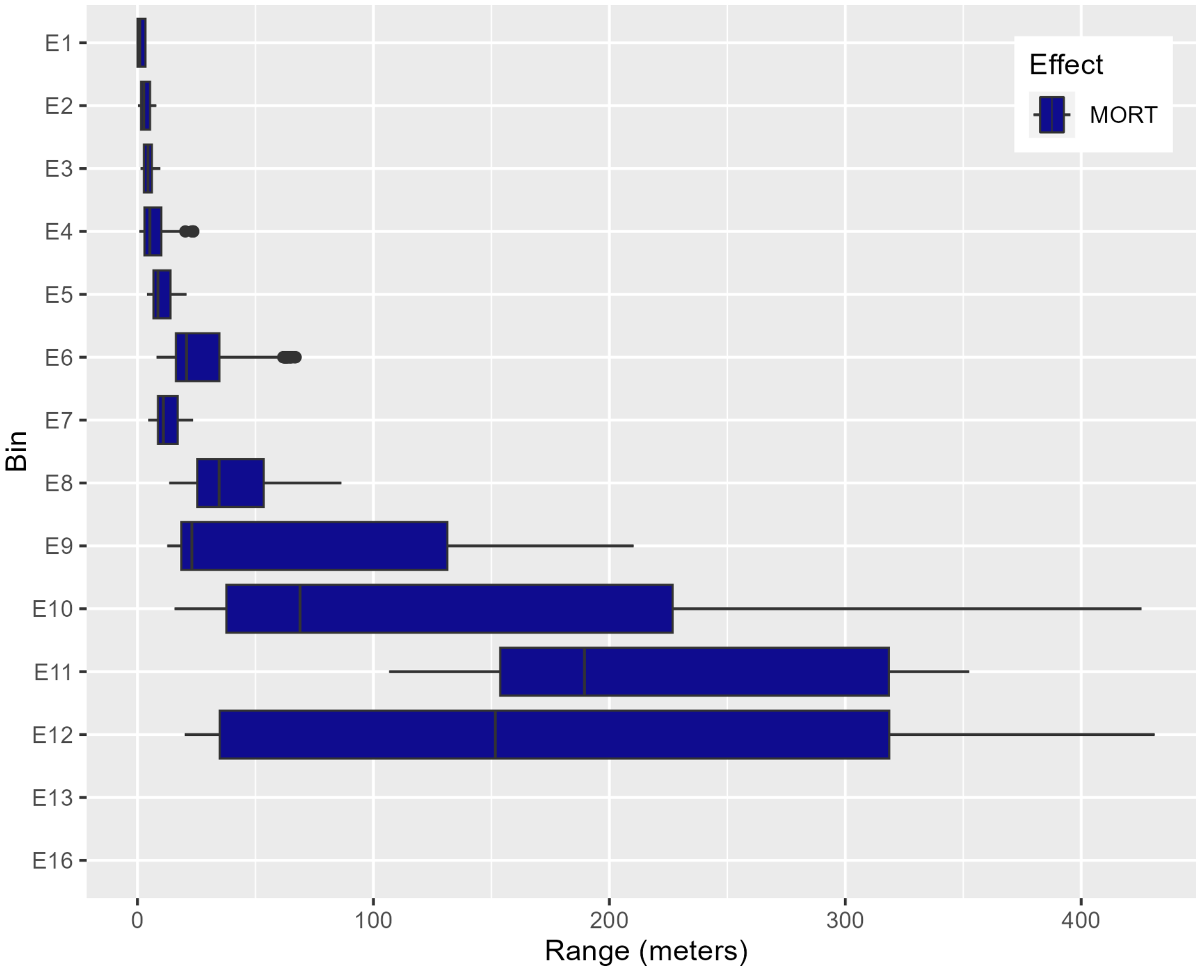

Figure 3.4-5: Explosive Ranges to Mortality for Sea Turtles

4 IMPACTS ON FISHES FROM ACOUSTIC AND EXPLOSIVE STRESSORS

This analysis is presented as follows:

- The approach to modeling and quantifying impacts, as it applies to fishes, is summarized in Section 4.1 (Quantifying Impacts on Fishes from Acoustic and Explosive Stressors).
- The impacts on fish populations that would be expected due to each type of acoustic substressor and explosives used in the Proposed Action are described in Section 4.2 (Impacts Due to each Acoustic Substressor and Explosives).
- Impacts on ESA-species (Distinct Population Segments [DPS] and Evolutionarily Significant Units [ESU]) in the Study Area, including predicted instances of harm or harassment, are presented in Section 4.3 (ESA-Listed Species Impact Assessment).

4.1 Quantifying Impacts on Fishes from Acoustic and Explosive Stressors

Although the impact analysis presented below is largely qualitative, a quantitative analysis was performed to estimate ranges to effects for fishes exposed to activities that involve the use of some acoustic substressors (sonar, pile driving, and air guns) and explosives (see Section 4.4, Range to Effects, for details). As such, this section is organized differently than the preceding analyses for marine mammals and reptiles because the quantitative aspects of the analysis are included in Section 4.2 (Impacts Due to Each Acoustic Substressor and Explosives) when considering impacts on fish populations, not just ESA-species (as analyzed in Section 4.3, ESA-Listed Species Impact Assessments).

Ranges for sonar, air guns, and explosives were estimated using fish sound exposure criteria and thresholds (described below in Sections 4.1.1 through 4.4.4) and sound propagation modeling performed in the Navy's Acoustic Effects Model. Ranges to effects for pile driving (Section 4.1.3) also use the criteria described below but were modeled outside of the Navy's Acoustic Effects Model (see the *Quantitative Analysis TR* for details). Note, although ranges to effects are estimated for some stressors, density data for fishes throughout the Study Area are not available; therefore, it is not possible to estimate the total number of individuals that may be affected by Navy acoustic and explosive stressors.

Sound exposure criteria for the current analysis are largely consistent with thresholds used during previous assessments of impacts due to military readiness activities in the Study Area, with new data and modifications from previous phases described in detail below (i.e., explosive injury criteria). The literature used to derive proposed criteria and thresholds are summarized in the *Fishes Acoustic Background* section. The data presented herein represent current best available science.

4.1.1 Quantifying Hearing Impacts from Sonars

Most of the available research on the effects of non-impulsive sound sources on fishes utilize tonal or broadband signals (e.g., white noise). However, experiments that utilize these types of sound sources are often not analogous to potential exposures to Navy sonars due to differences in the test stimuli and environment (i.e., tanks or aquariums). Additionally, the overall exposure durations often exceed many hours or even days, time frames that are much longer than the likely exposures fish may experience due to transiting Naval vessels that operate sonar and other transducers. The only three studies that have documented potential threshold shifts in fishes exposed to actual Naval sonar are summarized in Table

4.1-1. This data was used to derive interim sound exposure criteria consistent with proposed thresholds in the ANSI Sound Exposure Guideline technical report (Popper et al., 2014).

Table 4.1-1: TTS Data for Fishes Exposed to Sonar

Reference	Reported SPL (dB RMS)	Exposure Duration (seconds)	Calculated cSEL [1]	Species	TTS (Y/N)
Mid-Frequency Sonar					
Halvorsen et al. (2012c)	210	15	222	Channel catfish (*Ictalurus punctatus*)[2]	Y
	210	15	222	Rainbow trout (*Oncorhynchus mykiss*)	N
Low-Frequency Sonar					
Popper et al. (2007)	193	324	218	Rainbow trout (*Oncorhynchus mykiss*)	Y
	193	648	221	Rainbow trout (*Oncorhynchus mykiss*)	Y
Halvorsen et al. (2013)	195	324	220	Channel catfish (*Ictalurus punctatus*)[2]	Y
				Largemouth bass (*Micropterus salmoides*)	N
				Yellow perch (*Perca flavescens*)	N

Notes: SPL = sound pressure level; dB RMS = decibel root mean square; cSEL = cumulative sound exposure level; TTS = temporary threshold shift. Significance is defined and reported in each publication as a statistically significant threshold shift compared to baseline data (regardless of the amount of dB shift).

[1] Calculated cumulative sound exposure level = Reported SPL + 10 log (Duration)

[2] Hearing specialist, fishes with a swim bladder involved in hearing

As shown in Table 4.1-1, significant threshold shifts were reported in channel catfish (a hearing specialist) when exposed to mid-frequency sonar at a maximum sound pressure level of 210 dB for a total duration of 15 seconds (Halvorsen et al., 2012c). However, the same effect was not observed in rainbow trout (a hearing generalist). Based on limited data, the Navy calculated the cumulative sound exposure level, then rounded down for a final proposed threshold of 220 dB re 1 μPa^{2}s for all hearing specialists (see Table 4.1-2). This threshold is consistent with criteria presented in the *ANSI Sound Exposure Guideline* technical report which is reported in dB RMS. No numeric criteria are proposed for hearing generalists (including fishes without a swim bladder) as species within these fish categories do not sense pressure well and likely cannot hear frequencies above 2 kHz. Furthermore, hearing generalists are less susceptible to hearing impairment from sound exposures compared to hearing specialists (Halvorsen et al., 2012c; Popper et al., 2014).

A hearing specialist and at least one example of a hearing generalist showed signs of TTS after exposure to low-frequency sonars (see Table 4.1-1). Specifically, threshold shifts in channel catfish and rainbow trout were reported after exposure to a maximum received sound pressure level of 193 dB re 1 μPa (criteria presented in the *ANSI Sound Exposure Guideline* technical report) for 324 seconds, but not in largemouth bass or yellow perch (Halvorsen et al., 2013; Popper et al., 2007). Because the results were variable, and because most fishes are sensitive to low-frequency sound, the Navy's threshold for TTS from exposure to low-frequency sonar for all fishes with a swim bladder was rounded down to a cumulative sound exposure level of 210 dB re 1 μPa^2-s (see Table 4.1-2). Furthermore, based on available data and the assumption that generalists are less susceptible to hearing loss than specialists, the onset of TTS is presumed to occur above this proposed threshold for hearing generalists (as evident by the greater than sign).

Table 4.1-2: Thresholds to TTS in Fishes from Sonar

Hearing Group	Fish Category	Mid-Frequency Sonar	Low-Frequency Sonar
Generalists	Fishes without a swim bladder	NC	NC
	Fishes with a swim bladder not involved in hearing	NC	> 210
Specialists	Fishes with a swim bladder involved in hearing	220	210
	Fishes with a swim bladder and with high-frequency hearing[1]	220	210

Notes: cSEL = cumulative sound exposure level (dB re 1 µPa2-s); NC = effects from exposure to sonar are not likely, therefore no criteria are proposed; ">" indicates that the given effect would occur above the reported threshold.

[1] Some species within this category can detect sound pressure up to 10 or 100 kHz. All other fishes have an upper frequency cutoff at 2kHz.

4.1.2 Quantifying Injury and Hearing Impacts from Air Guns and Pile Driving

Criteria and thresholds used to estimate impacts from sound produced by impact pile driving and air gun activities are presented in Table 4.1-3. Consistent with the ANSI Sound Exposure Guideline technical report (Popper et al., 2014), dual metric sound exposure criteria and cumulative sound exposure metrics are utilized to estimate ranges to mortality, non-auditory injury, and TTS (respectively) from impulsive sources.

Table 4.1-3: Sound Exposure Criteria for Air Guns and Pile Driving

Hearing Group	Fish Category	Mortality		Injury		TTS
		cSEL	peak SPL	cSEL	peak SPL	cSEL
Generalists	Fishes without a swim bladder	> 219	> 213	> 216	> 213	NC
	Fishes with a swim bladder not involved in hearing	210	> 207	203	> 207	> 186
Specialists	Fishes with a swim bladder involved in hearing and those with high-frequency hearing[1]	207	> 207	203	> 207	186

Notes: cSEL = cumulative sound exposure level (dB re 1 µPa2-s); peak SPL = average single strike peak sound pressure level (dB re 1 µPa); TTS = temporary threshold shift; NC = effects from exposure to impulsive sources are unlikely, therefore no criteria are proposed; ">" indicates that the given effect would occur above the reported threshold.

Due to the lack of detailed data on injury thresholds in fishes exposed to air guns, thresholds from impact pile driving exposures were used as a proxy for this analysis (Halvorsen et al., 2012a; Halvorsen et al., 2011, 2012b). However, it is important to note that the thresholds derived from pile driving experiments are likely specific to the test conditions under which the criteria were derived, and therefore may not accurately predict ranges to effects from exposure to other impulsive sound sources. As discussed in the *Fishes Acoustic Background* section, injury and mortality in fishes exposed to impulsive sources may vary depending on the presence or absence, and type, of swim bladder. Injury and mortal injury have not been observed in fishes without a swim bladder because of exposure to impulsive sources. Therefore, these effects would likely occur above the thresholds in Table 4.1-3.

Overall, PTS has not been known to occur in fishes. Any hearing loss in a fish may be as temporary as the timeframe required to repair or replace the sensory cells that were damaged or destroyed (Popper et al., 2014; Popper et al., 2005; Smith et al., 2006). The lowest sound exposure level at which TTS has been observed in fishes with a swim bladder involved in hearing is 186 dB re 1 µPa2-s (Popper et al., 2005). Hearing generalists would be less susceptible to hearing loss (i.e., TTS) than hearing specialists, even at higher levels and longer durations. As a result, the proposed interim thresholds in the ANSI Sound Exposure Guideline technical report (Popper et al., 2014) for hearing generalists would be greater than (>) or much greater than (>>) 186 dB re 1 µPa2-s for fishes with a swim bladder not involved and those without a swim bladder, respectively. However, the threshold for TTS for fishes without a swim bladder was not carried forward in this analysis as fishes without a swim bladder generally have not shown signs of TTS from exposure to sound and therefore this effect is considered unlikely to occur.

4.1.3 Quantifying Mortality, Injury, and Hearing Impacts from Explosives

Criteria and thresholds to estimate impacts from sound and energy produced by explosive activities are presented below (Table 4.1-4) These thresholds were applied in the Navy's previous analysis of impacts in the Study Area. The mortality threshold is the lowest value recommended for explosives in the *ANSI Sound Exposure Guideline* technical report (Popper et al., 2014). The guidelines provide qualitative criteria for injury due to explosives and do not suggest any thresholds. Instead, the peak pressure injury threshold of 220 dB is based on available explosive literature. An explanation of the development of this threshold is provided below. The TTS threshold for fishes with a swim bladder is the value suggested in the guidelines for impulsive sounds other than explosives, as no data on explosive impacts on fish hearing is available. Consistent with the recommendations in the guidelines, fishes without a swim bladder would not be susceptible to TTS and therefore no criteria are proposed.

Table 4.1-4: Sound Exposure Criteria for Fishes Exposed to Underwater Explosives

Hearing Group	Fish Category	Mortality	Injury	TTS
		peak SPL	peak SPL	cSEL
Generalists	Fishes without a swim bladder	229	220	NC
Generalists and Specialists[1]	Fishes with a swim bladder	229	220	> 186

Notes: CSEL = cumulative sound exposure level (dB re 1 µPa2-s); peak SPL = peak sound pressure level (dB re 1 µPa); TTS = temporary threshold shift; NC = effects from exposure to explosives are not likely, therefore no criteria are proposed; “>” indicates that the given effect would occur above the reported threshold.
[1] Fishes with a swim bladder not involved in hearing are considered generalists, fishes with a swim bladder involved in hearing and with high frequency hearing are considered specialists.

It is not appropriate to utilize the SPL or SEL injury thresholds developed for pile driving to estimate impacts from explosives. The peak sound pressure levels reported in the pile driving literature, upon which the guidelines injury thresholds were based, were not actually correlated with injury (Casper et al., 2017; Casper et al., 2013a; Casper et al., 2012; Casper et al., 2013b; Halvorsen et al., 2012a; Halvorsen et al., 2011, 2012b). Rather, these were the highest peak pressures achieved in the test apparatus that produced the specific SELs desired by the researchers. This was done by modifying the number of strikes per exposure while maintaining the same average single strike peak SPL. Injuries were only reported following exposure to many strikes (i.e., the lowest number of strikes in any of these experimental exposures was 960, over exposure durations of 40-60 minutes) and were correlated to cumulative SEL. It is not possible to discern from these datasets what peak pressure would correlate to injury in a single strike exposure, only that it would likely be higher than the peak pressure used in these experiments.

Additionally, sound from pile driving is not directly comparable to that produced by an explosion. It is likely that the much more rapid and sharper pressure changes make exposure to an explosion more injurious than exposures to multiple pile driving strikes of equal energy. The cumulative SEL metric derived for multiple pile driving strikes should not be applied to single explosives or clusters of explosives (with number of impulses several orders of magnitude lower than studied for pile driving). Although the Navy initially considered pile driving thresholds for explosives in the previous analysis, the injury threshold was revised to better analyze explosive impacts as described herein.

