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Northwest Training and Testing

Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement

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Northwest Training and Testing Activities
Final Supplemental Environmental Impact Statement/ Overseas Environmental Impact Statement

Volume 2

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3.5 Sea Turtles

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3.5 Sea Turtles

3.5.1 Affected Environment

This section analyzes potential impacts on sea turtles found in the Northwest Training and Testing (NWTT) Study Area (Study Area). As noted in Section 3.5 (Sea Turtles) in the 2015 NWTT Final Environmental Impact Statement (EIS)/Overseas EIS (OEIS), the leatherback sea turtle (*Dermochelys coriacea*), a cold-water adapted species, is the only species of sea turtle expected to occur within the Study Area. Other species of sea turtles (loggerhead sea turtle [*Caretta caretta*], olive ridley sea turtle [*Lepidochelys olivacea*], and green sea turtle [*Chelonia mydas*]) are considered tropical, subtropical, and warm temperate species and rarely stray into cold waters. If these species were found in the Study Area they would be likely become cold stressed in the environment to the point of stranding or death and therefore are not carried forward for further analysis.

Within the Study Area, leatherback sea turtles are only expected to occur within the Offshore Area; therefore, training and testing activities that would occur in the Inland Waters or Western Behm Canal, Alaska, are not analyzed for potential impacts on the leatherback sea turtle (see Section 3.5.2.4.2, Habitat and Geographic Range, in the 2015 NWTT Final EIS/OEIS).

The Navy conducted a literature search for any new information that pertains to the leatherback sea turtles' status and distribution within the Study Area. This information is included in the following subsections. In addition, the Navy's literature search included a review of any new information on other sea turtle species that may occur within the Study Area. Based on this review, there is no new substantive information on other sea turtle species that may occur within the Study Area, and the Navy determined that inclusion of other sea turtle species for analysis in this Supplemental EIS/OEIS (Supplemental) is not warranted. The Navy also reviewed the status and distribution of other pelagic reptile species, such as sea snakes, to evaluate if these species should be included in this Supplemental. Although there are recent sightings of yellow-bellied sea snakes off the coast of southern California, the Navy's review of recent literature published since the 2015 NWTT Final EIS/OEIS found no records or anecdotal sightings of sea snakes within the Study Area. Therefore, sea snakes are not included in this Supplemental.

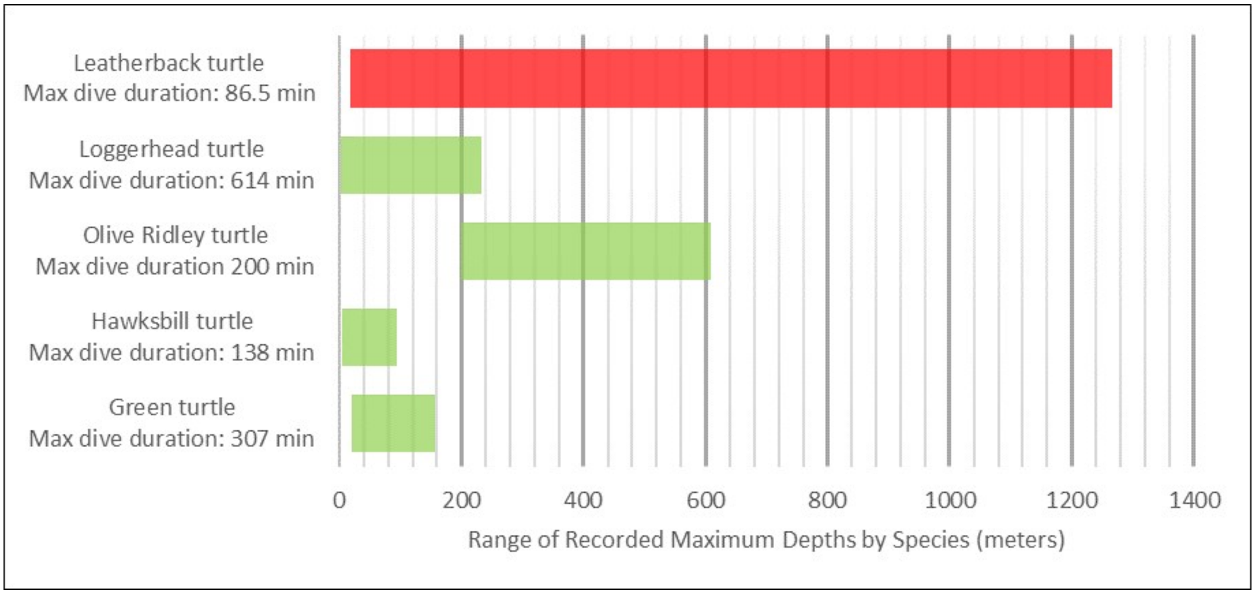
The 2015 NWTT Final EIS/OEIS provided a general overview of sea turtle diving, hearing and vocalizations, and general threats. New information since the publication of the 2015 NWTT Final EIS/OEIS is included below to better understand potential stressors and impacts on sea turtles resulting from training and testing activities.

3.5.1.1 Diving

Sea turtle dive depth and duration varies by species, the age of the animal, the location of the animal, and the activity (foraging, resting, and migrating). The leatherback is the deepest diving sea turtle, with a recorded maximum depth of 4,200 feet (ft.) (1,280 meters [m]) (Houghton et al., 2008), although most dives are much shallower (usually less than 820 ft. [250 m]) (Hays et al., 2004b; Hays et al., 2004c; Sale et al., 2006; Wallace et al., 2015). Diving activity (including surface time) is influenced by a suite of environmental factors (e.g., water temperature, availability and vertical distribution of food resources, bathymetry) that result in spatial and temporal variations in dive behavior (James et al., 2006; Sale et al., 2006; Wallace et al., 2016).

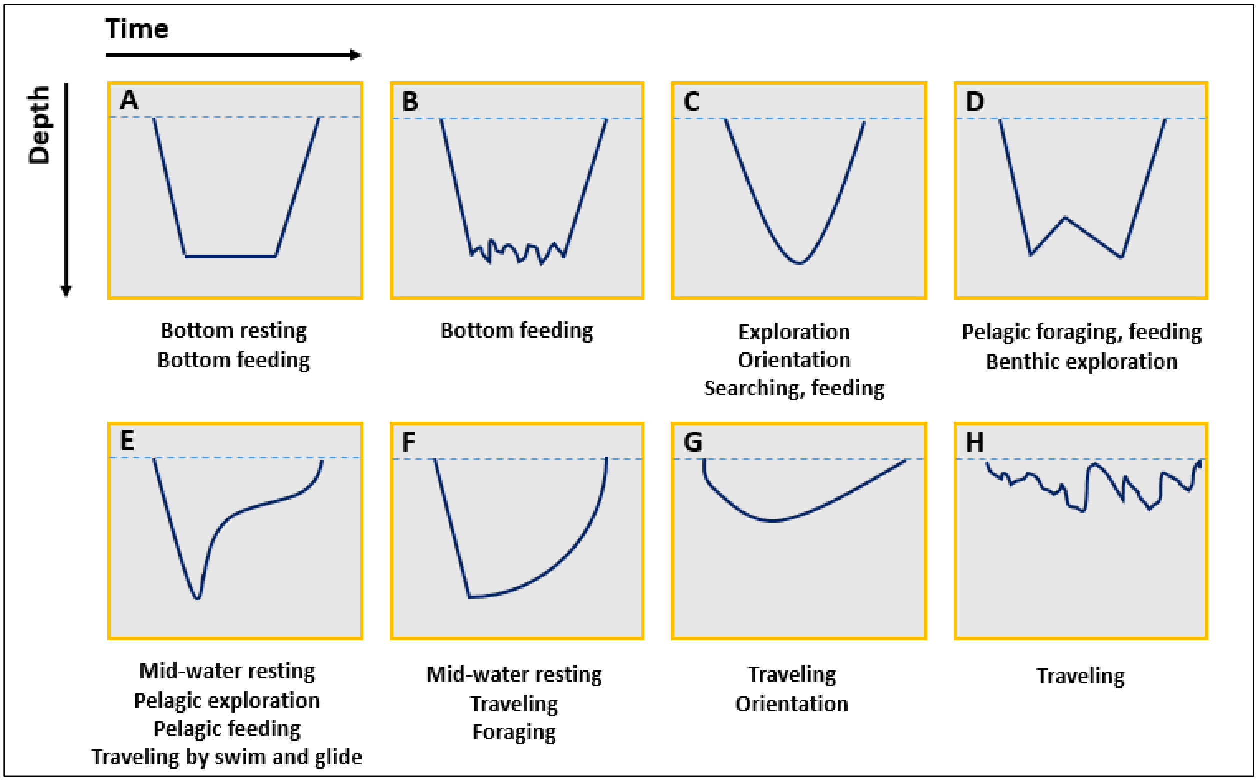
No new information is available on leatherback sea turtle diving behavior that would alter the analysis from the 2015 NWTT Final EIS/OEIS; however, Hochscheid (2014) has completed a species-specific summary for sea turtles within the Study Area that was not included in the 2015 NWTT Final EIS/OEIS. Hochscheid (2014) collected data from 57 studies published between 1986 and 2013, which summarized depths and durations of dives of datasets including an overall total of 538 sea turtles. Figure 3.5-1 presents the ranges of maximum dive depths for different sea turtle species that shows the unique diving capabilities of leatherback sea turtles compared to other sea turtle species. This summary can improve the exposure analysis for stressors analyzed in Section 3.5.2 (Environmental Consequences).