While several metrics have been used in the literature to characterize explosive exposure (e.g., peak pressure and impulse), peak pressure is the most consistently documented metric. As a conservative measure, the absolute lowest peak SPL for larval fishes exposed to explosions that resulted in injury (Settle et al., 2002) was selected to represent the threshold to injury. Recent explosive exposure data also support the threshold with reported rates of injury significantly different than controls starting at peak SPLs of 226 dB (Dahl et al., 2020; Jenkins et al., 2022; Jenkins et al., 2023).

The injury threshold is applied to all fishes due to the lack of rigorous data for multiple species. Since thresholds were selected from exposures of larval fishes, this threshold likely overestimates impacts for larger or adult fishes. Additionally, fishes exposed to received levels higher than 220 dB peak SPL have shown no signs of injury (e.g., Gaspin et al., 1976; Settle et al., 2002; Yelverton et al., 1975).

As data from the most recent series of explosive experiments are still being analyzed (Dahl et al., 2020; Jenkins et al., 2022; Jenkins et al., 2023), the Navy will continue to consider newer data sets for potential refinement of this threshold in the future. It is important that the development of future criteria consider statistical analyses when robust data sets are available as selecting the lowest reported received level at which an effect is observed may be an inaccurate representation of potential effects on the environment.

4.2 Impacts Due to Each Acoustic Substressor and Explosives

This section analyzes the potential impacts from acoustic and explosive stressors on fishes. There are many factors that contribute to how a fish will respond to sound, such as the frequency and received sound level, the duration of the sound-producing activity, the animal's behavioral activity at the time of exposure (e.g., feeding, traveling, resting), and proximity of the animal to the source of the sound.

For what is known about the effects of all acoustic substressor and explosives on fishes, refer to the *Fishes Acoustic Background* section. In this analysis, impacts are categorized as mortality, non-auditory injury, temporary hearing loss (temporary threshold shift [TTS]), auditory injury (AINJ, including auditory neural injury), other physiological response (including stress), masking (occurs when a noise interferes with the detection, discrimination, or recognition of other sounds), and behavioral responses.

4.2.1 Impacts from Sonar and Other Transducers

Sonars and other transducers (collectively referred to as sonars in this analysis) emit sound waves into the water to detect objects, safely navigate, and communicate. Sonars are considered non-impulsive and vary in source level, frequency, duration (the total time that a source emits sound including any silent periods between pings), duty cycle (the portion of time a sonar emits sound when active, from infrequent to continuous), beam characteristics (narrow to wide, directional to omnidirectional, downward or forward facing), and movement (stationary or on a moving platform). Additional characteristics and occurrence of sonar and other transducers used under the Proposed Action are described in the *Acoustic Stressors* and *Activity Descriptions* section.

As discussed in the *Fishes Acoustic Background* section, direct injury (e.g., barotrauma) has not been documented in fishes exposed to sonar. Therefore, injury from sonar is highly unlikely and is not considered further in this analysis. Impacts from exposure to sonar could include TTS, masking, physiological response (including stress), and behavioral reactions.

The *Fishes Acoustic Background* section also discusses that different fish species are not equally sensitive to all sound frequencies. Most marine fishes are hearing generalists or lack a swim bladder, including all ESA-listed species within the Study Area, and would be unable to detect frequencies greater than approximately 2 kHz. Therefore, most marine species would not be susceptible to effects (e.g., TTS, behavioral response) from these sound sources. Some marine fishes are hearing specialists (all non-ESA-listed), which are more sensitive to sound detection and potential impacts than other hearing groups; although fishes within this group would still have to be very close to a relatively high-level low-frequency sonar source to experience TTS. Only a few species of shad (all non-ESA-listed) can detect high-frequency sonar (greater than 10 kHz), although the overlap is very limited between high-frequency sonar use and estuarine areas where shad species concentrate. Additionally, sound from high-frequency sonar systems attenuates below detectable levels (i.e., close to or below ambient sound levels) over a short range in shallow water. Thus, most species in the Study Area (including all ESA-listed species) may only detect low-frequency sonar systems with higher source levels within a few kilometers; and most other, less powerful low-frequency sonar systems, at much shorter ranges.

Military readiness activities that involve the use of sonars could occur throughout the Study Area, although use would generally occur in Navy range complexes and testing ranges, or around inshore locations, and specified ports and piers identified in the *Proposed Activities* section. Impacts from sonar to fishes within the Study Area would be limited to systems with energy below 2 kHz, primarily from low-frequency sonars but could also include some broadband and lower mid-frequency sources (less than 2 kHz). These systems could be used throughout the Study Area but would be concentrated in the Hawaii Study Area and SOCAL Range Complex. Some low-frequency sonars could also be utilized in shallow water training ranges or nearshore areas (e.g., San Clemente Island nearshore under training and Pearl Harbor under testing activities), though these systems are typically operated farther offshore, in deeper waters. Overall, low-frequency sources are operated less often than higher frequency sources throughout the Study Area. Although the general impacts from sonar during testing would be similar in severity to those described during training, there is a higher quantity of sonar usage under testing activities and therefore there may be slightly more impacts during testing activities.

Active sonars used in the Study Area that are within the hearing range of marine fishes are unlikely to substantially mask key environmental sounds due to the intermittent and infrequent use of these systems at most locations within the Study Area. High and continuous duty cycle systems may increase the risk of masking for biologically important sounds, including some fish vocalizations, that overlap in frequency over the brief period these systems are used in any given location within the Study Area. Although some species may be able to produce sound at frequencies greater than 2 kHz, most vocal marine fishes communicate well below this frequency, below the range of most Navy sonar sources. For these reasons, any masking effects would be temporary and infrequent.

Although low-frequency systems generally lack the power necessary to generate TTS in fish, a quantitative analysis was performed using the Navy Acoustic Effects Model and varying potential exposure durations (1, 30, 60 and 120 seconds) to estimate ranges to TTS for fishes exposed to Navy sonars. Calculated ranges to TTS from low-frequency sources, regardless of exposure duration (1 to 120 s), resulted in estimated ranges of zero meters for all fishes and therefore TTS is not anticipated.

As discussed in the *Fishes Acoustic Background* section, fishes that can detect sonars could experience physiological responses or behavioral reactions such as startle or avoidance responses, although the relative risk of these effects at any distance from sonars are expected to be low. In fact, available research showed very little response of both captive and wild Atlantic herring (hearing specialists) to sonar (e.g., no avoidance). Such data suggests a low probability of behavioral reactions to sonar for most fishes; therefore, sonar is unlikely to affect fish populations. It is more likely that fish located near, or attracted to, a moving platform operating sonar (e.g., vessel or in-water device), would avoid the source due to the physical presence of the platform. In addition, there is the potential for some low-frequency sonars to mask biologically important sounds, including some fish vocalizations, that overlap in frequency content with the system that is operated. Such effects could limit the distance over which fishes can communicate or detect important signals, or fish may respond by altering their vocalizations to compensate for the noise, but only if the sound source is louder than the biological signals and lasts long enough to impact transmission and receipt of those signals. Due to the transient nature of most sonar operations, impacts, if any, would be localized and infrequent, only lasting a few seconds or minutes. Overall, sonar use is unlikely to impact individuals. If impacts do occur, they are expected to be insignificant; therefore, long-term consequences for fish populations would not be expected.

Conclusions regarding impacts from the use of sonar and other transducers during military readiness activities for ESA-listed species is provided in Section 4.3 (ESA-Listed Species Impact Assessments).

4.2.2 Impacts from Air guns

Air guns use bursts of pressurized air to create intermittent, broadband, impulsive sounds which are dominated by lower frequencies. Air gun use by the Navy is limited and is unlike large-scale seismic surveys that use multiple air guns. Characteristics and occurrence of air guns used under the Proposed Action are described in the *Acoustic Stressors* and *Activity Descriptions* section.

Air gun use would occur nearshore in the SOCAL Range Complex under Intelligence, Surveillance, Reconnaissance testing activities, and greater than 3 NM from shore in the Hawaii, Northern and SOCAL Range Complexes under Acoustic and Oceanographic Research testing. Table 4.2-1 shows the number of days in a maximum year that air guns would be estimated to occur during testing activities. Air guns would only be used during a few days per year in any given location within the Study Area. Some testing events could occur in any one of the multiple listed range complexes and therefore the total number of days is distributed between them for the assessment of impacts.

Table 4.2-1: Number of Days per Year Air Guns Could Occur Under Testing Activities

Range Complex	Days per Year
HRC	57
NOCAL	57
SOCAL	43–44

Most marine fishes are generalists and hear primarily below 2 kHz and would be able to detect broadband signals produced by air guns. Exposure of fishes to air guns could result in direct injury, hearing loss, masking, physiological response, or behavioral reactions.

Impulses from air guns lack the strong shock wave and rapid pressure increases known to cause primary blast injury or barotrauma during explosive events and (to a lesser degree) impact pile driving (see the *Fishes Acoustic Background* section for details). Although data from impact pile driving are often used as a proxy to estimate effects to fish from air guns, using such data may not accurately estimate potential impacts due to the differences in the sound characteristics (e.g., the rise times between the two types of impulsive sources). Typically, impact pile driving signals have a much steeper rise time and higher peak pressure than air gun signals.

To determine whether mortality, injury, or TTS would occur from air gun activities, a quantitative analysis was performed using the Navy Acoustic Effects Model to estimate ranges to effects for fishes exposed to air guns. However, modeling resulted in very small, estimated ranges to mortality, injury and TTS (less than 5 m) for the most sensitive fishes (i.e., those with a swim bladder, see Section 4.4.2, Range to Effects for Air Guns, for details). Based on these short, predicted ranges, most fish would likely avoid the source prior to entering the area of effect due to the physical presence of the system or the platform from which the air gun is operated, further reducing the potentials for impacts. Although some individuals could be present within these small footprints, impacts would be limited to the few fish that are co-located with the air guns during operation of the system. The isolated and infrequent use of air guns would further reduce the potential for impacts on individuals.

Due to the brief nature of each pulse (approximately 0.1 second), it is unlikely that fishes within relatively close distance tens to hundreds of meters of the source would experience masking effects. If masking occurred, it is more likely to happen at farther distances from the source where signals may sound continuous. Such effects could limit the distance over which fishes can communicate or detect important signals, or fish may respond by altering their vocalizations to compensate for the noise, but only if the sound source is louder than the biological signals and lasts long enough to impact transmission and receipt of those signals. However, air gun signals at farther distances (e.g., 100s of meters) are unlikely detectable over existing ambient noise levels and thus are unlikely to cause impacts on individuals or populations.

Fishes may exhibit signs of physiological response or alterations in natural behavior. Some fish species with high site fidelity such as reef fish may show initial startle reactions, returning to normal behavioral patterns within a matter of a few minutes. Pelagic and schooling fishes that typically show less site fidelity may avoid the immediate area for the duration of the event. Multiple exposures to individuals (across days) in the offshore portions of the Study Area are unlikely as air guns are not operated in the same areas from day to day, but rather would be utilized in different areas over time. The exception would be the use of air guns at pierside locations, but these tests are rare in any given year further reducing the potential for multiple exposures of individuals.

Due to the limited use and relatively small footprint of air guns, although some individuals may be harmed if they are co-located with air gun activities, impacts on individual fish are expected to be minor and insignificant and long-term population level consequences would not be expected.

Conclusions regarding impacts from the use of air guns during military readiness activities for ESA-listed species is provided in Section 4.3 (ESA-Listed Species Impact Assessments).

4.2.3 Impacts from Pile Driving

Fishes could be exposed to sounds from impact (installation only) and vibratory (install and extraction) pile driving during Port Damage Repair training activities at Port Hueneme, California throughout the year (pile driving would not occur during testing activities). Port Damage Repair training activities are made up of multiple events, each which could occur up to 12 times per year. Each training events is comprised of up to seven separate modules, each which could occur up to three iterations during a single event (for a maximum of 21 modules). Training events would last a total of 30 days, of which pile driving is only anticipated to occur for a maximum of 14 days. Sound from pile driving activities could occur over several hours in each day, though breaks in pile driving are taken frequently to reposition the drivers between piles. Depending on where the activity occurs at Port Hueneme, transmission of pile driving noise may be reduced by pier structures. As a standard operating procedure, the Navy performs soft starts at reduced energy during an initial set of strikes from an impact hammer. Soft starts may “warn” fishes and cause them to move away from the sound source before impact pile driving increases to full operating capacity. Soft starts were not considered during the calculation of ranges to effects (see Section 4.4.2, Range to Effects for Air Guns, for details), nor was the possibility that fishes could avoid the construction area. Therefore, not all fishes within the calculated ranges to effects would receive those effects.

Sounds from the impact hammer are impulsive, broadband, and dominated by lower frequencies. The impulses are within the hearing range of fishes. Sounds produced from a vibratory hammer are similar in frequency range as that of the impact hammer, except the levels are much lower than for the impact hammer, especially when extracting piles from sandy, nearshore ground, and the sound is continuous while operating.

Ranges to effects for fishes exposed to impact pile driving were determined using the calculations, sound propagation modeling, and surrogate sound levels described in the Quantitative Analysis TR. Where effects are anticipated to occur above the designated criteria (see Section 4.1.2, Quantifying Injury and Hearing Impacts from Air Guns and Pile Driving), the estimated ranges to that effect would be less than those displayed in the table. Note, sound exposure criteria are based on impulsive pile driving therefore there are only ranges to effects for activities involving the use of impact pile driving. Currently, there are no proposed criteria for vibratory pile driving and therefore these activities are analyzed qualitatively based on available literature and observed reactions.

Due to the static nature of pile driving activities, two exposure times were used when calculating potential range to effects for different types of fish (e.g., transient, or migratory species versus resident species or those with high site fidelity). The calculations for ranges to effects assumed that some transient fishes would likely move through the area during pile driving activities, resulting in low exposure durations. Therefore, range to effects for these species are estimated based on a cumulative exposure time of 5 minutes (60 strikes per minute * 5 minutes = 300 strikes). As shown in Section 4.4.3 (Range to Effects for Pile Driving), estimated ranges to mortality and injury from the largest pile type and size (i.e., up to 20-inch steel piles) was 10 meters, and estimated ranges were shorter for other pile types and sizes. Although it was estimated that TTS could occur within 131 m for some species, TTS would likely occur at shorter distances for other pile types and sizes, and for hearing generalists. Even fishes that are considered hearing specialists would need to remain within this distance for the full exposure duration to receive TTS, which is unlikely as transitory fishes would likely continue to move through the area after initial exposure.

In contrast, calculations for ranges to effects assumed that resident fishes may remain in the area during pile driving activities and therefore would receive a higher cumulative exposure level. As such, ranges were calculated based on an estimated exposure period of one day where the maximum number of piles for a given type and size would be driven in (e.g., for 20-inch steel piles, the analysis assumed up to 30 piles per day * 300 strikes per minute = 9,000 strikes per day). As shown in Section 4.4.3 (Range to Effects for Pile Driving), single day ranges to effects resulted in potential mortality and injury in hearing specialists within 50 and 93 m, respectively, from the largest pile type and size (i.e., up to 20-inch steel piles). Furthermore, it is anticipated that most hearing specialists present in the port for a full day may receive TTS. Based on the ranges in Section 4.4.3 (Range to Effects for Pile Driving), hearing generalists, fishes without a swim bladder, and fishes exposed to other pile types and sizes could also experience similar impacts, but at shorter distances from the source.

The death of an animal would remove them from the population. Removal of individuals with high reproductive potential (e.g., adult females) would result in a larger impact on the overall population than potential loss of many larval or juvenile fishes, which tend to occur in high numbers (i.e., spawning) and have naturally high mortality rates. 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.

Considering the standard operating procedure for soft starts, some fishes (both transient and resident) may still avoid the immediate area surrounding pile driving at the onset of the sound exposure. Hearing loss would be most likely to occur in resident fishes, with a lower probability of impacts on transitory species. However, even those that remained in the area for a full day would likely experience some recovery of hearing loss during the pauses in pile driving activity when the driver is repositioned. Fishes that experience hearing loss may have 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).

Port Damage Repair activities occur in shallow, nearshore areas where ambient noise levels are already typically high. Port Hueneme is a military port with potentially high ambient noise levels due to vessel traffic and port activities. Given these factors, significant masking is unlikely to occur in fishes due to exposure to sound from impact pile driving or vibratory pile driving/extraction. If masking occurred, it is more likely to happen at farther distances from the source where signals may sound continuous. Such effects could limit the distance over which fishes can communicate or detect important signals, or fish may respond by altering their vocalizations to compensate for the noise, but only if the sound source is louder than the biological signals and lasts long enough to impact transmission and receipt of those signals. As reported during behavioral response experiments using impulsive sources, it is more likely that fish may startle or avoid the immediate area surrounding a pile driving activity or would habituate and return to normal behaviors after initial exposure (see the *Fishes Acoustic Background* section for more details).