Hochscheid (2014) also collected information on generalized dive profiles, with correlations to specific activities, such as bottom resting, bottom feeding, orientation and exploration, pelagic foraging and feeding, mid-water resting, and traveling during migrations. Generalized dive profiles compiled from 11 different studies show eight distinct profiles tied to specific activities. These profiles and activities are shown in Figure 3.5-2.



Sources: Hochscheid (2014), Sakamoto et al. (1993), Rice and Balazs (2008), Gitschlag (1996), Salmon et al. (2004)

Figure 3.5-1: Dive Depth and Duration Summaries for Sea Turtle Species



Sources: Hochscheid (2014); Rice and Balazs (2008), Sakamoto et al. (1993), Houghton et al. (2003), Fossette et al. (2007), Salmon et al. (2004), Hays et al. (2004a); Southwood et al. (1999).

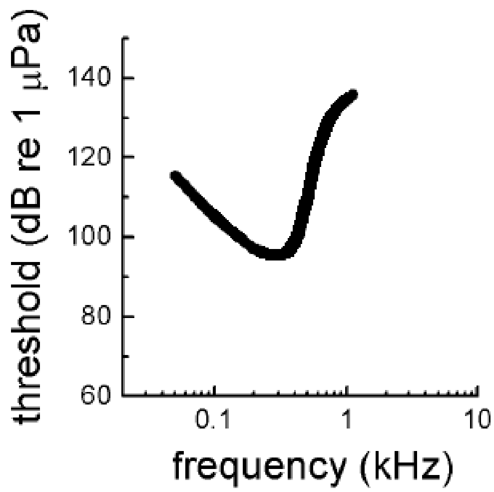
Notes: Profiles A-H, as reported in the literature and compiled by Hochscheid (2014). The depth and time arrows indicate the axis variables, but the figure does not represent true proportions of depths and durations for the various profiles. In other words, the depths can vary greatly, but behavioral activity seems to dictate the shape of the profile. Profiles G and H have only been described for shallow dives (less than 5 m).

Figure 3.5-2: Generalized Dive Profiles and Activities Described for Sea Turtles

3.5.1.2 Hearing and Vocalization

Sea turtle ears are adapted for hearing underwater and in air, with auditory structures that may receive sound via bone conduction (Lenhardt et al., 1985), via resonance of the middle ear cavity (Willis et al., 2013), or via standard tympanic middle ear path (Hetherington, 2008). Studies of hearing ability show that sea turtles' ranges of in-water hearing detection generally lie between 50 and 1600 hertz (Hz), with maximum sensitivity between 100 and 400 Hz, and that hearing sensitivity drops off rapidly at higher frequencies. Sea turtles are also limited to low-frequency hearing in-air, with hearing detection in juveniles possible between 50 and 800 Hz, with a maximum hearing sensitivity around 300–400 Hz (Bartol & Ketten, 2006; Piniak et al., 2016). Hearing abilities have primarily been studied with sub-adult, juvenile, and hatchling subjects in four sea turtle species, including green (Bartol & Ketten, 2006; Ketten & Moein-Bartol, 2006; Piniak et al., 2016; Ridgway et al., 1969; Yudhana et al., 2010), olive ridley (Bartol & Ketten, 2006), loggerhead (Bartol et al., 1999; Lavender et al., 2014; Martin et al., 2012), and leatherback (Dow Piniak et al., 2012). Only one study examined the auditory capabilities of an adult sea turtle (Martin et al., 2012); the hearing range of the adult loggerhead turtle was similar to other measurements of juvenile and hatchling sea turtle hearing ranges.

Using existing data on sea turtle hearing sensitivity, the U.S. Department of the Navy (Navy) developed a composite sea turtle audiogram for underwater hearing (Figure 3.5-3), as described in the technical report *Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase III)* (U.S. Department of the Navy, 2017a).



Source: U.S. Department of the Navy (2017a)
Notes: dB re 1 µPa = decibels referenced to 1 micropascal, kHz = kilohertz

Figure 3.5-3: Composite Underwater Audiogram for Sea Turtles

The role of underwater hearing in sea turtles is unclear. Sea turtles may use acoustic signals from their environment as guideposts during migration and as cues to identify their natal beaches (Lenhardt et al., 1983). However, they may rely more on other senses, such as vision and magnetic orientation, to interact with their environment (Avens, 2003; Narazaki et al., 2013).

Some sounds have been recorded during nesting activities ashore, including belch-like sounds and sighs (Mrosovsky, 1972), exhale/inhales, gular pumps, and grunts (Cook & Forrest, 2005) by female leatherback turtles, and low-frequency pulsed and harmonic sounds by leatherback embryos in eggs and hatchlings (Ferrara et al., 2014; Ferrara et al., 2019; McKenna et al., 2019).

3.5.1.3 General Threats

The general threats to sea turtles are described in the 2015 NWTT Final EIS/OEIS. New information is available that provides a more refined understanding of how bycatch, ship strikes, marine debris, climate change, and nesting can potentially threaten sea turtle species within the Study Area. Although the information summarized below is from more recent literature since the publication of the 2015 NWTT Final EIS/OEIS, the information presented in the 2015 NWTT Final EIS/OEIS remains valid. The analysis of potential impacts of activities described in this Supplemental benefit from an increased understanding of how marine debris and climate change can potentially threaten leatherback sea turtles within the Study Area.

3.5.1.3.1 Marine Debris

Ingestion of marine debris can cause mortality or injury to leatherback sea turtles. The United Nations Environment Programme estimates that approximately 6.4 million tons of anthropogenic debris enters the marine environment every year (Jeftic et al., 2009; Richardson et al., 2016; Schuyler et al., 2016).

This estimate, however, does not account for cataclysmic events, such as the 2011 Japanese tsunami estimated to have generated 1.5 million tons of floating debris (Murray et al., 2015). Plastic is the primary type of debris found in marine and coastal environments, and plastics are the most common type of marine debris ingested by sea turtles (Schuyler et al., 2014). Sea turtles can mistake debris for prey; one study found 37 percent of dead leatherback sea turtles to have ingested various types of plastic (Mrosovsky et al., 2009), and Narazaki et al. (2013) noted an observation of a loggerhead exhibiting hunting behavior on approach to a plastic bag, possibly mistaking the bag for a jelly fish. Even small amounts of plastic ingestion can cause an obstruction in a sea turtle's digestive track, resulting in mortality (Bjorndal, 1997; Bjorndal et al., 1994), and hatchlings are at risk for ingesting small plastic fragments. Ingested plastics can also release toxins, such as bisphenol-A (commonly known as "BPA") and phthalates, or absorb heavy metals from the ocean, which are released into the turtle's tissues (Fukuoka et al., 2016; Teuten et al., 2007). Life stage and feeding preference affects the likelihood of ingestion. Sea turtles living in oceanic or coastal environments and feeding in the open ocean or on the seafloor may encounter different types and densities of debris, and may therefore have different probabilities of ingesting debris. In 2014, Schuyler et al. (2014) reviewed 37 studies of debris ingestion by sea turtles, showing that young oceanic sea turtles are more likely to ingest debris (particularly plastic), and that green and loggerhead sea turtles were significantly more likely to ingest debris than other sea turtle species.

3.5.1.3.2 Climate Change

Since the publication of the 2015 NWTT Final EIS/OEIS, the Navy has obtained and consolidated additional information to conceptualize the potential of climate change to threaten sea turtle species within the Study Area. Sea turtles are particularly susceptible to climate change effects because their life history, physiology, and behavior are extremely sensitive to environmental temperatures (Fuentes et al., 2013). Climate change models predict sea level rise and increased intensity of storms and hurricanes in tropical sea turtle nesting areas (Patino-Martinez et al., 2014). These factors could significantly increase beach inundation and erosion, thus affecting water content of sea turtle nesting beaches and potentially inundating nests (Pike et al., 2015). Climate change may negatively impact turtles in multiple ways and at all life stages. These impacts may include the potential loss of nesting beaches due to sea level rise and increasingly intense storm surge (Patino-Martinez et al., 2014), feminization of turtle populations from elevated nest temperatures (and skewing populations to more females than males unless nesting shifts to northward cooler beaches) (Reneker & Kamel, 2016), decreased reproductive success (Clark & Gobler, 2016; Hawkes et al., 2006; Laloë et al., 2016; Pike, 2014), shifts in reproductive periodicity and latitudinal ranges (Birney et al., 2015; Pike, 2014), disruption of hatchling dispersal and migration, and indirect effects to food availability (Witt et al., 2010). While rising temperatures may initially result in increased female population sizes, the lack of male turtles will likely impact the overall fertility of females in the population (Jensen et al., 2018). For example, breeding male sea turtles show strong natal philopatry (the tendency for animals to return to their birth places to mate) (Roden et al., 2017; Shamblin et al., 2015). With fewer available breeding males, it is unlikely that available males from other locations would interact with females in male-depleted breeding areas (Jensen et al., 2018).

3.5.1.4 Leatherback Sea Turtle (*Dermochelys coriacea*)

3.5.1.4.1 Status and Management

The leatherback turtle is listed as a single population, classified as endangered under the Endangered Species Act (ESA), and has Critical Habitat designated within the Study Area. Although the U.S. Fish and Wildlife Service and National Marine Fisheries Service (NMFS) believe the current listing is valid, preliminary information indicates an analysis and review of the species should be conducted under the distinct population segment policy (National Marine Fisheries Service & U.S. Fish and Wildlife Service, 2013). Recent information on population structure (through genetic studies) and distribution (through telemetry, tagging, genetic studies, and population modeling) has led to an increased understanding and refinement of the global stock structure (Clark et al., 2010; Gaspar & Lalire, 2017). This effort is critical to focus efforts to protect the species, because the status of individual stocks varies widely across the world. Unlike populations in the Caribbean and Atlantic Ocean, which are generally stable or increasing, western Pacific leatherbacks have declined more than 80 percent and eastern Pacific leatherbacks have declined by more than 97 percent since the 1980s (Kobayashi et al., 2016). Because the threats to these subpopulations have not ceased, the International Union for Conservation of Nature has predicted a decline of 96 percent for the western Pacific subpopulation and a decline of nearly 100 percent for the eastern Pacific subpopulation by 2040 (Nachtigall et al., 2016; Wallace et al., 2016).

3.5.1.4.2 Habitat and Geographic Range

In 2012, NMFS designated critical habitat for the leatherback sea turtle off the coast of Washington and Oregon, as shown in Figure 3.5-4). The designated areas comprise approximately 41,914 square miles (108,557 square kilometers) of marine habitat and include waters from the ocean surface down to a maximum depth of 262 ft. (80 m) (77 Federal Register 4170). This designation includes approximately 25,004 square miles (64,760 square kilometers) stretching from Cape Flattery, Washington, to Cape Blanco, Oregon, east of the 2,000 m depth contour, as well as 16,910 square miles (43,797 square kilometers) stretching along the California coast from Point Arena to Point Arguello east of the 3,000 m depth contour. Critical habitat overlaps with the Study Area. NMFS identified one Primary Constituent Element (PCE) essential for the conservation of leatherbacks in marine waters off the U.S. West Coast. This PCE is the occurrence of prey species, primarily scyphomedusae of the order Semaeostomeae (an order of large jellyfish) of sufficient condition, distribution, diversity, abundance, and density necessary to support individual as well as population growth, reproduction, and development.

In the 2015 NWTT Final EIS/OEIS, the Navy's analysis of leatherback sea turtles assumed that these sea turtles only inhabited the Offshore Area of the Study Area. For this Supplement, the Navy conducted a literature search of leatherback sea turtle occurrence in the Offshore Area, Inland Waters, and Western Behm Canal but did not find any additional information that would indicate the presence of leatherback sea turtles in different portions of the Study Area. New population modeling conducted by Gaspar and Lalire (2017) compare Pacific juvenile leatherback predicted distributions with passive dispersion (juvenile turtles drifting or following currents) and active dispersion, where juvenile turtles respond to habitat cues (e.g., water temperature) and actively swim to foraging grounds often counter to prevailing currents. This modeling effort suggests that oceanic currents broadly shape the dispersal area of leatherbacks within the North Central Pacific Basin, and habitat-driven movements strongly influence the spatial and temporal distribution of juveniles within this area. Specifically, these habitat-driven movements lead juveniles to gather in the North Pacific Transition Zone and to undertake seasonal north-south migrations. The modeling effort also suggests that juveniles in the North Pacific Transition Zone migrate westward, counter to prevailing currents, thereby increasing residence time. This likely exposes leatherbacks in the Pacific to increased risk of interactions with fisheries, in the central and eastern part of the North Pacific basin. Habitat-driven movements modeled by Gaspar and Lalire (2017) would also reduce the risk of cold-induced mortality. This risk appears to be larger among the juveniles that rapidly circulate into the Kuroshio Current than in other, more southern latitude currents.