Fishes exposed to vibratory driving or extraction would not result in 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. Vibratory pile extraction is more likely than impact pile driving to cause masking of environmental sounds; however, due to its low source level, the masking effect would only be relevant in a small area around the activity. Fishes may also react to by changing their swimming speed, moving away from the source, or not responding at all.

Repeated exposures of individual fishes would be unlikely for transitory species but could occur in resident species due to the highly localized nature of the activity. Multiple exposures over the course of a day could lead to higher order effects (i.e., temporary hearing loss) due to the accumulated energy on the animal, but would most likely lead to an alteration of natural behavior or the avoidance of that specific area.

Overall, most behavioral effects are expected to be short term (seconds or minutes) and localized, and fish would likely return to their natural behavior shortly after exposure. Although some individuals may be impacted, long-term consequences to fish populations (migratory or resident) would not be expected.

Conclusions regarding impacts from the use of pile driving during military readiness activities for ESA-listed species is provided in Section 4.3 (ESA-Listed Species Impact Assessments).

4.2.4 Impacts from Vessel Noise

Fishes may be exposed to vessel-generated noise throughout the Study Area. Military readiness activities with vessel-generated noise would be conducted as described in the *Proposed Activities* and *Activity Descriptions* sections. Specifically, Navy vessel traffic in Hawaii is heaviest south of Pearl Harbor, and in Southern California Navy vessel traffic is heaviest around San Diego and roughly within 50 NM of shore, though these activities could occur throughout the Study Area, as described in the *Acoustic*

Habitat section. The four amphibious approach lanes on the coast of central California bordering NOCAL and PSMR near Mill Creek Beach, Morro Bay, Pismo Beach, and Vandenberg Space Force Base are sources of nearshore vessel noise as well. Navy traffic also has clear routes from Hawaii to the Mariana Islands, Japan, and San Diego, and from San Diego north to the Pacific Northwest. Vessel movements involve transits to and from ports to various locations within the Study Area, and many ongoing and proposed activities within the Study Area involve maneuvers by various types of surface ships, boats, and submarines (collectively referred to as vessels), as well as unmanned vehicles. Activities involving vessel movements occur intermittently and are variable in duration, with some activities ranging from a few hours up to two weeks in a particular location. Surface combatant ships (e.g., destroyers, guided missile cruisers, and littoral combat ships) and submarines especially are designed to be quiet to evade enemy detection.

Characteristics of vessel noise are described in the *Acoustic Habitat* section. Moderate- to low-level passive sound sources including vessel noise are unlikely to cause any direct injury or trauma due to characteristics of the sounds and the moderate source levels. Furthermore, vessels are transient and would result in brief periods of exposure.

All fishes would be able to detect vessels which produce continuous broadband noise, with larger vessels producing sound that is dominant in the lower frequencies where fish hearing is most sensitive. Smaller vessels emit more energy in higher frequencies, much of which would not be detectable by fishes. Although hearing loss due to exposure to continuous sound sources has been reported, the test environment for these experiments (i.e., long-term exposures in a small tank or aquaculture facility) is not representative of Navy vessel transits. Injury and hearing loss because of exposure to vessel noise is not discussed further in this analysis.

Best available science on responses to vessel noise, including behavioral responses, stress, and masking, is summarized in the *Fishes Acoustic Background* section. Vessel noise can potentially mask vocalizations and other biologically relevant sounds (e.g., sounds of prey, predators, or conspecifics) that fishes may rely on, especially in nearshore areas where Navy vessel traffic is high (near ports, harbors and within designated shipping lanes). However, existing high ambient noise levels in ports and harbors with non-Navy vessel traffic and in shipping lanes with commercial vessel traffic would limit the potential for masking by naval vessels in those areas. In offshore areas with lower ambient noise, the duration of any masking effects in a particular location would depend on the time in transit by a vessel through an area. Masking by Navy vessel movements would only occur during the timeframe that the Navy vessel is within a detectable range of a fish. Such effects could limit the distance over which fishes can communicate or detect important signals, or fish may respond by altering their vocalizations to compensate for the noise. Some species may also avoid these areas or modify their behavior (e.g., the Lombard effect) to account for the overall increased noise levels in areas of high anthropogenic activity.

Exposure to vessel noise could result in short-term behavioral reactions, physiological response, masking, or no response. Fishes are more likely to react to nearby vessel noise (i.e., within tens of meters) than to vessel noise emanating from a distance. Fishes may experience physiological response from vessel noise, but responses would likely recover quickly as vessels pass by. Although research indicate prolonged reactions could occur from exposure to chronic noise, it is unlikely that the level of Navy vessel movements would provide a meaningful contribution to the elevated ambient noise levels in industrialized areas and shipping channels. It is more likely brief reactions would occur in quiet, open ocean environments to passing vessels.

Overall, impacts from vessel noise would be temporary and localized, and such responses would not be expected to compromise the general health or condition of individual fish. Therefore, long-term consequences for populations are not expected.

Conclusions regarding impacts from activities that produce vessel noise during military readiness activities for ESA-listed species is provided in Section 4.3 (ESA-Listed Species Impact Assessments).

4.2.5 IMPACTS FROM AIRCRAFT NOISE

Fishes may be exposed to aircraft-generated noise throughout the Study Area. Military readiness activities with aircraft would be conducted as described in the *Proposed Activities* and *Activity Descriptions* sections. Fixed- and rotary-wing (e.g., helicopters) aircraft are used for a variety of military readiness activities throughout the Study Area. Tilt-rotor impacts would be like fixed-wing or rotary-wing aircraft impacts depending on which mode the aircraft is in. Most of these sounds would be concentrated around airbases and fixed ranges within each of the range complexes. Aircraft noise could also occur in the waters immediately surrounding aircraft carriers at sea during takeoff and landing or directly below hovering rotary-wing aircraft that are near the water surface.

Aircraft produce extensive airborne noise from either turbofan or turbojet engines. An infrequent type of aircraft noise is the sonic boom, produced when the aircraft exceeds the speed of sound. Rotary-wing aircraft produce low-frequency sound and vibration (Pepper et al., 2003). Transmission of sound from a moving airborne source to a receptor underwater is influenced by numerous factors, but significant acoustic energy is primarily transmitted into the water directly below the craft in a narrow cone, as discussed in detail in the *Acoustic Primer* section. Underwater sounds from aircraft are strongest just below the surface and directly under the aircraft.

Sounds from aircraft activities, including occasional sonic booms, lack the amplitude or duration to cause injury in fishes underwater. Furthermore, aircraft noise would only result in brief periods of exposure that lack the duration and cumulative energy necessary to cause hearing loss. Due to the brief and dispersed nature of aircraft overflights, the risk of masking is very low. If masking occurred, it would only be during periods of time where a fish is near the surface while directly under a hovering rotary-wing aircraft or aircraft overflight.

In most cases, exposure of fishes to fixed-wing aircraft presence and noise would be brief as the aircraft quickly passes overhead. Supersonic flight at sea is typically conducted at altitudes exceeding 30,000 ft., limiting the number of occurrences of supersonic flight being audible at the water surface. Because most aircraft would pass quickly overhead and rotary-wing aircraft may hover for a few minutes at a time over the ocean, fish at or near the surface have the highest likelihood of exposure to sound.

Due to their low sound levels in water, fixed-wing aircraft or transiting rotary-wing aircraft may not be detectable beyond a short distance (10s of meters) beneath the flight path and therefore it is unlikely that most fish would respond. Those that do respond would likely startle or avoid the immediate area. Daytime and nighttime activities involving rotary-wing aircraft may occur for extended periods of time, up to a couple of hours in some areas, potentially increasing the overall risk of noise exposure. During these activities, rotary-wing aircraft would typically transit throughout an area and may hover over the water. Longer activity durations and periods of time where rotary-wing aircraft hover may increase the potential for behavioral reactions, startle reactions, and physiological response. Low-altitude flights of rotary-wing aircraft during some activities, which often occur under 100 ft. altitude, may elicit a stronger response due to the proximity of a rotary-wing aircraft to the water; the slower airspeed and longer exposure duration; and the downdraft created by a rotary-wing aircraft's rotor.

Overall, if fish were to respond to aircraft noise, only short-term behavioral or physiological response would be expected. Therefore, impacts on individuals would be unlikely and long-term consequences for populations are not expected.

Conclusions regarding impacts from activities that produce aircraft noise during military readiness activities for ESA-listed species is provided in Section 4.3 (ESA-Listed Species Impact Assessments).

4.2.6 Impacts from Weapon Noise

Fishes may be exposed to sounds caused by the firing of weapons, objects in flight, and inert impact of non-explosive munitions on the water surface. Military readiness activities using weapons and deterrents would be conducted as described in the *Proposed Activities* and *Activity Descriptions* sections*.* The locations where gunnery and other munitions may be used are shown in the *Munitions* data section. Most weapons noise is attributable to Gunnery activities. The overall proposed use of large caliber gunnery has decreased since the prior analysis, whereas medium caliber gunnery would be similar. Most activities involving large caliber naval gunfire or other munitions fired or launched from a vessel are conducted more than 12 NM from shore. The Navy will implement mitigation to avoid or reduce potential impacts from weapon firing noise during Large-Caliber Gunnery activities, as discussed in the *Mitigation* section. For explosive munitions, only associated firing noise is considered in the analysis of weapons noise. The noise produced by the detonation of explosive weapons is analyzed separately.

In general, noise from weapons firing is considered impulsive sound and is generated in close vicinity to, or at the water surface, except for weapons that are launched underwater. Fishes at the surface of the water, in a narrow footprint under a weapons trajectory, could be exposed to naval gunfire sound. Sound due to Missile and Target Launches is considered non-impulsive and is typically at a maximum during initiation of the booster rocket and rapidly fades as the missile or target travels downrange. Furthermore, many missiles and targets are launched from aircraft, which would produce minimal sound in the water due to the altitude of the aircraft at launch. Objects that are dropped and impact the water with great force could produce a loud broadband sound at the water surface. Large-caliber non-explosive projectiles, non-explosive bombs, and intact missiles and targets could also produce a large impulse upon impact with the water surface. These activities would have the highest potential for impacts on nearby fishes. Although reactions by fishes to these specific stressors have not been recorded, fishes would be expected to react to weapons noise, as they would other transient sounds.

Sound from these sources generally lack the duration and high intensity to cause mortality or injury therefore, these effects are not discussed further. Although TTS could potentially occur, the probability is very low of a non-explosive munition landing within a few meters of a fish while it is near the surface. Animals within the area may hear the impact of objects on the surface of the water and would likely alert, dive, or avoid the immediate area. Due to the brief and dispersed nature of weapons noise, masking is also unlikely and not discussed further in this analysis.

Overall, fishes that are exposed to weapons noise may only exhibit brief behavioral reactions such as startle reactions or avoidance, or no reaction at all. Due to the short-term, transient nature of gunfire and launch activities, animals may be exposed to multiple shots within a few seconds but are unlikely to be exposed multiple times within a short period (minutes or hours) as fish would likely avoid the area after initial exposure to these sounds. Behavioral reactions, if they occur, would likely be short term (minutes) and are unlikely to lead to substantial costs or long-term consequences for individuals or populations.

Conclusions regarding impacts from activities that produce weapons noise during military readiness activities for ESA-listed species is provided in Section 4.3 (ESA-Listed Species Impact Assessments).

4.2.7 Impacts from Explosives

Fishes may be exposed to sound and energy from explosions in the water and near the water surface associated with the proposed activities. Activities using explosives would be conducted as described in the *Proposed Activities* and *Activity Descriptions* sections. Most explosive activities would occur in the SOCAL Range Complex, the Hawaii Study Area, and PMSR, although activities with explosives would also occur in other areas as described in the *Activity Descriptions* section. Most activities involving in-water explosives associated with large caliber naval gunfire, or the launching of targets, missiles, bombs, or other munitions, are conducted more than 12 NM from shore. Small Ship Shock Trials could occur in the SOCAL Range Complex greater than 12 NM from shore as shown in the *Proposed Activities* section. Sinking Exercises are conducted greater than 50 NM from shore as shown in the *Proposed Activities* section. Certain activities with explosives may be conducted close to shore at locations identified in the *Activity Descriptions* section and Appendix H (Description of Systems and Ranges) of the HCTT EIS/OEIS. This includes certain Mine Warfare and Expeditionary Warfare activities. In the Hawaii Study Area explosive activities could occur at specified ranges and designated locations around Oahu, including the Puuloa Underwater Range and designated locations in and near Pearl Harbor. In the SOCAL Range Complex, explosive activities could occur near San Clemente Island, in the Silver Strand Training Complex, and in other designated mine training areas along the Southern California coast.

Characteristics, quantities, and net explosive weights of in-water explosives used during military readiness activities are provided in the *Acoustic Stressors* section. The use of in-water explosives would increase from the prior analysis for training activities, and would decrease slightly for testing. There is an overall reduction in the use of most of the largest explosive bins (bin E8 [> 60–100 pounds (lb.) net explosive weight (NEW)] and above) for training, and a decrease in two of the largest explosive bins (bin E10 [> 250–500 lb. NEW] and E11 [> 500–650 lb. NEW]) under testing activities. There would be notable increases in the smaller explosive bins (E7 [> 20–60 lb. NEW] and below) under training and testing activities, with the exception of bin E1 (0.1–0.25 lb. NEW) which would decrease under testing activities. Small Ship Shock Trials (bin E16 [> 7,250–14,500 lb. NEW]) not previously analyzed are currently proposed under testing activities. Although the general impacts from explosives during training would be similar in severity to those described during testing, there is a higher quantity of explosives used under training activities and therefore there may be slightly more impacts.

The types of activities with detonations below the surface include Mine Warfare, activities using explosive torpedoes, and ship shock trials, as well as specific training and testing activities. Most explosive munitions used during military readiness activities, however, would occur at or just above the water surface (greater than 90 percent by count). These include those used during surface warfare activities, such as explosive gunnery, bombs, and missiles. Certain nearshore activities use explosives in the surf zone up to the beach, where most explosive energy is released in the air (refer to Appendix H, Description of Systems and Ranges, for location details). In the below quantitative analysis, impacts on fishes are over-estimated because in-air near surface and surf zone explosions are modeled as underwater explosions, with all energy assumed to remain in the water. Sound and energy from in-air detonations at higher altitudes would be reflected at the water surface and therefore are not analyzed further in this section and would have no effect on fishes

Note, the Action Proponents will implement mitigation to avoid impacts from explosive military readiness activities on shallow-water coral reefs, artificial reefs, live hard bottom, submerged aquatic vegetation, and shipwrecks throughout the Study Area (see the *Mitigation* section for details), which consequently, will help avoid potential impacts on fishes that shelter and feed within those habitats.

Sound and energy from explosions could result in mortality and injury, on average, for hundreds or thousands of meters from some of the largest explosions (see Section 4.4.4, Range to Effects for Explosives). Generally, explosives that belong to larger bins (with large net explosive weights) and those calculated based on SPL sound exposure criteria (for single detonations) produce longer ranges within each effect category. However, some ranges vary depending upon several other factors (e.g., cluster size, depth of the water, depth of the charge, etc.) 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 small, juvenile, or larval fishes. Additionally, fish may experience brief periods of masking, physiological response, or behavioral reactions, depending on the level and duration of exposure.

The death of an animal would remove them from the population. Removal of individuals with high reproductive potential (e.g., adult females) would result in a larger impact on the overall population than potential loss of many larval or juvenile fishes, which tend to occur in high numbers (i.e., spawning) and have naturally high mortality rates. 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 significant effect. Based on available research, any present hearing effects may be accompanied by higher order impacts such as barotrauma or other internal injuries (e.g., inner ear tissue) with the likelihood of these reactions decreasing with increasing distance from the source (see the *Fishes Acoustic Background* section for details).

Fish could also experience masking, physiological response, and behavioral reactions within or beyond the estimated ranges to injury or TTS, with the likelihood of response lower at farther distances from the source (thousands of meters). Due to the nature of single explosive detonations, masking would be unlikely, and any stress or behavioral reactions would be brief (seconds to minutes) during the onset of the explosive signal. Multiple detonations that occur within a few seconds could pose an increased risk of impacts on nearby fishes, though many would likely avoid the source during the first few impulses. Although clustered shots could result in a higher risk of masking, this would likely happen at farther distances from the source where individual detonations might sound more continuous. If an individual fish were repeatedly exposed throughout a day or over multiple days to sound and energy from in-water explosions that caused alterations in natural behavioral patterns or physiological response, these impacts could lead to long-term consequences for the individual such as reduced survival, growth, or reproductive capacity depending on the overall severity and duration of the exposure.