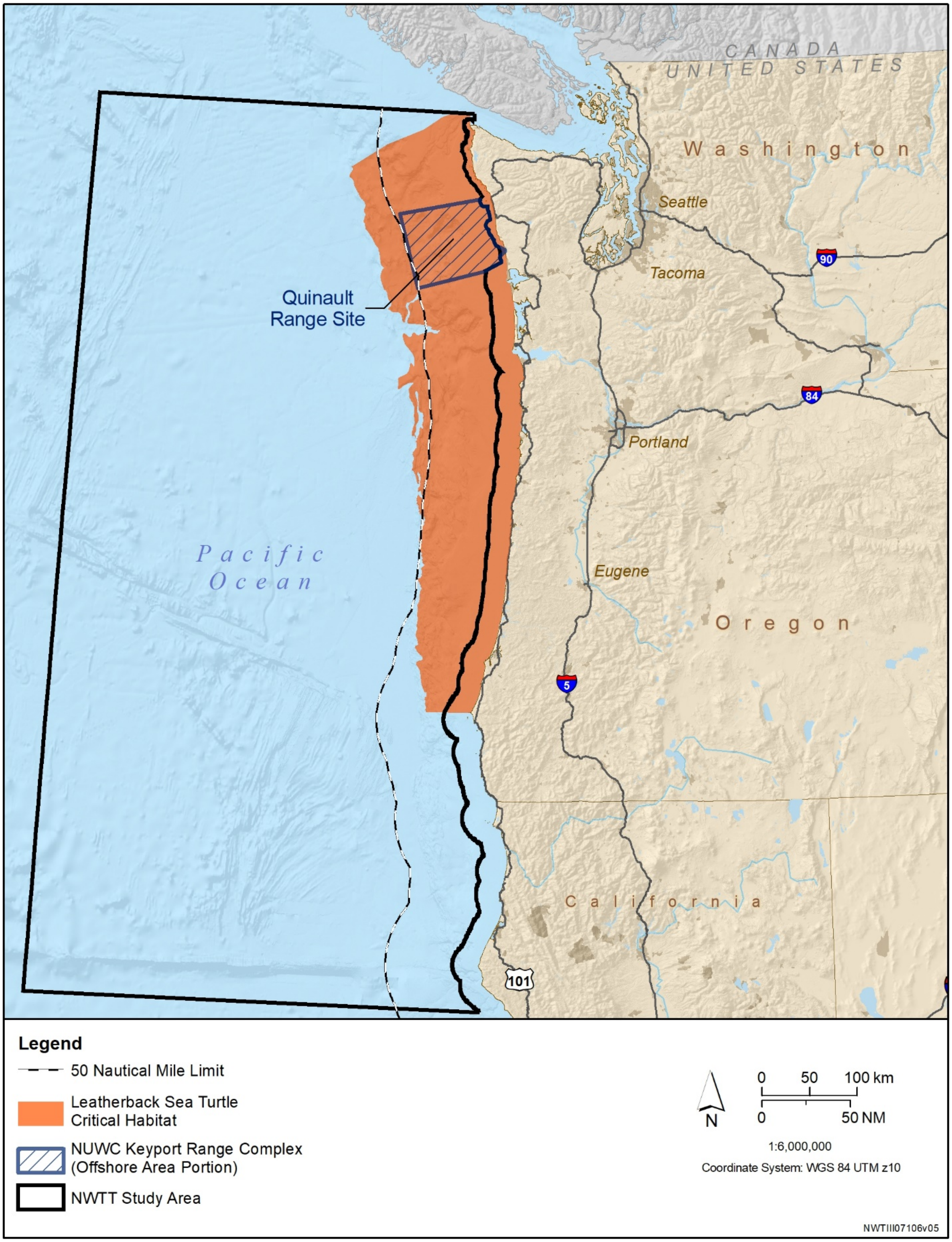


Figure 3.5-4: Designated Critical Habitat for the Leatherback Sea Turtle Within the Study Area

3.5.1.4.2.1 Population and Abundance

The eastern and western Pacific leatherback populations have been the subjects of several action plans and recovery plans over the last two decades, including the Bellagio Blueprint for Action on Pacific Sea Turtles (Polasek et al., 2017), the U.S. Recovery Plan for Pacific populations of Leatherbacks (National Marine Fisheries Service & U.S. Fish and Wildlife Service, 1998), and the North American Conservation Action Plan for Pacific Leatherback Sea Turtles (Seymour et al., 2017).

3.5.1.4.2.2 Predator-Prey Interactions

The Navy conducted a literature search of leatherback sea turtle predator-prey interactions, but did not find any additional information that would change the information presented in the 2015 NWTT Final EIS/OEIS.

3.5.1.4.2.3 Species-Specific Threats

Since the publication of the 2015 NWTT Final EIS/OEIS, National Oceanic and Atmospheric Administration Fisheries has updated their conservation strategy for Pacific leatherback sea turtles with the publication of *Species in the Spotlight Priority Actions: 2016-2020 Pacific Leatherback Turtle* Dermochelys coriacea (National Marine Fisheries Service, 2016). This plan focuses on five primary areas: (1) reducing fisheries interactions, (2) improving nesting beach protections and increasing reproductive output, (3) international cooperation, (4) monitoring and research, and (5) public engagement.

3.5.2 Environmental Consequences

In the 2015 NWTT Final EIS/OEIS, the Navy considered all potential stressors associated with ongoing training and testing in the Study Area and then analyzed their potential impacts on leatherback sea turtles and leatherback designated critical habitat in the Study Area. In this Supplemental, the Navy has reviewed the analysis of impacts from these ongoing activities and additionally analyzed new or changing military readiness activities as projected into the reasonably foreseeable future. The projected future actions are based on evolving operational requirements, including those associated with any anticipated new platforms or systems not previously analyzed. Because leatherback sea turtles are not expected to occur in the Inland Waters or Western Behm Canal portions of the Study Area, only those activities proposed to occur in the Offshore Area are considered.

The Navy has completed a literature review for information on sea turtles within the Study Area, which included a search for the best available science since the publication of the 2015 NWTT Final EIS/OEIS. Where there has been no substantive or otherwise meaningful change in the action, science, or regulations, the Navy will rely on the previous 2015 NWTT Final EIS/OEIS analysis. Where there has been substantive change in the action, science, or regulations, the information provided in this Supplemental supplements the 2015 NWTT Final EIS/OEIS to support environmental compliance with applicable environmental statutes for sea turtles.

In the Proposed Action for this Supplemental, there have been some modifications to the quantity and type of acoustic stressors under the two action alternatives. There are also new acoustic impact criteria, hearing weighting functions, and sea turtle densities. In addition, as stated in Section 3.0 (Introduction), there are new activities being proposed. One new testing activity involves the use of high-energy laser weapons in the Study Area (as an Energy stressor) as detailed in Section 3.0.3.3.2 (Lasers). Another new testing activity involves the use of a biodegradable polymer (as an Entanglement stressor) as detailed in Section 3.0.3.5.3 (Biodegradable Polymer).

In general, there have been no substantial changes to the activities analyzed as the Proposed Action in the 2015 NWTT Final EIS/OEIS which would change the conclusions reached regarding populations of sea turtles in the Study Area. Use of acoustic stressors (sonar and other active acoustic sources) and use of explosives have occurred since the completion of the 2015 NWTT Final EIS/OEIS Record of Decision and the 2015 NMFS Biological Opinion. There have been no known adverse effects to sea turtles, impacts on leatherback sea turtle prey items, or population impacts that were not otherwise previously analyzed or accounted for in the 2015 NWTT Final EIS/OEIS or the NMFS Biological Opinion pursuant to the ESA (National Oceanic and Atmospheric Administration, 2015b) with regard to acoustic or explosive stressors. The potential stressors associated with the training and testing activities in the Study Area included the following:

- **Acoustic** (sonar and other transducers, vessel noise, aircraft noise, weapon noise)
- **Explosives** (in water explosions)
- **Energy** (in-water electromagnetic devices, high-energy laser weapons)
- **Physical disturbance and strike** (vessels and in-water devices, military expended materials, seafloor devices)
- **Entanglement** (wires and cables, decelerators/parachutes, biodegradable polymer)
- **Ingestion** (military expended materials, munitions, military expended materials – other than munitions)
- **Secondary stressors** (impacts on habitat, impacts on prey availability)

In 2015, NMFS determined that within the Study Area, only acoustic stressors and explosive stressors could potentially result in the incidental take of leatherback sea turtles from Navy training and testing activities. None of the other stressors would result in significant adverse impacts or jeopardize the continued existence of leatherback sea turtle species (National Oceanic and Atmospheric Administration, 2015b).

As detailed in Chapter 2 (Description of Proposed Action and Alternatives) of this Supplemental, the only substantive changes in the Proposed Action are those specified eliminations, increases, or decreases in the use of sonar and other active acoustic sources and the use of in-water explosives, and the introduction of high energy lasers and biodegradable polymers. Table 2.5-1, Table 2.5-2, and Table 2.5-3 in Chapter 2 (Description of Proposed Action and Alternatives) list the proposed training and testing activities and include the number of times each activity would be conducted annually and the locations within the Study Area where the activity would typically occur under each alternative. The tables also present the same information for activities presented in the 2015 NWTT Final EIS/OEIS so that the proposed levels of training and testing under this Supplemental can be compared. As presented in Section 3.0 (Introduction), since completion of the 2015 NWTT Final EIS/OEIS there have been refinements made in the modeling of potential impacts from sonar and other active acoustic sources and explosives, presented below under the acoustics and explosives stressor sections.

The analysis includes consideration of the mitigation that the Navy will implement to avoid or reduce potential impacts on sea turtles from acoustic, explosive, and physical disturbance and strike stressors. Mitigation was coordinated with NMFS through the consultation process. Details of the Navy's mitigation are provided in Chapter 5 (Mitigation) and Appendix K (Geographic Mitigation Assessment).

The analysis includes consideration of the mitigation that the Navy will implement to avoid or reduce potential impacts on sea turtles from acoustic, explosive, and physical disturbance and strike stressors. Mitigation will be coordinated with NMFS through the consultation process. Details of the Navy's mitigation are provided in Chapter 5 (Mitigation).

3.5.2.1 Acoustic Stressors

The analysis of effects to sea turtles follows the concepts outlined in Section 3.0.3.7 (Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities). This section begins with a summary of relevant data regarding acoustic impacts on sea turtles in Section 3.5.2.1.1 (Background). This is followed by an analysis of estimated impacts on sea turtles due to specific Navy acoustic stressors (sonar and other transducers, vessel noise, aircraft noise, and weapon noise). Additional explanations of the acoustic terms and sound energy concepts used in this section are found in Appendix D (Acoustic and Explosive Concepts). Studies of the effects of sound on sea turtles are limited; therefore, where necessary, knowledge of impacts on other species from acoustic stressors is used to assess impacts on sea turtles.

The Navy will rely on the previous 2015 NWTT Final EIS/OEIS for the analysis of vessel noise, aircraft noise, and weapon noise, and new applicable and emergent science in regard to these sub-stressors is presented in the sections which follow. Due to new acoustic impact criteria, sea turtle densities, and revisions to the Navy Acoustic Effects Model, the analysis provided in Section 3.5.2.1.2 (Impacts from Sonar and Other Transducers) of this Supplemental will supplant the 2015 NWTT Final EIS/OEIS for sea turtles, and may result in changes to estimated impacts since the 2015 NWTT Final EIS/OEIS.

3.5.2.1.1 Background

The sections below include a survey and synthesis of best available science published in peer-reviewed journals, technical reports, and other scientific sources pertinent to impacts on sea turtles potentially resulting from Navy training and testing activities. Sea turtles could be exposed to a range of impacts depending on the sound source and context of the exposure. Exposures to sound-producing activities may result in auditory or non-auditory trauma, hearing loss resulting in temporary or permanent hearing threshold shift, auditory masking, physiological stress, or changes in behavior.

3.5.2.1.1.1 Injury

The high peak pressures close to some non-explosive impulsive underwater sound sources may be injurious, although there are no reported instances of injury to sea turtles caused by these sources. A Working Group organized under the American National Standards Institute-Accredited Standards Committee S3, Subcommittee 1, Animal Bioacoustics, developed sound exposure guidelines for fish and sea turtles (Popper et al., 2014), hereafter referred to as the *ANSI Sound Exposure Guidelines*. Lacking any data on non-auditory sea turtle injuries due to sonars, the working group estimated the risk to sea turtles from low-frequency sonar to be low and mid-frequency sonar to be non-existent.

As discussed in Section 3.0.3.7 (Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities, specifically Section 3.0.3.7.1, Injury), mechanisms for non-auditory injury due to acoustic exposure have been hypothesized for diving breath-hold animals. Acoustically induced bubble formation, rectified diffusion, and acoustic resonance of air cavities are considered for their similarity to pathologies observed in marine mammals stranded coincident with sonar exposures but were found to not be likely causal mechanisms (Section 3.5.2.1.1.1, Injury), and findings are applicable to sea turtles.

Nitrogen decompression due to modifications to dive behavior has never been observed in sea turtles. Sea turtles are thought to deal with nitrogen loads in their blood and other tissues, caused by gas exchange from the lungs under conditions of high ambient pressure during diving, through anatomical, behavioral, and physiological adaptations (Lutcavage & Lutz, 1997). Although diving sea turtles experience gas supersaturation, gas embolism has only been observed in sea turtles bycaught in fisheries, including loggerhead sea turtles (Garcia-Parraga et al., 2014), as well as leatherback, green, and olive ridley sea turtles (Crespo-Picazo et al., 2020). Therefore, nitrogen decompression due to changes in diving behavior is not considered a potential consequence to diving sea turtles.

Hearing Loss

Exposure to intense sound may result in hearing loss, typically quantified as threshold shift, which persists after cessation of the noise exposure. Threshold shift is a loss of hearing sensitivity at an affected frequency of hearing. This noise-induced hearing loss may manifest as temporary threshold shift (TTS), if hearing thresholds recover over time, or permanent threshold shift (PTS), if hearing thresholds do not recover to pre-exposure thresholds. Because studies on inducing threshold shift in sea turtles are very limited (e.g., alligator lizards: Dew et al., 1993; Henry & Mulroy, 1995), are not sufficient to estimate TTS and PTS onset thresholds, and have not been conducted on any of the sea turtles present in the Study Area, auditory threshold shift in sea turtles is considered to be consistent with general knowledge about noise-induced hearing loss described in Section 3.0.3.7 (Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities).

Because there are no data on auditory effects on sea turtles, the ANSI Sound Exposure Guidelines (Popper et al., 2014) do not include numeric sound exposure thresholds for auditory effects on sea turtles. Rather, the guidelines qualitatively estimate that sea turtles are less likely to incur TTS or PTS with increasing distance from various sound sources. The guidelines also suggest that data from fishes may be more relevant than data from marine mammals when estimating impacts on sea turtles, because, in general, fish hearing range is more similar to the limited hearing range of sea turtles. As shown in Section 3.5.1.2 (Hearing and Vocalization), sea turtle hearing is most sensitive around 100–400 Hz in-water, is limited over 1 kilohertz (kHz), and is much less sensitive than that of any marine mammal. Therefore, sound exposures from most mid-frequency and all high-frequency sound sources are not anticipated to affect sea turtle hearing, and sea turtles are likely only susceptible to auditory impacts when exposed to very high levels of sound within their limited hearing range.

3.5.2.1.1.2 Physiological Stress

A stress response is a suite of physiological changes meant to help an organism mitigate the impact of a stressor. If the magnitude and duration of the stress response is too great or too long, then it can have negative consequences to the animal (e.g., decreased immune function, decreased reproduction). Physiological stress is typically analyzed by measuring stress hormones, other biochemical markers, or vital signs. Physiological stress has been measured for sea turtles during nesting (Flower et al., 2015; Valverde et al., 1999), capture and handling (Flower et al., 2015; Gregory & Schmid, 2001), and when caught in entanglement nets (Hoopes et al., 2000; Snoddy et al., 2009) and trawls (Stabenau et al., 1991). However, the stress caused by acoustic exposure has not been studied for sea turtles. Therefore, the stress response in sea turtles in the Study Area due to acoustic exposures is considered to be consistent with general knowledge about physiological stress responses described in Section 3.0.3.7 (Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities).