Overall, military readiness activities involving explosions are generally dispersed in space and time. Consequently, repeated exposure of individual fishes to sound and energy from in-water explosions over the course of a day or multiple days is unlikely. Exposure to multiple detonations over the course of a day would most likely lead to an alteration of natural behavior or the avoidance of that specific area. However, most behavioral effects are expected to be short term (seconds or minutes) and localized, regardless of the size of the explosion. Non-injurious impacts are expected to be short-term, and fish would likely return to their natural behavior shortly after exposure. Although some individuals may be impacted, long-term consequences to fish populations would not be expected.

Conclusions regarding impacts from the use of explosives during military readiness activities for ESA-listed species is provided in Section 4.3 (ESA-Listed Species Impact Assessments).

4.3 ESA-Listed Species Impact Assessments

This section relies on the analysis of acoustic and explosive stressors on fish populations described above in Section 4.2 (Impacts Due to Each Acoustic Substressor and Explosives). Available research on reactions of fishes to underwater sound largely suggest that different species may respond similarly to the same sound source, especially similar types of fishes (e.g., migratory versus resident) and those that share similar anatomical features (see the *Fishes Acoustic Background* section). Although many of the ESA-listed species present in the Study Area may overlap locations where acoustic and explosive stressors occur (see the *Fishes Background* section for details*)*, several acoustic substressors (sonar, vessel, aircraft, and weapons noise) were determined to have minor and insignificant effects on fish populations. For example, injurious effects have not been reported in fishes exposed to non-impulsive, tonal, or broadband signals. This is because the characteristics of these non-impulsive sources lack the amplitude and the overall duration to result in physical damage. Therefore, it is not anticipated that non-impulsive acoustic stressors would result in injurious effects to ESA-listed species.

Overall, the described effects from these substressors would be minor, are unlikely to lead to a significant disruption of normal behavioral patterns such as breeding, feeding, or sheltering, and are unlikely to lead to harm. Impacts would be short-term for individuals and long-term consequences for populations would not be expected. Therefore, sonar, vessel, aircraft, and weapons noise are not analyzed further for each ESA-listed species below, but rather rely on the analysis provided above in Section 4.2 (Impacts Due to Each Acoustic Substressor and Explosives).

ESA-listed Chinook and coho salmon, eulachon, and green sturgeon would only occur in the northern portion of the California Study Area, far north of Port Hueneme where pile driving activities occur. Although some southern populations of steelhead could occur in the nearby coastal areas surrounding Port Hueneme, it is not likely that steelhead would enter the port itself as it is a highly developed commercial and military harbor, and would not provide suitable habitat for migrating steelhead to and from their natal rivers. Additionally, giant manta rays, oceanic whitetip and scalloped hammerhead sharks would only occur in Southern California (i.e., the SOCAL Range Complex), south of the location for pile driving activities. Therefore, due to lack of geographic overlap with the stressor, pile driving is not analyzed further.

Air guns and explosives could potentially effect ESA-listed fishes that overlap in space and time with these stressors. As such, a full analysis is provided for each ESA-listed species in the sections below. Additionally, an assessment of the overlap and potential pathways for effects with designated critical habitat for green sturgeon is provided as a small portion of the critical habitat overlaps the Study Area. Critical habitat for all other ESA-listed species do not overlap spatially with the HCTT Study Area, and are not analyzed further.

4.3.1 Chinook Salmon (*Oncorhynchus tshawytscha*) – Threatened, Endangered

The California Coastal, Central Valley spring-run, and Sacramento River winter-run ESU of Chinook salmon could occur in the NOCAL Range Complex throughout the year depending on various population migration timing. Although Chinook salmon tend to move north, outside of the California Study Area after entering the marine environment (Bellinger et al., 2015; Crozier et al., 2019; Moyle et al., 2017; Satterthwaite et al., 2015; Satterthwaite et al., 2014), catch data suggest some limited occurrence of Chinook salmon from the California Coastal and Central Valley spring-run ESUs in the northern most part of the PMSR (south of Monterey Bay, see Bellinger et al., 2015, for details). However, presence of migrating Chinook salmon in this portion of the Study Area would likely be localized, infrequent and temporary. Juvenile Chinook salmon would only occur in nearshore environments, outside of the Study Area. Adult Chinook salmon generally prefer nearshore, coastal waters along the shelf and are less often found over the continental slope or basin habitats as supported by tag data from the Gulf of Alaska (Seitz & Courtney, 2022, 2023, 2024).

Chinook salmon may be exposed to sound from air guns associated with testing activities in the NOCAL Range Complex (air guns are not used during training activities and are not used in the PMSR). As summarized in Table 4.2-1, air guns would be used up to 57 days per year in this portion of the Study Area. Exposures to air guns would be highly dependent on the co-occurrence of adult and juvenile Chinook salmon during the limited timeframe air guns are used, which is further limited for some of the ESUs described here as their migration over the continental shelf would be temporary and localized. Based on the small, estimated ranges (see Section 4.4.2, Range to Effects for Air Guns), mortality, injury, and TTS are highly unlikely to occur. Furthermore, Chinook salmon are considered hearing generalists, therefore any TTS that could occur would be anticipated at distances shorter than those reported in Section 4.4.2 (Range to Effects for Air Guns). If exposures occur, Chinook salmon may exhibit impacts such as behavioral reactions or physiological response depending on their proximity to the activity, though reactions would be brief and Chinook salmon would likely return quickly to their normal behavior or avoid the immediate area where the sound source is located. Masking effects are unlikely from single air gun pulses due to the short pulse length but may occur at farther distances from the source (100s of meters) if multiple shots were fired in succession and the signal was detectable above ambient noise levels. Masking at greater distances from the source could temporarily limit the distance over which fishes can communicate or detect important signals. Overall, these described effects would be minor, are unlikely to lead to a significant disruption of normal behavior patterns such as breeding, feeding, or sheltering, and are unlikely to lead to injury.

Chinook salmon could also be exposed to sound and energy from explosives associated with military readiness activities in the NOCAL Range Complex, and potentially the northernmost part of the PMSR. Juvenile Chinook salmon would remain close to shore and would not be present in the Study Area, and therefore would not be exposed to explosive activities. Overall, there are very few activities that utilize explosives in the NOCAL Range Complex compared to other locations and, the munitions used during these activities are considered small (E3 [> 0.5–2.5 lb. NEW] or below). Explosive activities are generally dispersed in space and time reducing the likelihood that explosions would co-occur with individual Chinook salmon. In the NOCAL Range Complex, all explosive activities will be conducted at least 12 NM from the closest point of land, which will avoid or reduce impacts on Chinook salmon present in nearshore habitats. Due to the infrequent and isolated use of explosives in this portion of the Study Area, potential impacts on Chinook salmon would be minimal.

Although there are higher quantities of explosives used in the PMSR compared to the NOCAL Range Complex, explosive activities are generally dispersed in space and time reducing the likelihood that explosions would co-occur with individual Chinook salmon. Furthermore, most of the explosive munitions used in this location are considered small (E5 [> 5–10 lb. NEW] or below). Some Chinook salmon could also be exposed to large detonations during activities such as oceanographic research (E7

[> 20–60 lb. NEW]) and Torpedo Testing (E8 [> 60–100 lb. NEW] or E11 [> 500–675 lb. NEW]). However, these larger detonations are typically used beyond 12 NM from shore, reducing the potential overlap for Chinook that may occur farther south and closer to shore. Furthermore, large detonations are used much less often than smaller ones, reducing the potential for overlap with migrating salmon.

Generally, smaller explosive bins produce smaller ranges to higher order effects such as mortality, injury and hearing loss compared to larger bin sizes (see Section 4.4.4, Range to Effects for Explosives, for details). Based on the estimated ranges in Section 4.4.4, Chinook salmon that are co-located with explosive activities in these described areas may experience TTS, injury or mortality. The potential for masking from single or multiple detonations would be low due to the brief duration of an individual detonation. More likely, exposures could lead to physiological response or behavioral reactions. Due to the short duration of explosives, dispersed and infrequent use throughout the ranges, Chinook salmon are not likely to be exposed multiple times within a short period and any physiological response or behavioral reactions that do occur are anticipated to be brief (seconds to minutes) and insignificant. If a school of salmon were present within the vicinity of an explosive, this could result in a larger number of individuals affected depending on their proximity to the source. Although some individuals may be impacted, long-term consequences to ESA-listed chinook salmon are not expected.

Based on the analysis presented above, the use of sonars, and activities that produce vessel, aircraft, and weapons noise during training activities, <u>may affect, but are not likely to adversely affect,</u> the California Coastal, Central Valley spring-run, and Sacramento River winter-run ESU of Chinook salmon. The use of explosives during training activities, <u>may affect, and are likely to adversely affect,</u> each ESU of Chinook salmon. Activities that involve the use of pile driving are <u>not applicable</u> to Chinook salmon because there is no geographic overlap of this stressor with the species occurrence. Air gun activities are not conducted during training.

Based on the analysis presented above, the use of sonars and air guns, and activities that produce vessel, aircraft, and weapons noise during testing activities, <u>may affect, but are not likely to adversely affect,</u> the California Coastal, Central Valley spring-run, and Sacramento River winter-run ESU of Chinook salmon. The use of explosives during testing activities, <u>may affect, and are likely to adversely affect,</u> each ESU of Chinook salmon. Pile diving activities are not conducted during testing.

4.3.2 Coho Salmon (*Oncorhynchus kisutch*) – Threatened, Endangered

The Oregon Coast, Southern Oregon and Northern California Coast, and Central California Coast ESU of coho salmon could occur in the NOCAL Range Complex throughout the year depending on various population migration timing. Survey data suggest coho salmon largely occur along the shelf in coastal, nearshore habitats and are widely dispersed with lower abundances in deeper, offshore waters (Harding, 2015). Juvenile coho salmon are likely to remain closer to shore than subadults and adults and are typically distributed in the uppermost portion of the water column (i.e., within the first ~10 m) whereas adults would occur at deeper depths (up to 50 m) (Pearcy & Fisher, 1988).

Coho salmon may be exposed to sound from air guns associated with testing activities in the NOCAL Range Complex (air guns are not used during training activities). As summarized in Table 4.2-1, air guns would be used on up to 57 days per year in this portion of the Study Area. Exposures to air guns would be highly dependent on the co-occurrence of coho salmon during the limited timeframe air guns are used, which is further limited for some of the ESUs described here as their migration over the continental shelf would be temporary and localized. Based on the small, estimated ranges (see Section 4.4.2, Range to Effects for Air Guns), mortality, injury, and TTS are highly unlikely to occur. Furthermore, coho salmon are considered hearing generalists, therefore any TTS that could occur would be anticipated at distances shorter than those reported in in Section 4.4.2 (Range to Effects for Air Guns). If exposures occur, coho salmon may exhibit impacts such as behavioral reactions or physiological response depending on their proximity to the activity, though reactions would be brief and coho salmon would likely return quickly to their normal behavior or avoid the immediate area where the sound source is located. Masking effects are unlikely from single air gun pulses due to the short pulse length but may occur at farther distances from the source (100s of meters) if multiple shots were fired in succession and the signal was detectable above ambient noise levels. Masking at greater distances from the source could temporarily limit the distance over which fishes can communicate or detect important signals. Overall, these described effects would be minor, are unlikely to lead to a significant disruption of normal behavior patterns such as breeding, feeding, or sheltering, and are unlikely to lead to injury.

Coho salmon could also be exposed to sound and energy from explosives associated with military readiness activities in the NOCAL Range Complex. Juvenile coho salmon that remain close to shore would not likely be exposed to explosive activities in this portion of the Study Area. Although subadult and adult coho salmon may be exposed to detonations placed throughout the water column (i.e., near the surface to depths of 50 m), they are very surface oriented and therefore are more likely to be exposed to explosives detonated in the upper portion of the water column, or those at the water surface. Overall, there are very few activities that utilize explosives in the NOCAL Range Complex compared to other locations and, the munitions used during these activities are considered small (E3 [> 0.5–2.5 lb. NEW] or below). Explosive activities are generally dispersed in space and time potentially reducing the likelihood that explosions would co-occur with individual coho salmon. In the NOCAL Range Complex, any explosive activities will be at least 12 NM from the closest point of land, which will avoid or reduce impacts on coho that are present in nearshore, coastal habitats. Due to the infrequent and isolated use of explosives in this portion of the Study Area, potential impacts on coho salmon would be minimal.

Generally, smaller explosive bins produce smaller ranges to higher order effects such as mortality, injury and hearing loss compared to larger bin sizes (see Section 4.4.4, Range to Effects for Explosives, for details). Based on the estimated ranges in Section 4.4.4, coho salmon that are co-located with explosive activities in these described areas may experience TTS, injury or mortality. The potential for masking from single or multiple detonations would be low due to the brief duration of an individual detonation. More likely, exposures could lead to physiological response or behavioral reactions. Due to the short duration of explosives, dispersed and infrequent use throughout the ranges, coho salmon are not likely to be exposed multiple times within a short period and any physiological response or behavioral reactions that do occur are anticipated to be brief (seconds to minutes) and insignificant. If a school of salmon were present within the vicinity of an explosive, this could result in a larger number of individuals affected depending on their proximity to the source. Although some individuals may be impacted, long-term consequences to ESA-listed coho salmon are not expected.

Based on the analysis presented above, the use of sonars, and activities that produce vessel, aircraft, and weapons noise during training activities, <u>may affect, but are not likely to adversely affect</u>, the Oregon Coast, Southern Oregon and Northern California Coast, and Central California Coast ESU of coho salmon. The use of explosives during training activities, <u>may affect, and are likely to adversely affect</u>, each ESU of coho salmon. Activities that involve the use of pile driving are <u>not applicable</u> to coho salmon because there is no geographic overlap of this stressor with the species occurrence. Air gun activities are not conducted during training.

Based on the analysis presented above, the use of sonars and air guns, and activities that produce vessel, aircraft, and weapons noise during testing activities, <u>may affect, but are not likely to adversely affect</u>, the Oregon Coast, Southern Oregon and Northern California Coast, and Central California Coast ESU of coho salmon. The use of explosives during testing activities, <u>may affect, and are likely to adversely affect,</u> each ESU of coho salmon. Pile diving activities are not conducted during testing.

4.3.3 STEELHEAD (ONCORHYNCHUS MYKISS) – THREATENED, ENDANGERED

The Northern California, California Central Valley, Central California Coast, South-Central California Coast, and Southern California DPS of steelhead could occur in the California Study Area throughout the year depending on various population migration timing. Based on the location of their natal streams and the tendency to migrate north along the coast of California, it is possible that steelhead from each of the listed DPSs could occur in the NOCAL Range Complex. Steelhead from the Central California Coast, South-Central California Coast and Southern California DPS could also occur in PMSR, with steelhead from the South-Central California Coast and Southern California DPS also present in the SOCAL Range Complex. Although some steelhead may occur farther offshore in open ocean areas for rearing and foraging, adult and juvenile steelhead are more likely to be present in nearshore, coastal areas or along the continental shelf during migration to and from their natal streams. Both adults and juveniles are strongly surface oriented and generally occur within the top 2 m of the water column. Juveniles from some populations would likely remain in freshwater habitats, limiting the potential overlap with explosive activities in the Study Area.

Steelhead may be exposed to sound from air guns associated with testing activities in the NOCAL and SOCAL Range Complex (air guns are not used during training activities or in the PMSR). As summarized in Table 4.2-1, air guns would be used on up to 57 and 44 days per year in the NOCAL and SOCAL Range Complexes, respectively. Exposures to air guns would be highly dependent on the co-occurrence of steelhead during the limited timeframe air guns are used, which is further limited for some of the DPSs described here as their migration over the continental shelf would be temporary and localized. Based on the small, estimated ranges (see Section 4.4.2, Range to Effects for Air Guns), mortality, injury, and TTS are highly unlikely to occur. Furthermore, steelhead are considered hearing generalists, therefore any TTS that could occur would be anticipated at distances shorter than those reported in in Section 4.4.2 (Range to Effects for Air Guns). If exposures occur, steelhead may exhibit impacts such as behavioral reactions or physiological response depending on their proximity to the activity, though reactions would be brief, and steelhead would likely return quickly to their normal behavior or avoid the immediate area where the sound source is located. Masking effects are unlikely from single air gun pulses due to the short pulse length but may occur at farther distances from the source (100s of meters) if multiple shots were fired in succession and the signal was detectable above ambient noise levels. Masking at greater distances from the source could temporarily limit the distance over which fishes can communicate or detect important signals. Overall, these described effects would be minor, are unlikely to lead to a significant disruption of normal behavior patterns such as breeding, feeding, or sheltering, and are unlikely to lead to injury.