Marine animals naturally experience stressors within their environment and as part of their life histories. Changing weather and ocean conditions, exposure to diseases and naturally occurring toxins, lack of prey availability, social interactions with members of the same species, nesting, and interactions with predators all contribute to stress. Anthropogenic sound-producing activities have the potential to provide additional stressors beyond those that naturally occur.

Due to the limited information about acoustically induced stress responses, the Navy conservatively assumes in its effects analysis that any physiological response (e.g., hearing loss or injury) or significant behavioral response is also associated with a stress response.

3.5.2.1.1.3 Masking

As described in Section 3.0.3.7 (Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities), auditory masking occurs when one sound, distinguished as the “noise,” interferes with the detection or recognition of another sound or limits the distance over which other biologically relevant sounds, including those produced by prey, predators, or conspecifics, can be detected. Masking only occurs when the sound source is operating; therefore, direct masking effects stop immediately upon cessation of the sound-producing activity. Any sound above ambient noise and within an animal’s hearing range may potentially cause masking.

Compared to other marine animals, such as marine mammals that are highly adapted to use sound in the marine environment, marine reptile hearing is limited to lower frequencies and is less sensitive. Because marine sea turtles likely use their hearing to detect broadband low frequency sounds in their environment, the potential for masking would be limited to certain similar sound exposures. Only continuous human-generated sounds that have a significant low-frequency component, are not brief in duration, and are of sufficient received level, would create a meaningful masking situation (e.g., proximate vessel noise). Other intermittent, short-duration sound sources with low-frequency components (e.g., low-frequency sonars) would have more limited potential for masking depending on duty cycle.

There is evidence that sea turtles may rely primarily on senses other than hearing for interacting with their environment, such as vision (Narazaki et al., 2013) and magnetic orientation (Avens, 2003; Putman et al., 2015). Any effect of masking may be mediated by reliance on other environmental inputs.

3.5.2.1.1.4 Behavioral Reactions

Behavioral responses fall into two major categories: Alterations in natural behavior patterns and avoidance. These types of reactions are not mutually exclusive and reactions may be combinations of behaviors or a sequence of behaviors. As described in Section 3.0.3.7 (Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities), the response of a reptile to an anthropogenic sound would likely depend on the frequency, duration, temporal pattern, and amplitude of the sound as well as the animal’s prior experience with the sound and the context in which the sound is encountered (i.e., what the animal is doing at the time of the exposure). Distance from the sound source and whether it is perceived as approaching or moving away may also affect the way a reptile responds to a sound.

Sea turtles may detect sources below 2 kHz but have limited hearing ability above 1 kHz. They likely detect most broadband sources (including vessel noise) and low-frequency sonars, so they may respond to these sources. Because auditory abilities are poor above 1 kHz, detection and consequent reaction to any mid-frequency source is unlikely.

In the *ANSI Sound Exposure Guidelines* (Popper et al., 2014), qualitative risk factors were developed to assess the potential for sea turtles to respond to various underwater sound sources. The guidelines state that there is a low likelihood that sea turtles would respond within tens of meters of low-frequency sonars, and that it is highly unlikely that sea turtles would respond to mid-frequency sources. The risk that sea turtles would respond to other broadband sources, such as shipping, is considered high within tens of meters of the sound source, but moderate to low at farther distances.

Behavioral Reactions to Impulsive Sound Sources

There are limited studies of reptile responses to sounds from impulsive sound sources, and all data come from sea turtles exposed to seismic air gun, although air guns are not used during Navy training or testing activities. These exposures consist of multiple air gun shots, either in close proximity or over long durations, so it is likely that observed responses may over-estimate responses to single or short-duration impulsive exposures. Studies of responses to air guns are used to inform reptile responses to other impulsive sounds (e.g., some weapon noise).

O'Hara and Wilcox (1990) attempted to create a sound barrier at the end of a canal using seismic air guns. They reported that loggerhead turtles kept in a 300 m by 45 m enclosure in a 10 m deep canal maintained a minimum standoff range of 30 m from air guns fired simultaneously at intervals of 15 seconds with strongest sound components within the 25–1,000 Hz frequency range. (McCauley et al., 2000) estimated that the received sound pressure level (SPL) at which turtles avoided sound in the O'Hara and Wilcox (1990) experiment was 175–176 decibels referenced to 1 micropascal (dB re 1 µPa).

Moein Bartol et al. (1995) investigated the use of air guns to repel juvenile loggerhead sea turtles from hopper dredges. Sound frequencies of the air guns ranged from 100 to 1,000 Hz at three source SPLs: 175, 177, and 179 dB re 1 µPa at 1 m. The turtles avoided the air guns during the initial exposures (mean range of 24 m), but additional exposures on the same day and several days afterward did not elicit avoidance behavior that was statistically significant. They concluded that this was likely due to habituation.

McCauley et al. (2000) exposed a caged green and a caged loggerhead sea turtle to an approaching-departing single air gun to gauge behavioral responses. The trials showed that above a received SPL of 166 dB re 1 µPa, the turtles noticeably increased their swimming activity compared to nonoperational periods, with swimming time increasing as air gun SPLs increased during approach. Above 175 dB re 1 µPa, behavior became more erratic, possibly indicating the turtles were in an agitated state. The authors noted that the point at which the turtles showed more erratic behavior and exhibited possible agitation would be expected to approximate the point at which active avoidance to air guns would occur for unrestrained turtles.

No obvious avoidance reactions by free-ranging sea turtles, such as swimming away, were observed during a multi-month seismic survey using air gun arrays, although fewer sea turtles were observed when the seismic air guns were active than when they were inactive (Weir, 2007). The author noted that sea state and the time of day affected both air gun operations and sea turtle surface basking behavior, making it difficult to draw conclusions from the data. However, DeRuiter and Doukara (2012) noted several possible startle or avoidance reactions to a seismic air gun array in the Mediterranean by loggerhead turtles that had been motionlessly basking at the water surface.

Based on the limited sea turtle behavioral response data discussed above, sea turtle behavioral responses to impulsive sounds could consist of temporary avoidance, increased swim speed, or changes in depth; or there may be no observable response. Based on the behavioral response severity scale developed by Southall et al. (2007), the severity of these responses can be categorized as non-existent, low, and moderate.

Behavioral Reactions to Sonar and Other Transducers

Studies of sea turtle responses to non-impulsive sounds are limited. Lenhardt (1994) used very low frequency vibrations (< 100 Hz) coupled to a shallow tank to elicit swimming behavior responses by two loggerhead sea turtles. Watwood et al. (2016) tagged green sea turtles with acoustic transponders and monitored them using acoustic telemetry arrays in Port Canaveral, FL. Sea turtles were monitored before, during, and after a routine pier-side submarine sonar test that utilized typical source levels, signals, and duty cycle. No significant long-term displacement was exhibited by the sea turtles in this study. The authors note that Port Canaveral is an urban marine habitat and that resident sea turtles may be less likely to respond than naïve populations.

According to the qualitative risk factors developed in the *ANSI Sound Exposure Guideline Technical Report* (Popper et al., 2014), the likelihood of sea turtles responding to low- and mid-frequency sonar is low and highly unlikely, respectively. Based on the limited sea turtle behavioral response data discussed above, sea turtle behavioral responses to non-impulsive sounds could consist of temporary avoidance, increased swim speed, or no observable response. Using the behavioral response severity scale developed by Southall et al. (2007), the severity of these responses can be categorized as non-existent, low, and moderate.

3.5.2.1.1.5 Long-Term Consequences

For the sea turtles present in the Study Area, long-term consequences to individuals and populations due to acoustic exposures have not been studied. Therefore, long-term consequences to sea turtles due to acoustic exposures are considered following Section 3.0.3.7 (Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities).