Steelhead could also be exposed to sound and energy from explosives associated with military readiness activities in the NOCAL and SOCAL Range Complexes, and the PMSR. Because steelhead are highly surface oriented, they are most likely to be exposed to explosives detonated in the upper portion of the water column or at the water surface. Overall, there are very few activities that utilize explosives in the NOCAL Range Complex compared to other locations and, the munitions used during these activities are considered small (E3 [> 0.5–2.5 lb. NEW] or below). Explosive activities are generally dispersed in space and time potentially reducing the likelihood that explosions would co-occur with individual steelhead. In the NOCAL Range Complex, any explosive activities will be at least 12 NM from the closest point of land, which will avoid or reduce impacts on steelhead in nearshore habitat areas. Due to the infrequent and isolated use of explosives in this portion of the Study Area, potential impacts on steelhead would be minimal.

Although there are higher quantities of explosives used in PMSR and SOCAL Range Complex compared to the NOCAL Range Complex, explosive activities are generally dispersed in space and time. Most of the explosive munitions used in this location are considered small (E5 [> 5–10 lb. NEW] or below). Some steelhead could also be exposed to large detonations during activities such as oceanographic research (E7 [> 20–60 lb. NEW]) and Torpedo Testing (E8 [> 60–100 lb. NEW] or E11 [> 500–675 lb. NEW]). Overall, large detonations are used much less often than smaller ones, reducing the potential for overlap with migrating steelhead. Additionally, these larger detonations are typically used beyond 12 NM from shore, reducing the potential overlap for steelhead that are present closer to shore. Some exceptions to this include explosives conducted close to shore at locations identified in the *Activity Descriptions* section and Appendix H (Description of Systems and Ranges) of the HCTT EIS/OEIS. This includes certain Mine Warfare and Expeditionary Warfare activities In the SOCAL Range Complex (i.e., near San Clemente Island, in the Silver Strand Training Complex, and in other designated mine training areas along the Southern California coast). Although some steelhead could overlap amphibious approach lanes in the NOCAL Range Complex and the PMSR, there are no explosives used in these areas so no potential for effect from activities conducted in these specific locations.

Generally, smaller explosive bins produce smaller ranges to higher order effects such as mortality, injury and hearing loss compared to larger bin sizes (see Section 4.4.4, Range to Effects for Explosives, for details). Based on the estimated ranges in Section 4.4.4, steelhead that are co-located with explosive activities in these described areas may experience TTS, injury or mortality. The potential for masking from single or multiple detonations would be low due to the brief duration of an individual detonation. More likely, exposures could lead to physiological response or behavioral reactions. Due to the short duration of explosives, dispersed and infrequent use throughout the ranges, steelhead are not likely to be exposed multiple times within a short period and any physiological response or behavioral reactions that do occur are anticipated to be brief (seconds to minutes) and insignificant. If a school of salmon were present within the vicinity of an explosive, this could result in a larger number of individuals affected depending on their proximity to the source. Although some individuals may be impacted, long-term consequences to ESA-listed steelhead are not expected.

Based on the analysis presented above, the use of sonars, and activities that produce vessel, aircraft, and weapons noise during training activities, <u>may affect, but are not likely to adversely affect</u>, the Northern California Coast, California Central Valley, Central California Coast, South-Central California Coast, and Southern California DPS of steelhead. The use of explosives during training activities, <u>may affect, and are likely to adversely affect</u>, each DPS of steelhead. Activities that involve the use of pile driving are <u>not applicable</u> to steelhead because there is no geographic overlap of this stressor with the species occurrence. Air gun activities are not conducted during training.

Based on the analysis presented above, the use of sonars and air guns, and activities that produce vessel, aircraft, and weapons noise during testing activities, <u>may affect, but are not likely to adversely affect</u>, the Northern California Coast, California Central Valley, Central California Coast, South-Central California Coast, and Southern California DPS of steelhead. The use of explosives during testing activities, <u>may</u>

affect, and are likely to adversely affect, each DPS of steelhead. Pile diving activities are not conducted during testing.

4.3.4 Green Sturgeon (*Acipenser medirostris*) – Threatened

The Southern DPS of green sturgeon could occur in the northern portion of the California Study Area (i.e., the NOCAL Range Complex) throughout the year depending on seasonal migration. Early life stage and juveniles would only be present in freshwater environments, therefore subadults and adults are the only age class likely to occur within the Study Area. Migrations typically occur along the continental shelf within the 110 m depth contour, with most data suggesting green sturgeon are typically found at depths between 40–70 m. However, some sturgeon are known to linger in shallow waters (20 m) after exiting bays and estuaries before departing on their migration route. Although sturgeon spend much of their time on the bottom, some may make occasional vertical ascents to the surface.

Green sturgeon may be exposed to sound from air guns associated with testing activities in the NOCAL Range Complex (air guns are not used during training activities). Although large concentrations of green sturgeon have been observed seasonally within coastal bays and estuaries along the west coast of the US (e.g., San Francisco and Monterey Bay), activities that involve the use of air guns would not occur in these locations. As summarized in Table 4.2-1, air guns would be used up to 57 days a year in the NOCAL Range Complex. Except for the occasional visits to the surface, green sturgeon are largely benthic and therefore are less likely to be exposed to air guns used at or near the water surface. Exposures to air guns would be highly dependent on the co-occurrence of green sturgeon during the limited timeframe air guns are used, which is further limited for the Southern DPS of green sturgeon as their migration over the continental shelf would be temporary and localized. Based on the small, estimated ranges (see Section 4.4.2, Range to Effects for Air Guns), mortality, injury, and TTS are highly unlikely to occur. Furthermore, green sturgeon are considered hearing generalists, therefore any TTS that could occur would be anticipated at distances shorter than those reported in in Section 4.4.2 (Range to Effects for Air Guns). If exposures occur, green sturgeon may exhibit impacts such as behavioral reactions or physiological response depending on their proximity to the activity, though reactions would be brief and green sturgeon would likely return quickly to their normal behavior or avoid the immediate area where the sound source is located. Masking effects are unlikely from single air gun pulses due to the short pulse length but may occur at farther distances from the source (100s of meters) if multiple shots were fired in succession and the signal was detectable above ambient noise levels. Masking at greater distances from the source could temporarily limit the distance over which fishes can communicate or detect important signals. Overall, these described effects would be minor, are unlikely to lead to a significant disruption of normal behavior patterns such as breeding, feeding, or sheltering, and are unlikely to lead to injury.

Green sturgeon could also be exposed to sound and energy from explosives associated with military readiness activities. Specifically, exposures could occur to migrating adults and subadults in the NOCAL Range Complex. Although large concentrations of green sturgeon have been observed seasonally within coastal bays and estuaries along the west coast of the US (e.g., San Francisco and Monterey Bay), activities that involve the use of explosives would not occur in these locations. Green sturgeon spend most of their time on the seafloor, resulting in the highest potential exposures to detonations placed on the bottom or at depth. However, some individuals that occasionally move throughout the water column could also be exposed to surface or near surface munitions. Overall, there are very few activities that utilize explosives in the NOCAL Range Complex compared to other locations and, the munitions used during these activities are considered small (E3 [> 0.5–2.5 lb. NEW] or below). Explosive activities are generally dispersed in space and time potentially reducing the likelihood that explosions would co-occur with individual green sturgeon. In the NOCAL Range Complex, any explosive activities will be at least 12 NM from the closest point of land, which will avoid or reduce impacts on green sturgeon in nearshore, coastal habitats. Due to the infrequent and isolated use of explosives in this portion of the Study Area, potential impacts on green sturgeon would be minimal.

Generally, smaller explosive bins produce smaller ranges to higher order effects such as mortality, injury and hearing loss compared to larger bin sizes (see Section 4.4.4, Range to Effects for Explosives, for details). Based on the estimated ranges in Section 4.4.4, green sturgeon that are co-located with explosive activities in these described areas may experience TTS, injury or mortality. The potential for masking from single or multiple detonations would be low due to the brief duration of an individual detonation. More likely, exposures could lead to physiological response or behavioral reactions. Due to the short duration of explosives, dispersed and infrequent use throughout the ranges, sturgeon are not likely to be exposed multiple times within a short period and any physiological response or behavioral reactions that do occur are anticipated to be brief (seconds to minutes) and insignificant. Although some individuals may be impacted, long-term consequences to ESA-listed green sturgeon are not expected.

Based on the analysis presented above, the use of sonars, and activities that produce vessel, aircraft, and weapons noise during training activities, <u>may affect, but are not likely to adversely affect</u>, the Southern DPS of green sturgeon. The use of explosives during training activities, <u>may affect, and are likely to adversely affect</u>, green sturgeon. Activities that involve the use of pile driving are <u>not applicable</u> to green sturgeon because there is no geographic overlap of this stressor with the species occurrence. Air gun activities are not conducted during training.

Based on the analysis presented above, the use of sonars and air guns, and activities that produce vessel, aircraft, and weapons noise during testing activities, <u>may affect, but are not likely to adversely affect</u>, the Southern DPS of green sturgeon. The use of explosives during testing activities, <u>may affect, and are likely to adversely affect</u>, green sturgeon. Pile diving activities are not conducted during testing.

<u>Critical Habitat</u>

Much of the designated critical habitat for green sturgeon are restricted to nearshore, coastal, and riverine environments, with only a portion of the habitat that overlaps the northern portion of the California Study Area. Specifically, designated critical habitat overlaps the NOCAL Range Complex approximately 25 miles due west of San Francisco Bay. Military readiness activities that use sonar, air guns, explosives and those that produce vessel, aircraft, and weapons noise could occur in the marine portion of the critical habitat (pile driving activities would not occur within designated critical habitat). Many of the physical and biological features of the critical habitat are generally not applicable to the Study Area since they occur within the riverine habitat for this species. Features that do occur in marine areas within the Study Area include food resources, migratory corridors, and water quality. However, sonars and the production of vessel, aircraft, and weapons noise would be infrequent and transient and would not impact the overall abundance and availability of prey items and would not prevent sturgeon from reaching important habitat features (i.e., act as a barrier for passage). Additionally, there are no pathways for effect from these stressors on water quality. Therefore, these acoustic stressors would have no effect on any of the physical and biological features that have been identified.

Air guns and explosives associated with military readiness activities could injure or kill prey items. However, there are a low number of air guns and explosives used in the NOCAL Range Complex, and the NEW of the explosives used in this area are considered small (E3 [> 0.5–2.5 lb. NEW] or below).

Furthermore, any explosive activities in the NOCAL Range Complex will be at least 12 NM from the closest point of land, which will avoid impacts on green sturgeon prey items in nearshore, coastal habitats. Although some prey items may be impacted, long term population effects on invertebrate populations are not anticipated and there is unlikely to be a measurable reduction in abundance and availability of prey. Although green sturgeon may respond behaviorally to impulsive noise, sound and energy from air guns and explosives would be brief, and dispersed in space and time, and would not act as a physical barrier or prevent access to important habitat features. Lastly, there are no pathways for effect from noise produced by air guns and explosives on water quality. Overall, the use of air guns and explosives are not likely to result in destruction or adverse modification of green sturgeon critical habitat.

Based on the analysis presented above, the use of explosives during training activities, <u>may affect, but are not likely to adversely affect</u>, designated critical habitat for the Southern DPS of green sturgeon. The use of sonars, and activities that produce vessel, aircraft, and weapons noise during training activities, would have <u>no effect</u> on green sturgeon. Activities that involve the use of pile driving are <u>not applicable</u> to critical habitat for green sturgeon because there is no geographic overlap of this stressor with the habitat. Air gun activities are not conducted during training.

Based on the analysis presented above, the use of explosives during testing activities, <u>may affect, but are not likely to adversely affect</u>, designated critical habitat for the Southern DPS of green sturgeon. The use of sonars, noise produced by air guns, and activities that produce vessel, aircraft, and weapons noise during testing activities, would have <u>no effect</u> on green sturgeon. Pile driving activities are not conducted during testing.

4.3.5 EULACHON (*THALEICHTHYS PACIFICUS*) – THREATENED

The Southern DPS of eulachon could occur in the California Study Area (i.e., in the NOCAL Range Complex and the PMSR) throughout the year depending on their migration timing. Eulachon are typically distributed in deeper coastal waters and near benthic habitats in the open ocean at a wide range of depths (i.e., from 20 to 500 m) with an average depth around 150 m.

Eulachon may be exposed to sound from air guns associated with testing activities in the NOCAL Range Complex (air guns are not used during training activities or in the PMSR). As summarized in Table 4.2-1, air guns would be used on up to 57 days a year in this portion of the Study Area. Because eulachon typically occur deeper in the water column (at average depths of 150 m) they are less likely to be exposed to air guns used at or near the water surface. Exposures to air guns would be highly dependent on the co-occurrence of eulachon during the limited timeframe air guns are used. Based on the small, estimated ranges (see Section 4.4.2, Range to Effects for Air Guns), mortality and injury are highly unlikely to occur. Furthermore, eulachon do not have a swim bladder and are not susceptible to hearing loss. If exposures occur, eulachon may exhibit impacts such as behavioral reactions or physiological response depending on their proximity to the activity, though reactions would be brief, and eulachon would likely return quickly to their normal behavior or avoid the immediate area where the sound source is located. Masking effects are unlikely from single air gun pulses due to the short pulse length but may occur at farther distances from the source (100s of meters) if multiple shots were fired in succession and the signal was detectable above ambient noise levels. Masking at greater distances from the source could temporarily limit the distance over which fishes can communicate or detect important signals. Overall, these described effects would be minor, are unlikely to lead to a significant disruption of normal behavior patterns such as breeding, feeding, or sheltering, and are unlikely to lead to injury.

Eulachon could also be exposed to sound and energy from explosives associated with military readiness activities in the NOCAL Range Complex and the PMSR. Although eulachon may be exposed to detonations placed throughout the water column (i.e., 20 m from the surface to depths of 500 m), they are more likely to be exposed to explosives detonated at depth (mid-water) due to their preference for near benthic, deep ocean environments. Overall, there are very few activities that utilize explosives in the NOCAL Range Complex compared to other locations and, the munitions used during these activities are considered small (E3 [> 0.5–2.5 lb. NEW] or below). In the NOCAL Range Complex, any explosive activities will be at least 12 NM from the closest point of land, which will avoid or reduce impacts on eulachon in nearshore habitat areas. Due to the infrequent and isolated use of explosives in this portion of the Study Area, potential impacts on eulachon would be minimal. Although there are higher quantities of explosives used in the PMSR compared to the NOCAL Range Complex, explosive activities are generally dispersed in space and time potentially reducing the likelihood that explosions would co-occur with individual eulachon. Furthermore, most of the explosive munitions used in this location are considered small (E5 [> 5–10 lb. NEW] or below). Some eulachon could also be exposed to large detonations during activities such as oceanographic research (E7 [> 20–60 lb. NEW]) and Torpedo Testing (E8 [> 60–100 lb. NEW] or E11 [> 500–675 lb. NEW]). However, large detonations are used much less often than smaller ones, and the majority (over 90%) of explosive munitions used during military readiness activities would occur at or above the water surface, further reducing the potential for overlap with eulachon that are present at depth.

Generally, smaller explosive bins produce smaller ranges to higher order effects such as mortality, injury and hearing loss compared to larger bin sizes (see Section 4.4.4, Range to Effects for Explosives, for details). Based on the estimated ranges in Section 4.4.4, eulachon that are co-located with explosive activities in these described areas may experience injury or mortality. The potential for masking from single or multiple detonations would be low due to the brief duration of an individual detonation. More likely, exposures could lead to physiological response or behavioral reactions. Due to the short duration of explosives, dispersed and infrequent use throughout the ranges, eulachon are not likely to be exposed multiple times within a short period and any physiological response or behavioral reactions that do occur are anticipated to be brief (seconds to minutes) and insignificant. Although some individuals may be impacted, long-term consequences to ESA-listed eulachon are not expected.

Based on the analysis presented above, the use of sonars, and activities that produce vessel, aircraft, and weapons noise during training activities, <u>may affect, but are not likely to adversely affect</u>, the Southern DPS of eulachon. The use of explosives during training activities, <u>may affect, and are likely to adversely affect</u>, eulachon. Activities that involve the use of pile driving are <u>not applicable</u> to eulachon because there is no geographic overlap of this stressor with the species occurrence. Air gun activities are not conducted during training.

Based on the analysis presented above, the use of sonars and air guns, and activities that produce vessel, aircraft, and weapons noise during testing activities, <u>may affect, but are not likely to adversely affect</u>, the Southern DPS of eulachon. The use of explosives during testing activities, <u>may affect, and are likely to adversely affect</u>, eulachon. Pile diving activities are not conducted during testing.

4.3.6 Oceanic Whitetip Shark (*Carcharhinus longimanus*) – Threatened

Oceanic whitetip sharks could occur in southern portions of the Study Area (i.e., the Hawaii Study Area and SOCAL Range Complex) throughout the year. Oceanic whitetip sharks have a clear preference for open ocean waters, away from the continental shelf, and are not likely to occur within the coastal portions of the Study Area. Oceanic whitetip sharks are surface oriented, though they may also travel to deeper depths. It is likely oceanic whitetip sharks would be present during the summer months during seasonal movements to higher latitudes.

Oceanic whitetip sharks may be exposed to sound from air guns associated with testing activities in the Hawaii and SOCAL Range Complexes (air guns are not used during training activities). As summarized in Table 4.2-1, air guns would be used on up to 57 and 44 days per year in the Hawaii Study Area and SOCAL Range Complex, respectively. Although oceanic whitetip sharks are surface oriented, increasing the potential to be exposed to air guns, exposures would be highly dependent on the co-occurrence of sharks during the limited timeframe air guns are used. Based on the small, estimated ranges (see Section 4.4.2, Range to Effects for Air Guns), mortality and injury are highly unlikely to occur. Furthermore, oceanic whitetip sharks do not have a swim bladder and are not susceptible to hearing loss. If exposures occur, oceanic whitetip sharks may exhibit impacts such as behavioral reactions or physiological response depending on their proximity to the activity, though reactions would be brief and sharks would likely return quickly to their normal behavior or avoid the immediate area where the sound source is located. Masking effects are unlikely from single air gun pulses due to the short pulse length but may occur at farther distances from the source (100s of meters) if multiple shots were fired in succession and the signal was detectable above ambient noise levels. Masking at greater distances from the source could temporarily limit the distance over which fishes can communicate or detect important signals. Overall, these described effects would be minor, are unlikely to lead to a significant disruption of normal behavior patterns such as breeding, feeding, or sheltering, and are unlikely to lead to injury.

Oceanic whitetip sharks could also be exposed to sound and energy from explosives associated with military readiness activities. Specifically, exposures could occur in the Hawaii Study Area and SOCAL Range Complex, as well as the HCTT Transit Corridor. Oceanic whitetip sharks in deeper, offshore waters spend much of their time at the surface, potentially increasing the risk of exposure to surface detonations, though they could be exposed throughout the water column as they also frequent deep ocean waters. Explosive activities are generally dispersed in space and time potentially reducing the likelihood that explosions would co-occur with individual sharks. Most of the explosive munitions used throughout the Study Area (including the HCTT Transit Corridor) would be considered small (E5 (> 5 to 10 lb. NEW) or below). Larger detonation would typically occur farther from shore (beyond 12 NM) where oceanic whitetip sharks are present, however, large explosions would be used much less often than smaller detonations, reducing the risk of exposure. Individual sharks would need to be co-located in time and space during explosive activities for potential impacts to occur. Although some oceanic whitetip sharks may be present where Ship Shock Trials occur, this activity would only be conducted once over a seven-year period.

Generally, smaller explosive bins produce smaller ranges to higher order effects such as mortality, injury and hearing loss compared to larger bin sizes (see Section 4.4.4, Range to Effects for Explosives, for details). Based on the estimated ranges in Section 4.4.4, oceanic whitetip sharks that are co-located with explosive activities in these described areas may experience injury or mortality (TTS is not anticipated as sharks do not have a swim bladder and are not susceptible to hearing loss). The potential for masking from single or multiple detonations would be low due to the brief duration of an individual detonation. More likely, exposures could lead to physiological response or behavioral reactions. Due to the short duration of explosives, dispersed and infrequent use throughout the ranges, oceanic whitetip sharks are not likely to be exposed multiple times within a short period and any physiological response or behavioral reactions that do occur are anticipated to be brief (seconds to minutes) and insignificant.

Although some individuals may be impacted, long-term consequences to ESA-listed oceanic whitetip sharks are not expected.

Based on the analysis presented above, the use of sonars, and activities that produce vessel, aircraft, and weapons noise during training activities, <u>may affect, but are not likely to adversely affect</u>, oceanic whitetip sharks. The use of explosives during training activities, <u>may affect, and are likely to adversely affect</u>, oceanic whitetip sharks. Activities that involve the use of pile driving are <u>not applicable</u> to oceanic whitetip sharks because there is no geographic overlap of this stressor with the species occurrence. Air gun activities are not conducted during training.

Based on the analysis presented above, the use of sonars and air guns, and activities that produce vessel, aircraft, and weapons noise during testing activities, <u>may affect, but are not likely to adversely affect</u>, oceanic whitetip sharks. The use of explosives during testing activities, <u>may affect, and are likely to adversely affect</u>, oceanic whitetip sharks. Pile diving activities are not conducted during testing.

4.3.7 Scalloped Hammerhead Shark (*Sphyrna lewini*) – Endangered

Scalloped hammerhead sharks could occur in southern portions of the Study Area (i.e., the Hawaii Study Area and SOCAL Range Complex) throughout the year. Sightings of scalloped hammerhead sharks in Southern California are considered rare. If scalloped hammerheads are present within the SOCAL Range Complex, it is anticipated that juveniles may be present in coastal nursery areas, with subadults and adults potentially occupying both coastal and offshore habitats. Adult and juvenile sharks are anticipated to be present throughout the Hawaii Study Area, though movement patterns are restricted throughout the Hawaiian Archipelago. Tag data suggest that female scalloped hammerhead sharks typically remain close to shore, in coastal habitats, while males are dispersed farther offshore, in open ocean environments.

Scalloped hammerhead sharks may be exposed to sound from air guns associated with testing activities in the Hawaii Study Area and SOCAL Range Complex (air guns are not used during training activities). As summarized in Table 4.2-1, air guns would be used on up to 57 and 44 days per year in the Hawaii Study Area and SOCAL Range Complex, respectively. Exposure to air gun activities would be highly dependent on the co-occurrence of sharks during the limited timeframe air guns are used (especially in the SOCAL Range Complex where sightings are rare). Based on the small, estimated ranges (see Section 4.4.2, Range to Effects for Air Guns), mortality and injury are highly unlikely to occur. Furthermore, scalloped sharks do not have a swim bladder and are not susceptible to hearing loss. If exposures occur, scalloped hammerhead sharks may exhibit impacts such as behavioral reactions or physiological response depending on their proximity to the activity, though reactions would be brief and sharks would likely return quickly to their normal behavior or avoid the immediate area where the sound source is located. Masking effects are unlikely from single air gun pulses due to the short pulse length but may occur at farther distances from the source (100s of meters) if multiple shots were fired in succession and the signal was detectable above ambient noise levels. Masking at greater distances from the source could temporarily limit the distance over which fishes can communicate or detect important signals. Overall, these described effects would be minor, are unlikely to lead to a significant disruption of normal behavior patterns such as breeding, feeding, or sheltering, and are unlikely to lead to injury.

Scalloped hammerhead sharks could also be exposed to sound and energy from explosives associated with military readiness activities in the Hawaii Study Area, SOCAL Range Complex, and in the HCTT Transit Corridor. However, scalloped hammerhead sharks are considered rare to Southern California waters, reducing the potential to be impacted by explosive activities. Explosive activities are generally dispersed in space and time potentially reducing the likelihood that explosions would co-occur with individual sharks. Most of the explosive munitions used throughout the Study Area (including the HCTT Transit Corridor) would be considered small (E5 (> 5–10 lb. NEW) or below). Larger detonations would typically occur farther from shore (beyond 12 NM) where male scalloped hammerhead sharks are more likely to occur compared to females or juveniles. However, large explosions would be used much less often than smaller detonations, reducing the risk of exposure. Individual sharks would need to be co-located in time and space during explosive activities for potential impacts to occur.

Certain activities with explosives may also be conducted close to shore where scalloped hammerhead sharks could occur, at locations identified in the *Activity Descriptions* section and Appendix H (Description of Systems and Ranges) of the HCTT EIS/OEIS. This includes certain Mine Warfare and Expeditionary Warfare activities. In the Hawaii Study Area explosive activities could occur at specified ranges and designated locations around Oahu, including the Puuloa Underwater Range and designated locations in and near Pearl Harbor. Note, scalloped hammerhead sharks that are present within the nearshore mitigation areas surrounding the Hawaiian Islands would be protected as these areas prevent the use of explosives year round or seasonally depending on the location (see the *Mitigation* section for details). In the SOCAL Range Complex, explosive activities could occur near San Clemente Island, in the Silver Strand Training Complex, and in other designated mine training areas along the Southern California coast. Although some scalloped hammerhead sharks may be present farther offshore where Ship Shock Trials occur, this activity would only be conducted once over a seven-year period.

Generally, smaller explosive bins produce smaller ranges to higher order effects such as mortality, injury and hearing loss compared to larger bin sizes (see Section 4.4.4, Range to Effects for Explosives, for details). Based on the estimated ranges in Section 4.4.4, scalloped hammerhead sharks that are co-located with explosive activities in these described areas may experience injury or mortality (TTS is not anticipated as sharks do not have a swim bladder and are not susceptible to hearing loss). The potential for masking from single or multiple detonations would be low due to the brief duration of an individual detonation. More likely, exposures could lead to physiological response or behavioral reactions. Due to the short duration of explosives, dispersed and infrequent use throughout the ranges, scalloped hammerhead sharks are not likely to be exposed multiple times within a short period and any physiological response or behavioral reactions that do occur are anticipated to be brief (seconds to minutes) and insignificant. Although some individuals may be impacted, long-term consequences to ESA-listed scalloped hammerhead sharks are not expected.

Based on the analysis presented above, the use of sonars, and activities that produce vessel, aircraft, and weapons noise during training activities, <u>may affect, but are not likely to adversely affect</u>, scalloped hammerhead sharks. The use of explosives during training activities, <u>may affect, and are likely to adversely affect</u>, scalloped hammerhead sharks. Activities that involve the use of pile driving are <u>not applicable</u> to scalloped hammerhead sharks because there is no geographic overlap of this stressor with the species occurrence. Air gun activities are not conducted during training.

Based on the analysis presented above, the use of sonars and air guns, and activities that produce vessel, aircraft, and weapons noise during testing activities, <u>may affect, but are not likely to adversely affect</u>, scalloped hammerhead sharks. The use of explosives during testing activities, <u>may affect, and are likely to adversely affect</u>, scalloped hammerhead sharks. Pile diving activities are not conducted during testing.

4.3.8 Giant Manta Ray (*Manta birostris*) – Threatened

Giant manta rays could occur in the southernmost portions of the Study Area (i.e., the Hawaii Study Area and SOCAL Range Complex) throughout the year. Giant manta rays typically occur in areas of upwelling along the coast, or near islands or offshore pinnacles and seamounts. Typically, seasonal migrations are limited to either the west coast (from Baja to Southern California) or around specific islands of Hawaii and giant manta rays are not anticipated to cross ocean basins. Large seasonal aggregations are known to occur along the Kona coast off the Big Island of Hawaii. In the California Study Area, the SOCAL Range Complex is likely the northern limit of their distribution.

Giant manta rays may be exposed to sound from air guns associated with testing activities in the Hawaii Study Area and SOCAL Range Complex (air guns are not used during training activities). As summarized in Table 4.2-1, air guns would be used on up to 57 and 44 days per year in the Hawaii Study Area and SOCAL Range Complex, respectively. Exposures would be highly dependent on the co-occurrence of rays during the limited timeframe air guns are used. Based on the small, estimated ranges (see Section 4.4.2, Range to Effects for Air Guns), mortality and injury are highly unlikely to occur. Furthermore, giant manta rays do not have a swim bladder and are not susceptible to hearing loss. If exposures occur, Giant manta rays may exhibit impacts such as behavioral reactions or physiological response depending on their proximity to the activity, though reactions would be brief and Giant manta rays would likely return quickly to their normal behavior or avoid the immediate area where the sound source is located. Masking effects are unlikely from single air gun pulses due to the short pulse length but may occur at farther distances from the source (100s of meters) if multiple shots were fired in succession and the signal was detectable above ambient noise levels. Masking at greater distances from the source could temporarily limit the distance over which fishes can communicate or detect important signals. Overall, these described effects would be minor, are unlikely to lead to a significant disruption of normal behavior patterns such as breeding, feeding, or sheltering, and are unlikely to lead to injury.

Giant manta rays could also be exposed to sound and energy from explosives associated with military readiness activities in the Hawaii Study Area and SOCAL Range Complex, though manta ray presence in the SOCAL Range Complex may be limited as Southern California is the northern edge of their distribution. Giant manta rays have the potential to be exposed to detonations placed throughout the water column, including near the surface or on the seafloor. However, manta rays that occur on or near reefs, would be protected from exposure due to mitigation measures that prevent explosives on seafloor resources (see the *Mitigation* section for details). Explosive activities are generally dispersed in space and time, potentially reducing the likelihood that explosions would co-occur with individual manta rays. Most of the explosive munitions used throughout the Study Area would be considered small (E5 [> 5–10 lb. NEW] or below). Larger detonations would typically occur farther from shore (beyond 12 NM) where manta rays are present. However, large explosions would be used much less often than smaller detonations, reducing the risk of exposure. Individual manta rays would need to be co-located in time and space during explosive activities for potential impacts to occur. If seasonal aggregations of manta rays occur in other portions of the Study Area and are within the vicinity of an explosive, a larger number of individuals may be affected from a single event depending on their proximity to the source.

Certain activities with explosives may be conducted close to shore where manta rays could occur, specifically at locations identified in the *Activity Descriptions* section and Appendix H (Description of Systems and Ranges) of the HCTT EIS/OEIS. This includes certain Mine Warfare and Expeditionary Warfare activities. In the Hawaii Study Area explosive activities could occur at specified ranges and designated locations around Oahu, including the Puuloa Underwater Range and designated locations in and near Pearl Harbor. However, giant manta rays present within the nearshore mitigation areas surrounding the Hawaiian Islands, including large aggregations along the Kona coast off the Big Island of Hawaii, would be protected as these areas prevent the use of explosives year-round or seasonally depending on the location (see the *Mitigation* section for details). In the SOCAL Range Complex, explosive activities could occur in nearshore areas surrounding San Clemente Island, in the Silver Strand Training Complex, and in other designated mine training areas along the Southern California coast where manta rays may be present. However, the likelihood of giant manta rays co-occurring with these activities would be limited as the SOCAL Range Complex is likely the northern edge of their distribution. Although giant manta rays do not typically migrate across open ocean environments, some manta rays may also be present in the offshore portion of the SOCAL Range Complex where Ship Shock Trials occur. However, exposures would be unlikely as this activity would only be conducted once over a seven-year period.

Generally, smaller explosive bins produce smaller ranges to higher order effects such as mortality, injury and hearing loss compared to larger bin sizes (see Section 4.4.4, Range to Effects for Explosives, for details). Based on the estimated ranges in Section 4.4.4, giant manta rays that are co-located with explosive activities in these described areas may experience injury or mortality (TTS is not anticipated as rays do not have a swim bladder and are not susceptible to hearing loss). The potential for masking from single or multiple detonations would be low due to the brief duration of an individual detonation. More likely, exposures could lead to physiological response or behavioral reactions. Due to the short duration of explosives, dispersed and infrequent use throughout the ranges, giant manta rays are not likely to be exposed multiple times within a short period and any physiological response or behavioral reactions that do occur are anticipated to be brief (seconds to minutes) and insignificant. Although some individuals may be impacted, long-term consequences to ESA-listed giant manta rays are not expected.

Based on the analysis presented above, the use of sonars, and activities that produce vessel, aircraft, and weapons noise during training activities, <u>may affect, but are not likely to adversely affect</u>, giant manta rays. The use of explosives during training activities, <u>may affect, and are likely to adversely affect</u>, giant manta rays. Activities that involve the use of pile driving are <u>not applicable</u> to giant manta rays because there is no geographic overlap of this stressor with the species occurrence. Air gun activities are not conducted during training.

Based on the analysis presented above, the use of sonars and air guns, and activities that produce vessel, aircraft, and weapons noise during testing activities, <u>may affect, but are not likely to adversely affect</u>, giant manta rays. The use of explosives during testing activities, <u>may affect, and are likely to adversely affect</u>, giant manta rays. Pile diving activities are not conducted during testing.