The long-term consequences due to individual behavioral reactions and short-term (seconds to minutes) instances of physiological stress are especially difficult to predict because individual experience over time can create complex contingencies. It is more likely that any long-term consequences to an individual would be a result of costs accumulated over a season, year, or life stage due to multiple behavioral or stress responses resulting from exposures to multiple stressors over significant periods of time. Conversely, some sea turtles may habituate to or become tolerant of repeated acoustic exposures over time, learning to ignore a stimulus that in the past did not accompany any overt threat. For example, loggerhead sea turtles exposed to air guns with a source SPL of 179 dB re 1 µPa initially exhibited avoidance reactions. However, they may have habituated to the sound source after multiple exposures since a habituation behavior was retained when exposures were separated by several days (Moein Bartol et al., 1995). Intermittent exposures are assumed to be less likely to have lasting consequences.

3.5.2.1.2 Impacts from Sonar and Other Transducers

The overall use of sonar and other transducers for training and testing activities would be similar to what is currently conducted (Table 3.0-2 for details). Although individual activities may vary some from those previously analyzed, the overall determinations presented in the 2015 NWTT Final EIS/OEIS remain valid. The quantitative analysis has been updated since the 2015 NWTT Final EIS/OEIS; therefore, the new analysis is fully presented and described in further detail in the technical report *Quantifying Acoustic Impacts on Marine Mammals and Sea Turtles: Methods and Analytical Approach for Phase III Training and Testing* (U.S. Department of the Navy, 2017b).

Activities using sonars and other transducers would be conducted as described in Chapter 2 (Description of Proposed Action and Alternatives) and Appendix A (Navy Activities Descriptions). Sonar and other transducers proposed for use are transient in most locations because activities that involve sonar and other transducers take place at different locations and many platforms are generally moving throughout the Study Area. Sonar and other transducers emit sound waves into the water to detect objects, safely navigate, and communicate. General categories of these systems are described in Section 3.0.3.1 (Acoustic Stressors). The activities that use sonar and other transducers are described in Appendix A (Navy Activities Descriptions).

Sonar-induced acoustic resonance and bubble formation phenomena are very unlikely to occur under realistic conditions, as discussed in Section 3.5.2.1.1.1 (Injury). Non-auditory injury (i.e., other than PTS) and mortality from sonar and other transducers is so unlikely as to be discountable under normal conditions and is therefore not considered further in this analysis.

Potential impacts considered from exposure to sonar and other transducers are hearing loss due to threshold shift (permanent or temporary), physiological stress, masking of other biologically relevant sounds, and changes in behaviors, as described in Section 3.5.2.1.1.2 (Hearing Loss), Section 3.5.2.1.1.3 (Physiological Stress), Section 3.5.2.1.1.4 (Masking), and Section 3.5.2.1.1.5 (Behavioral Reactions).

3.5.2.1.2.1 Methods for Analyzing Impacts from Sonar and Other Transducers

The Navy performed a quantitative analysis to estimate the number of times that sea turtles could be affected by sonar and other transducers used during Navy training and testing activities. The Navy's quantitative analysis to determine impacts to sea turtles and marine mammals uses the Navy Acoustic Effects Model to produce initial estimates of the number of times these animals may experience these effects; these estimates are further refined by considering animal avoidance of sound-producing activities and implementation of mitigation. The steps of this quantitative analysis take into account:

- criteria and thresholds used to predict impacts from sonar and other transducers (see below);
- the density and spatial distribution of sea turtles; and
- the influence of environmental parameters (e.g., temperature, depth, salinity) on sound propagation when estimating the received sound level on the animals.

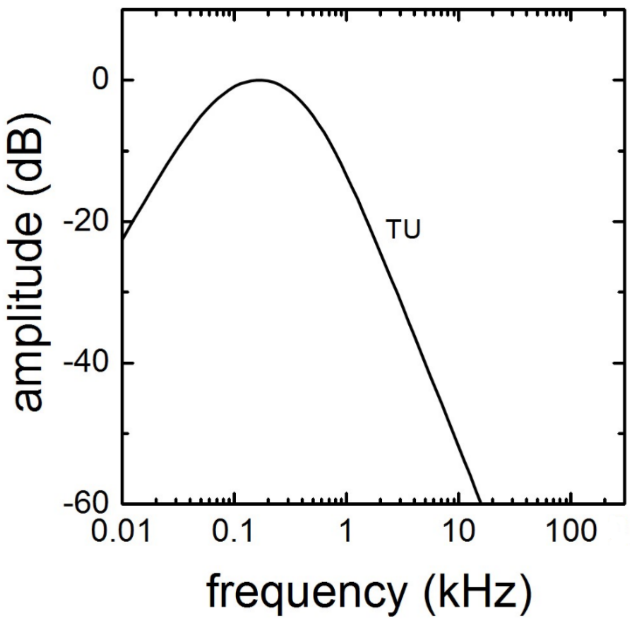
A further detailed explanation of this analysis is provided in the technical report titled *Quantifying Acoustic Impacts on Marine Mammals and Sea Turtles: Methods and Analytical Approach for Phase III Training and Testing* (U.S. Department of the Navy, 2017b).

<u>Criteria and Thresholds Used to Predict Impacts from Sonar and Other Transducers</u>

Auditory Weighting Functions

Animals are not equally sensitive to noise at all frequencies. To capture the frequency-dependent nature of the effects of noise, auditory weighting functions are used. Auditory weighting functions are mathematical functions that adjust received sound levels to emphasize ranges of best hearing and de-emphasize ranges with less or no auditory sensitivity. The adjusted received sound level is referred to as a weighted received sound level.

The auditory weighting function for sea turtles is shown in Figure 3.5-5. The derivation of this weighting function is described in the technical report *Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase III)* (U.S. Department of the Navy, 2017a). The frequencies around the top portion of the function, where the amplitude is closest to zero, are emphasized, while the frequencies below and above this range (where amplitude declines) are de-emphasized, when summing acoustic energy received by a sea turtle.

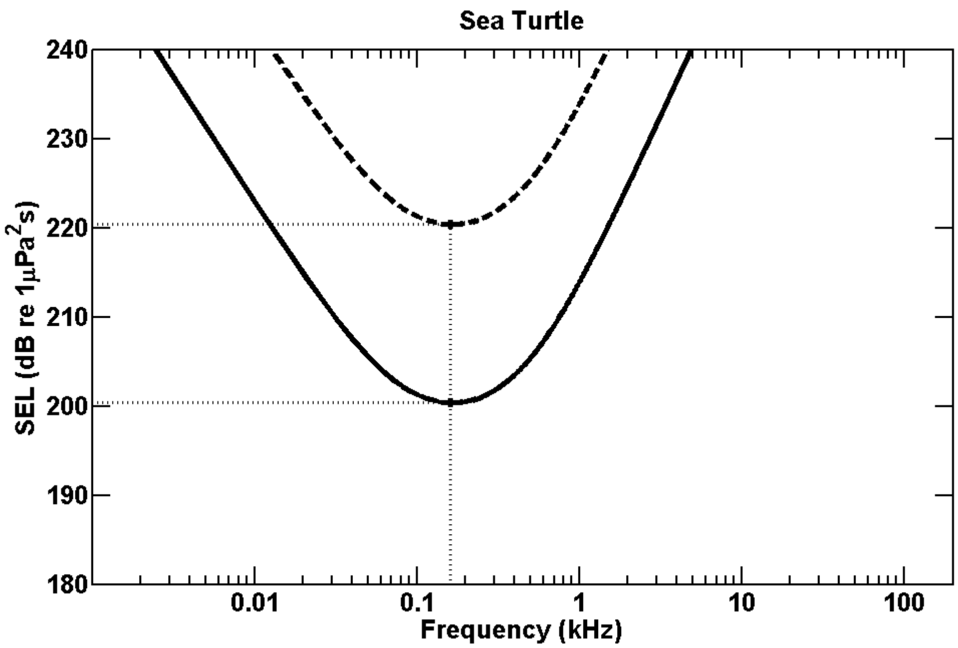


Source: U.S. Department of the Navy (2017a)
Notes: dB = decibels, kHz = kilohertz, TU = sea turtle species group

Figure 3.5-5: Auditory Weighting Function for Sea Turtles

Hearing Loss from Sonar and Other Transducers

No studies of hearing loss have been conducted on sea turtles. Therefore, sea turtle susceptibility to hearing loss due to an acoustic exposure is evaluated using knowledge about sea turtle hearing abilities in combination with non-impulsive auditory effect data from other species (marine mammals and fish). This yields sea turtle exposure functions, shown in Figure 3.5-6, which are mathematical functions that relate the sound exposure levels (SELs) for onset of TTS or PTS to the frequency of the sonar sound exposure. The derivation of the sea turtle exposure functions are provided in the technical report *Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase III)* (U.S. Department of the Navy, 2017a).