4.4 RANGE TO EFFECTS

The following section provides the range (distance) over which specific physiological or behavioral effects are expected to occur based on the acoustic and explosive criteria in Section 4.1 (Quantifying Impacts on Fishes from Acoustic and Explosive Stressors), and the acoustic and explosive propagation calculations from the Navy Acoustic Effects Model described in the *Quantitative Analysis TR*. The ranges to effects are shown for representative sonar systems, air guns, and explosive bins from E1 (0.1–0.25 lb. NEW) to E16 (>7,500–14,500 lb. NEW). Ranges are determined by modeling the distance that noise from a source will need to propagate to reach exposure level thresholds specific to a fish hearing group or category that will cause TTS, injury, and mortality. Ranges to effects are utilized to help predict impacts from acoustic and explosive sources.

Tables present median and standard deviation ranges to effects for each fish hearing group or category, source or bin, bathymetric depth intervals of ≤200 m and >200 m to represent areas on an off the continental shelf, exposure duration (sonar), and representative cluster size (air guns and explosives). Ranges to effects consider propagation effects of sources modeled at different locations (i.e., analysis points), seasons, source depths, and radials (i.e., each analysis point considers propagation effects in different x-y directions by modeling 18 radials in azimuthal increments of 20° to obtain 360° coverage around an analysis point). The exception to this is ranges to effects for pile driving, which were calculated outside of the Navy Acoustic Effects Model, do not have variance in ranges, and are not presented as a summary statistic (e.g., median and standard deviation).

Boxplots visually present the distribution, variance, and outlier ranges for a given combination of a source or bin, fish hearing group or category, and effect. On the boxplots, outliers are plotted as dots, the lowest and highest non-outlier ranges are the extent of the left and right horizontal lines respectively that extend from the sides of a colored box, and the 25th, 50th (i.e., median), and 75th percentiles are the left edge, center line, and right edge of a colored box respectively.

4.4.1 Range to Effects for Sonar and Other Transducers

The six representative sonar systems with ranges to effects are not applicable to fishes since they produce sound at frequencies greater than the upper hearing range of most fishes (i.e., > 2 kHz).

4.4.2 Range to Effects for Air Guns

Ranges to effects for air guns were determined by modeling the distance that sound would need to propagate to reach exposure level thresholds specific to a fish hearing group or category that would cause TTS, injury, and mortality as described in Section 4.1 (Quantifying Impacts on Fishes from Acoustic and Explosive Stressors). Air gun ranges for injury and mortality are SPL- and SEL-based.

Table 4.4-1: Fishes Ranges to Effects for Air Guns (SPL-based)

Group	Depth	Cluster Size	TTS	INJ	MORT
Fishes without a Swim Bladder	≤200 m	1	NA	< 1 m (0 m)	< 1 m (0 m)
		10	NA	NA	NA
	>200 m	1	NA	< 0 m (0 m)	0 m (0 m)
		10	NA	NA	NA
Fishes with a Swim Bladder (including generalists and specialists)	≤200 m	1	NA	< 2 m (1 m)	< 2 m (1 m)
		10	5 m (1 m)	NA	NA
	>200 m	1	NA	< 2 m (1 m)	< 2 m (1 m)
		10	5 m (2 m)	NA	NA

-INJ and MORT are SPL-based
-TTS ranges for fishes with a swim bladder only and are SEL-based
-Median ranges with standard deviation ranges in parentheses
-NA = not applicable
-No ranges for depths ≤200 m or >200 m unless shown
- < indicates that the range to effects would be less than the provided value

Table 4.4-2: Fishes Ranges to Effects for Air Guns (SEL-based)

Group	Depth	Cluster Size	TTS	INJ	MORT
Fishes without a Swim Bladder	≤200 m	1	NA	NA	NA
		10	NA	0 m (0 m)	0 m (0 m)
	>200 m	1	NA	NA	NA
		10	NA	0 m (0 m)	0 m (0 m)
Fishes with a Swim Bladder (including generalists and specialists)	≤200 m	1	NA	NA	NA
		10	5 m (1 m)	0 m (0 m)	0 m (0 m)
	>200 m	1	NA	NA	NA
		10	5 m (2 m)	0 m (0 m)	0 m (0 m)

-INJ and MORT are SEL-based
-TTS ranges for fishes with a swim bladder only
-Median ranges with standard deviation ranges in parentheses
-NA = not applicable
-No ranges for depths ≤200 m or >200 m unless shown

4.4.3 Range to Effects for Pile Driving

Ranges to effects for impact pile driving were determined by modeling the distance that sound would need to propagate to reach exposure level thresholds specific to a fish hearing group or category that would cause TTS, injury, and mortality as described in Section 4.1.2 (Quantifying Injury and Hearing Impacts from Air Guns and Pile Driving). Note, sound exposure criteria are not available for piles driven using the vibratory method, therefore ranges to effects are only estimated for piles driven using impact methods. Modeling for pile driving was done outside of the Navy's Acoustic Affects Model (see the Quantitative Analysis TR for details).

Table 4.4-3: Ranges to Effects for Impact Pile Driving for Transient Fishes (5 Minutes)

Pile Type/Size	Hearing Group	Fish Category	Range to Effects (meters)				
			TTS	Onset of Injury		Onset of Mortality	
			cSEL	cSEL	Peak SPL	cSEL	Peak SPL
12 to 20-inch Timber Round Piles	Generalists	Fishes without a swim bladder	0	0	0	0	0
	Generalists	Fishes with a swim bladder not involved in hearing	< 8	1	0	0	0
	Specialists	Fishes with a swim bladder involved in hearing and high-frequency hearing	8	1	0	0	0
12 to 20-inch Steel H-Piles	Generalists	Fishes without a swim bladder	0	0	< 1	0	< 1
	Generalists	Fishes with a swim bladder not involved in hearing	< 38	3	< 2	1	< 2
	Specialists	Fishes with a swim bladder involved in hearing and high-frequency hearing	38	3	< 2	2	< 2
12 to 20-inch Steel, Timber, or Composite Round Piles	Generalists	Fishes without a swim bladder	0	< 1	< 2	< 1	< 2
	Generalists	Fishes with a swim bladder not involved in hearing	< 131	10	< 5	3	< 5
	Specialists	Fishes with a swim bladder involved in hearing and high-frequency hearing	131	10	< 5	5	< 5

Notes: cSEL = Cumulative sound exposure level, peak SPL = Peak sound pressure level, TTS = Temporary Threshold Shift, NR = no criteria are available and therefore no range to effects are estimated, < indicates that ranges to effects would be less than the provided value.

Table 4.4-4: Ranges to Effects for Impact Pile Driving for Resident Fishes (1 Day)

Pile Type/Size	Hearing Group	Fish Category	Range to Effects (meters)				
			TTS	Onset of Injury		Onset of Mortality	
			cSEL	cSEL	Peak SPL	cSEL	Peak SPL
12 to 20-inch Timber Round Piles	Generalists	Fishes without a swim bladder	0	1	0	1	0
	Generalists	Fishes with a swim bladder not involved in hearing	< 80	6	0	2	0
	Specialists	Fishes with a swim bladder involved in hearing and high-frequency hearing	80	6	0	3	0
12 to 20-inch Steel H-Piles	Generalists	Fishes without a swim bladder	0	< 2	< 1	< 1	< 1
	Generalists	Fishes with a swim bladder not involved in hearing	< 201	15	< 2	5	< 2
	Specialists	Fishes with a swim bladder involved in hearing and high-frequency hearing	201	15	< 2	8	< 2
12 to 20-inch Steel, Timber, or Composite Round Piles	Generalists	Fishes without a swim bladder	0	< 13	< 2	< 8	< 2
	Generalists	Fishes with a swim bladder not involved in hearing	< 1,267	93	< 5	32	< 5
	Specialists	Fishes with a swim bladder involved in hearing and high-frequency hearing	1,267	93	< 5	50	< 5

Notes: cSEL = Cumulative sound exposure level, peak SPL = Peak sound pressure level, TTS = Temporary Threshold Shift, NR = no criteria are available and therefore no range to effects are estimated, < indicates that ranges to effects would be less than the provided value.

4.4.4 Range to Effects for Explosives

Ranges to effects for explosives were determined by modeling the distance that sound would need to propagate to reach exposure level thresholds specific to a fish hearing group or category that would cause TTS, injury, and mortality as described in Section 4.1 (Quantifying Impacts on Fishes from Acoustic and Explosive Stressors). The explosive ranges for injury and mortality are SPL-based and ranges for TTS are SEL-based.

The Navy Acoustic Effects Model cannot account for the highly non-linear effects of cavitation and surface blow off for shallow underwater explosions, nor can it estimate the explosive energy entering the water from a low-altitude detonation. Thus, for this analysis, in-air sources detonating at or near (within 10 m) the surface are modeled as if detonating completely underwater at a source depth of 0.1 m, with all energy reflected into the water rather than released into the air. Therefore, the amount of explosive and acoustic energy entering the water, and consequently the estimated ranges to effects, are likely to be overestimated. In the tables below, near surface explosions can occur for bathymetric depth intervals of ≤200 m and >200 m.

Table 4.4-5: Explosive Ranges to Effects for Fishes without a Swim Bladder

Bin	Depth	Cluster Size	TTS	INJ	MORT
E1	≤200 m	1	NA	86 m (4 m)	14 m (4 m)
	>200 m	1	NA	87 m (5 m)	17 m (4 m)
E2	≤200 m	1	NA	136 m (14 m)	37 m (5 m)
	>200 m	1	NA	136 m (14 m)	37 m (6 m)
E3	≤200 m	1	NA	243 m (16 m)	64 m (12 m)
	>200 m	1	NA	247 m (13 m)	73 m (9 m)
E4	≤200 m	1	NA	436 m (26 m)	158 m (13 m)
	>200 m	1	NA	437 m (31 m)	154 m (12 m)
E5	≤200 m	1	NA	416 m (29 m)	148 m (13 m)
	>200 m	1	NA	398 m (25 m)	144 m (9 m)
E6	≤200 m	1	NA	575 m (52 m)	216 m (24 m)
	>200 m	1	NA	575 m (48 m)	221 m (23 m)
E7	≤200 m	1	NA	706 m (24 m)	281 m (10 m)
	>200 m	1	NA	714 m (21 m)	281 m (9 m)
E8	≤200 m	1	NA	912 m (54 m)	357 m (8 m)
	>200 m	1	NA	903 m (47 m)	354 m (10 m)
E9	≤200 m	1	NA	953 m (40 m)	456 m (17 m)
	>200 m	1	NA	957 m (47 m)	458 m (19 m)
E10	≤200 m	1	NA	1,283 m (96 m)	578 m (51 m)
	>200 m	1	NA	1,274 m (112 m)	579 m (48 m)
E11	≤200 m	1	NA	2,042 m (58 m)	738 m (10 m)
	>200 m	1	NA	2,000 m (130 m)	747 m (29 m)
E12	≤200 m	1	NA	1,750 m (5 m)	760 m (2 m)
	>200 m	1	NA	1,707 m (31 m)	749 m (11 m)
E13	≤200 m	1	NA	6,486 m (348 m)	2,972 m (132 m)
E16	>200 m	1	NA	9,576 m (645 m)	3,757 m (168 m)

Median ranges with standard deviation ranges in parentheses, TTS ranges are SEL-based and for fishes with a swim bladder only
TTS = Temporary Threshold Shift, INJ = Injury, MORT = Mortality, NA = not applicable
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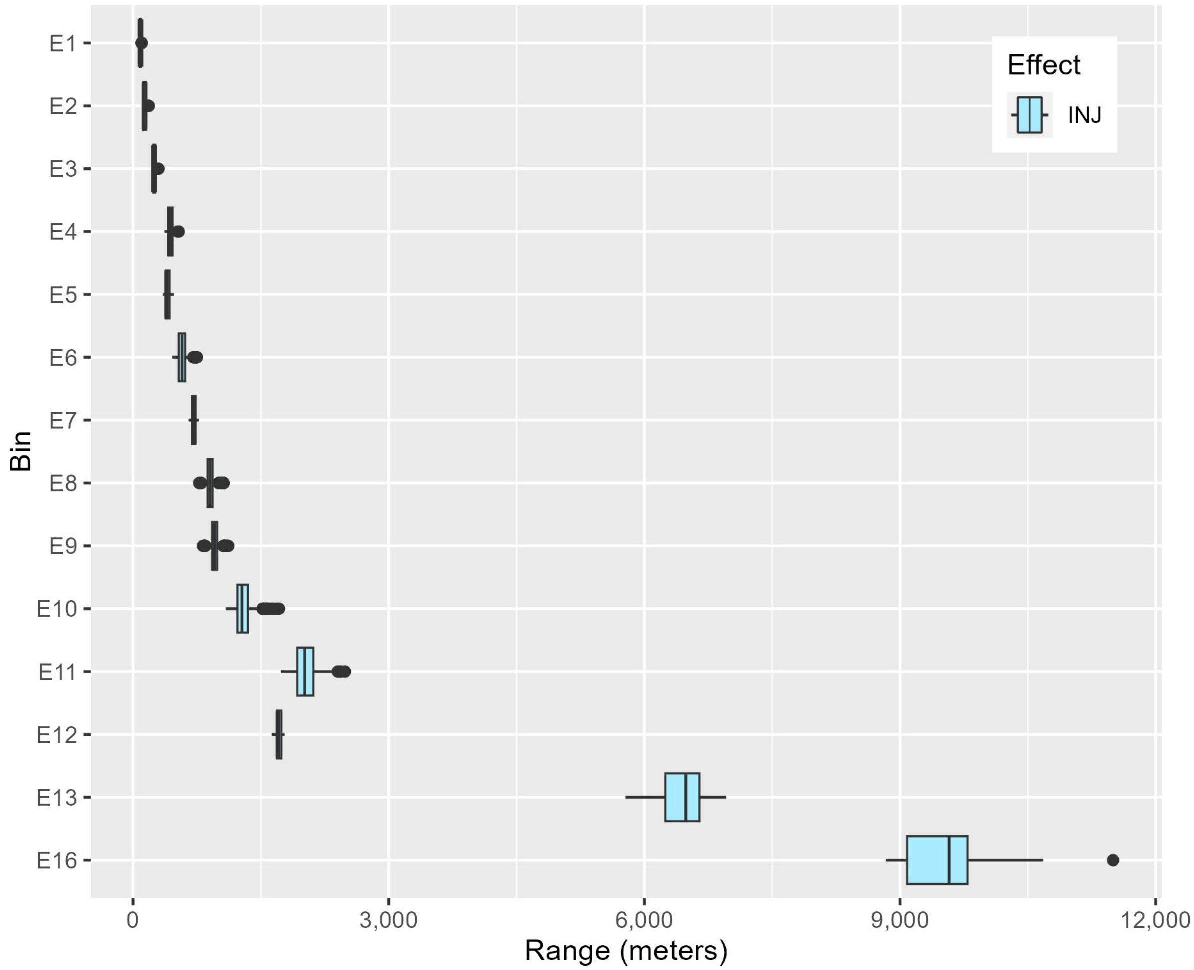

Figure 4.4-1: Explosive Ranges to Injury for Fishes Without a Swim Bladder

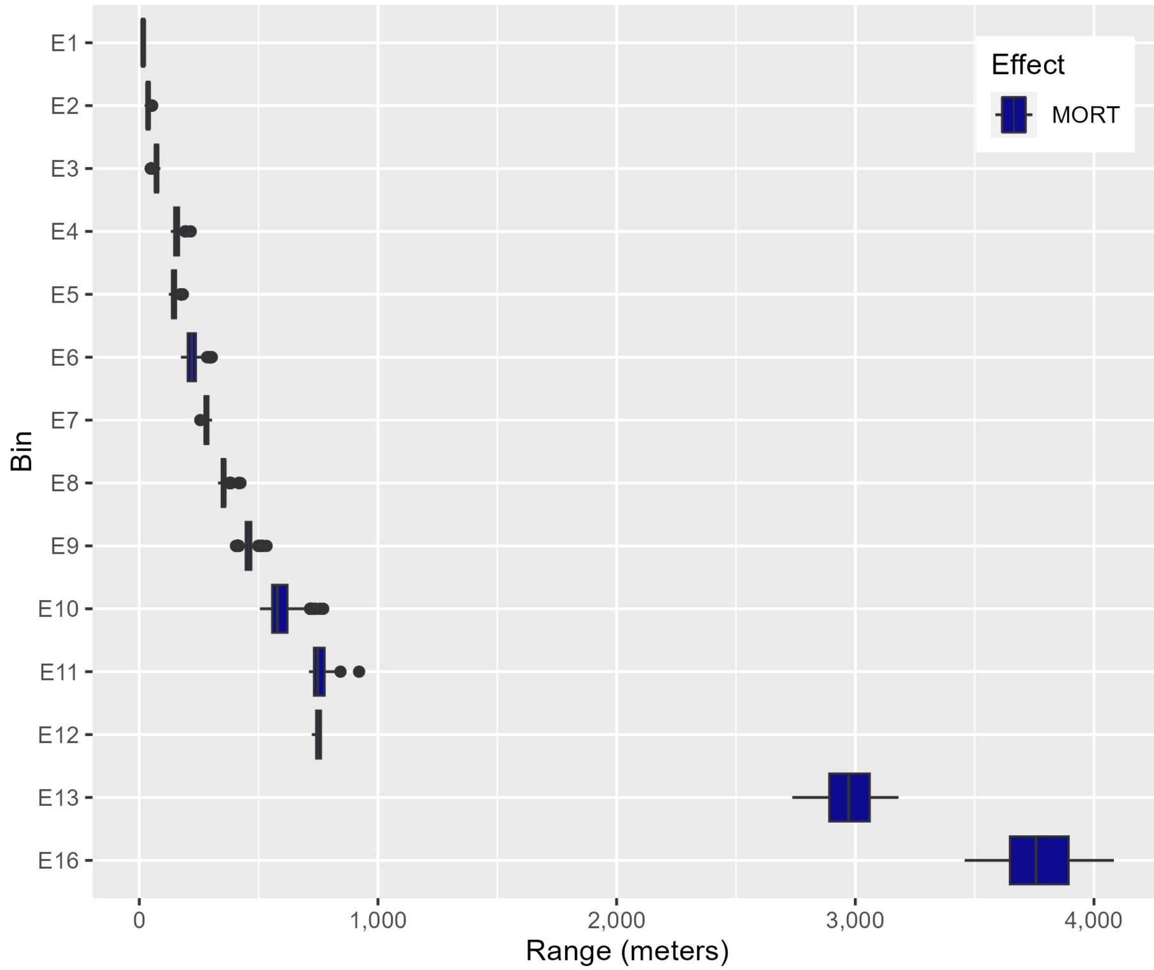

Figure 4.4-2: Explosive Ranges to Mortality for Fishes Without a Swim Bladder

Table 4.4-6: Explosive Ranges to Effects for Fishes with a Swim Bladder

Bin	Depth	Cluster Size	TTS	INJ	MORT
E1	≤200 m	1	< 45 m (7 m)	86 m (4 m)	14 m (4 m)
		5	< 90 m (18 m)	NA	NA
		25	< 187 m (51 m)	NA	NA
		50	< 254 m (33 m)	NA	NA
	>200 m	1	< 2 m (16 m)	87 m (5 m)	17 m (4 m)
		5	< 75 m (22 m)	NA	NA
		25	< 170 m (9 m)	NA	NA
		50	< 240 m (8 m)	NA	NA
E2	≤200 m	1	< 43 m (6 m)	136 m (14 m)	37 m (5 m)
	>200 m	1	< 44 m (7 m)	136 m (14 m)	37 m (6 m)
E3	≤200 m	1	< 96 m (34 m)	243 m (16 m)	64 m (12 m)
		5	< 200 m (75 m)	NA	NA
		25	< 388 m (149 m)	NA	NA
	>200 m	1	< 100 m (22 m)	247 m (13 m)	73 m (9 m)
		5	< 180 m (7 m)	NA	NA
		25	< 390 m (11 m)	NA	NA
E4	≤200 m	1	< 292 m (124 m)	436 m (26 m)	158 m (13 m)
	>200 m	1	< 180 m (17 m)	437 m (31 m)	154 m (12 m)
E5	≤200 m	1	< 160 m (201 m)	416 m (29 m)	148 m (13 m)
		5	< 302 m (58 m)	NA	NA
	>200 m	1	< 140 m (7 m)	398 m (25 m)	144 m (9 m)
		5	< 300 m (9 m)	NA	NA
		20	< 550 m (12 m)	NA	NA
E6	≤200 m	1	< 465 m (315 m)	575 m (52 m)	216 m (24 m)
		15	< 1,827 m (157 m)	NA	NA
	>200 m	1	< 330 m (85 m)	575 m (48 m)	221 m (23 m)

Bin	Depth	Cluster Size	TTS	INJ	MORT
E7	≤200 m	1	< 280 m (56 m)	706 m (24 m)	281 m (10 m)
	>200 m	1	< 270 m (79 m)	714 m (21 m)	281 m (9 m)
E8	≤200 m	1	< 495 m (54 m)	912 m (54 m)	357 m (8 m)
	>200 m	1	< 489 m (48 m)	903 m (47 m)	354 m (10 m)
E9	≤200 m	1	< 625 m (350 m)	953 m (40 m)	456 m (17 m)
	>200 m	1	< 438 m (15 m)	957 m (47 m)	458 m (19 m)
E10	≤200 m	1	< 684 m (124 m)	1,283 m (96 m)	578 m (51 m)
	>200 m	1	< 684 m (126 m)	1,274 m (112 m)	579 m (48 m)
E11	≤200 m	1	< 1,778 m (74 m)	2,042 m (58 m)	738 m (10 m)
	>200 m	1	< 1,806 m (90 m)	2,000 m (130 m)	747 m (29 m)
E12	≤200 m	1	< 676 m (1 m)	1,750 m (5 m)	760 m (2 m)
	>200 m	1	< 676 m (15 m)	1,707 m (31 m)	749 m (11 m)
E13	≤200 m	1	< 7,875 m (202 m)	6,486 m (348 m)	2,972 m (132 m)
E16	>200 m	1	< 10,965 m (491 m)	9,576 m (645 m)	3,757 m (168 m)

Median ranges with standard deviation ranges in parentheses, TTS ranges are SEL-based and for fishes with a swim bladder only
TTS = Temporary Threshold Shift, INJ = Injury, MORT = Mortality, NA = not applicable, < indicates that ranges to effects would be less than the provided value
Table Created: 05 Aug 2024 4:57:14 PM

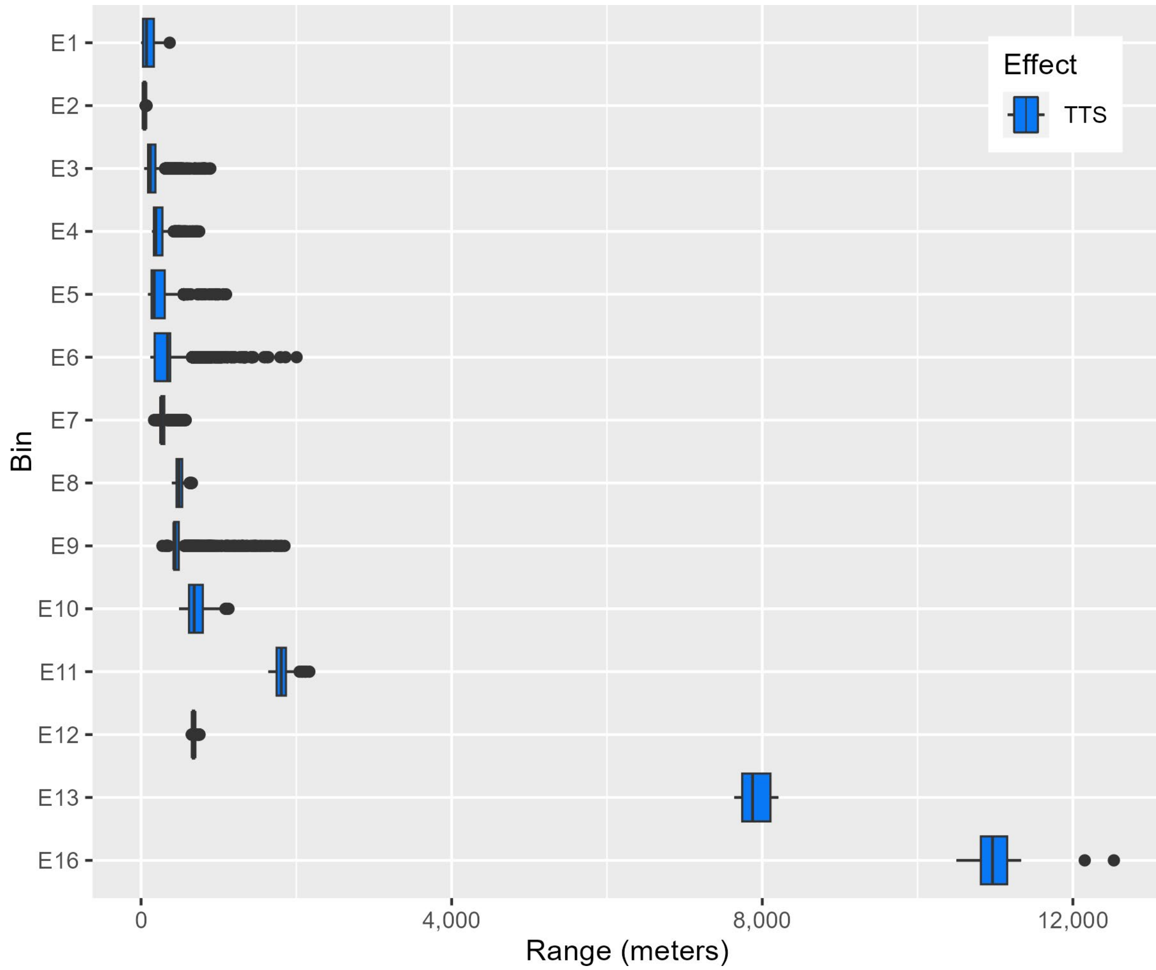

Figure 4.4-3: Explosive Ranges to Temporary Threshold Shift for Fishes with a Swim Bladder

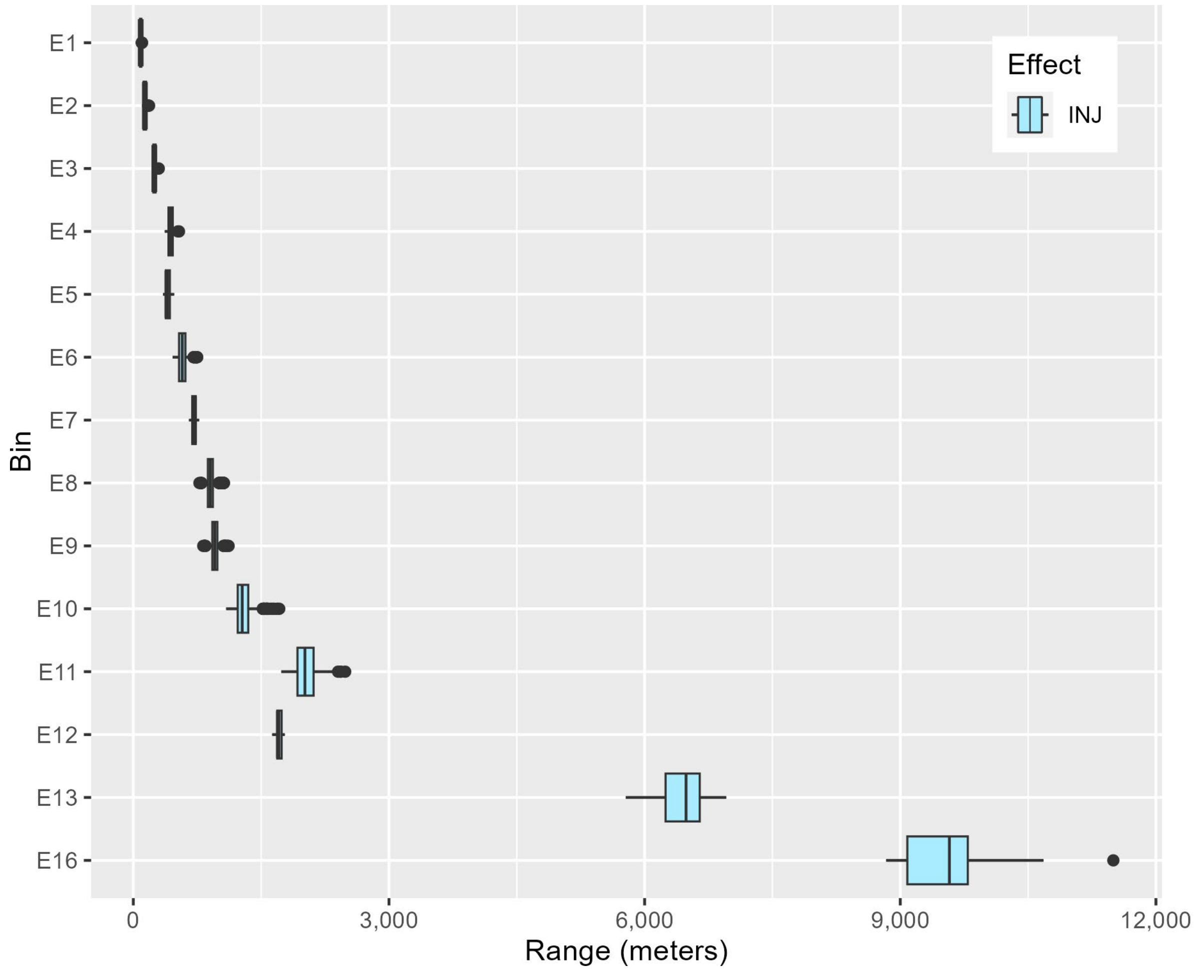

Figure 4.4-4: Explosive Ranges to Injury for Fishes with a Swim Bladder

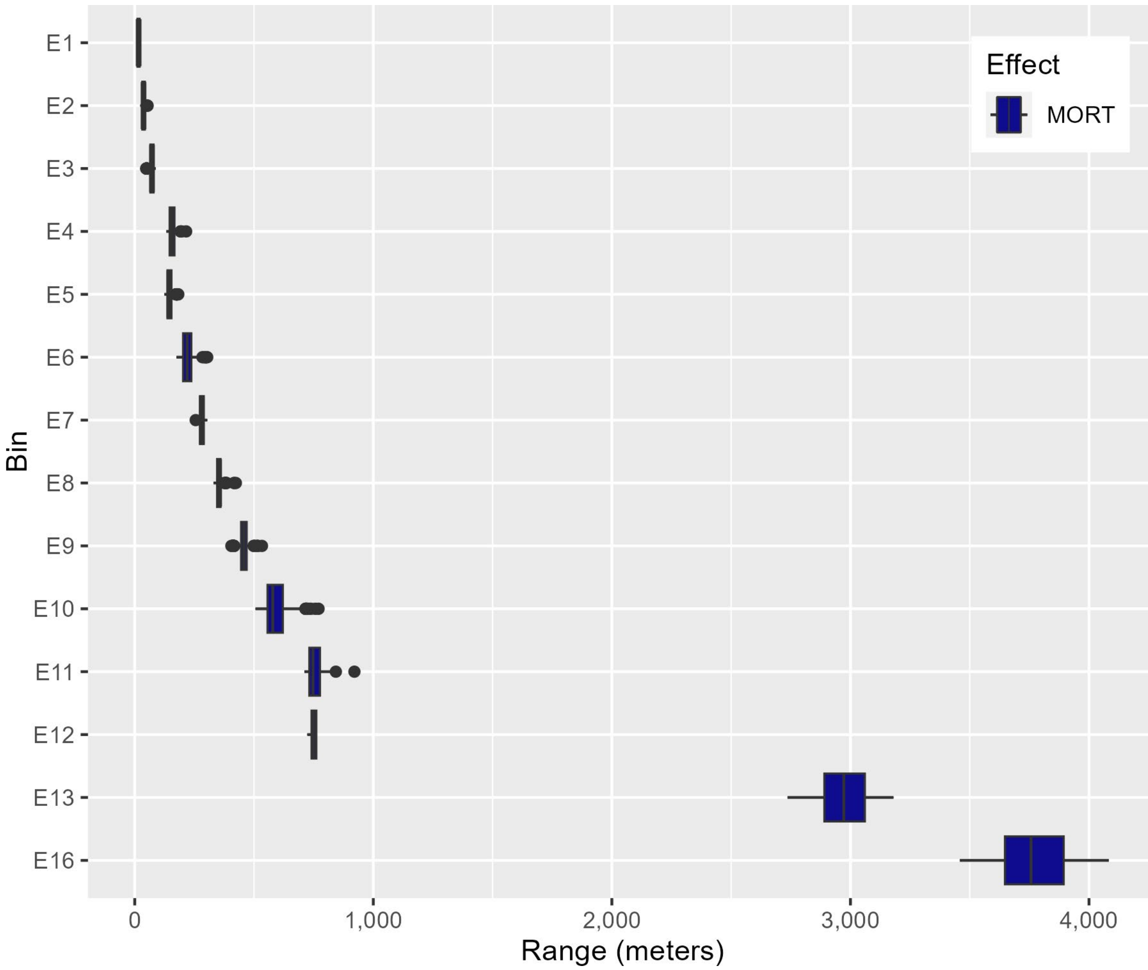

Figure 4.4-5: Explosive Ranges to Mortality for Fishes with a Swim Bladder

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