Source: U.S. Department of the Navy (2017a)
Notes: dB re 1 μPa²s = decibels referenced to 1 micropascal second squared, kHz = kilohertz. The solid black curve is the exposure function for TTS and the dashed black curve is the exposure function for PTS onset. Small dashed lines and asterisks indicate the SEL thresholds at the most sensitive frequency for TTS (200 dB) and PTS (220 dB).

Figure 3.5-6: TTS and PTS Exposure Functions for Sonar and Other Transducers

Accounting for Mitigation

The Navy will implement mitigation measures to avoid or reduce potential impacts from active sonar on sea turtles, as described in Section 5.3.2.1 (Active Sonar). The benefits of mitigation are conservatively factored into the analysis for Alternative 1 and Alternative 2 of the Proposed Action for training and testing. The Navy's mitigation measures are identical for both action alternatives.

Procedural mitigation measures include a power down or shut down (i.e., power off) of applicable active sonar sources when a sea turtle is observed in a mitigation zone. The mitigation zones for active sonar activities were designed to avoid or reduce the potential for sea turtles to be exposed to levels of sound that could result in auditory injury (i.e., PTS) from active sonar to the maximum extent practicable. The mitigation zones encompass the estimated ranges to injury (including PTS) for a given sonar exposure. Therefore, the impact analysis quantifies the potential for mitigation to reduce the risk of PTS. Two factors are considered when quantifying the effectiveness of mitigation: (1) the extent to which the type of mitigation proposed for a sound-producing activity (e.g., active sonar) allows for observation of the mitigation zone prior to and during the activity; and (2) the sightability of each species that may be present in the mitigation zone, which is determined by species-specific characteristics and the viewing platform. A detailed explanation of the analysis is provided in the technical report *Quantifying Acoustic Impacts on Marine Mammals and Sea Turtles: Methods and Analytical Approach for Phase III Training and Testing* (U.S. Department of the Navy, 2017b).

In the quantitative analysis, consideration of mitigation measures means that, for activities where mitigation is feasible, some model-estimated PTS is considered mitigated to the level of TTS. The impact analysis does not analyze the potential for mitigation to reduce TTS or behavioral effects, even though mitigation could also reduce the likelihood of these effects. In practice, mitigation also protects all unobserved (below the surface) animals in the vicinity, including other species, in addition to the observed animal. However, the analysis assumes that only animals sighted at the water surface would be protected by the applied mitigation. The analysis, therefore, does not capture the protection afforded to all marine species that may be near or within the mitigation zone.

The ability to observe the range to PTS was estimated for each training or testing event. The ability of Navy Lookouts to detect sea turtles in or approaching the mitigation zone is dependent on the animal's presence at the surface and the characteristics of the animal that influence its sightability (such as size or surface active behavior). The behaviors and characteristics of some species may make them easier to detect. Environmental conditions under which the training or testing activity could take place are also considered such as the sea surface conditions, weather (e.g., fog or rain), and day versus night.

The Navy will also implement mitigation measures for certain active sonar activities within mitigation areas, as described in Appendix K (Geographic Mitigation Assessment). Mitigation areas are designed to help avoid or reduce impacts during biologically important life processes within particularly important habitat areas. The benefits of mitigation areas are discussed qualitatively in terms of the context of impact avoidance or reduction. Should national security present a requirement to conduct activities that the Navy would otherwise prohibit in a particular mitigation area, naval units will obtain permission from the appropriate designated Command authority prior to commencement of the activity. The Navy will provide NMFS with advance notification and include information about the event in its annual activity reports to NMFS.

3.5.2.1.2.2 Impact Ranges from Sonar and Other Transducers

Because sea turtle hearing range is limited to a narrow range of frequencies and thresholds for auditory impacts are relatively high, there are few sonar sources that could result in exposures exceeding the sea turtle TTS and PTS thresholds. The representative bin of LF4 for PTS is zero meters and for TTS is up to five meters for 120 seconds of exposure. Ranges would be greater (i.e., up to tens of meters) for sonars and other transducers with higher source levels (within their hearing range); however, specific ranges cannot be provided in an unclassified document.

3.5.2.1.2.3 Impacts from Sonar and Other Transducers Under Alternative 1

Impacts from Sonar and Other Transducers Under Alternative 1 During Training Activities

Leatherback turtles present in the Study Area may be exposed to sound from sonar and other transducers associated with training activities throughout the year. Leatherback turtles are highly migratory and lead a pelagic existence, and they tend to prefer foraging in productive offshore waters, such as waters off the coast of Washington and Oregon in the NWTT Offshore Area.

Sonar and other transducers emit sound waves into the water to detect objects, safely navigate, and communicate. General categories and characteristics of sonar systems and the number of hours these sonars would be operated during training activities under Alternative 1 are described in Section 3.0.3.1.1 (Sonar and Other Transducers). Activities using sonars and other transducers would be conducted as described in Chapter 2 (Description of Proposed Action and Alternatives) and Appendix A (Navy Activities Descriptions). Overall use of sonar and other transducers in this Supplemental compared with the totals analyzed in the 2015 NWTT Final EIS/OEIS are described in Table 3.0-2.

Under Alternative 1, training activities would fluctuate each year to account for the natural variation of training cycles and deployment schedules. Some unit-level anti-submarine warfare training requirements would be met through synthetic training in conjunction with other training exercises. However, training activities using low-frequency sonar and other transducers within sea turtle hearing (< 2 kHz) will take place only in the NWTT Offshore Area, and would not fluctuate between years. Overall, use of sources in this frequency range are less common during training activities than testing activities, and occur less often than sources with higher frequency content.

The quantitative analysis, using the number of hours of sonar and other transducers for a maximum year of training activities under Alternative 1, predicts that no leatherback turtles are likely to be exposed to the high received levels of sound from sonars or other transducers that could cause TTS or PTS. Only a limited number of sonars and other transducers with frequencies within the range of reptile hearing (<2 kHz) and high source levels have potential to cause TTS and PTS.

The *ANSI Sound Exposure Guidelines* estimate that the risk of a sea turtle responding to a low-frequency sonar (less than 1 kHz) is low regardless of proximity to the source, and that there is no risk of a sea turtle responding to a mid-frequency sonar (1 to 10 kHz) (Popper et al., 2014). A sea turtle could respond to sounds detected within their limited hearing range if they are close enough to the source. The few studies of sea turtle reactions to sounds, discussed in Section 3.5.2.1.1.5 (Behavioral Reactions), suggest that a behavioral response could consist of temporary avoidance, increased swim speed, or changes in depth, or that there may be no observable response. Use of sonar and other transducers would typically be transient and temporary, and there is no evidence to suggest that any behavioral response would persist after a sound exposure. It is assumed that a stress response could accompany any behavioral response.

Implementation of mitigation may further reduce the already low risk of auditory impacts on sea turtles. Depending on the sonar source, mitigation includes powering down the sonar or ceasing active sonar transmission if a sea turtle is observed in the mitigation zone, as discussed in Section 3.5.2.1.2.1 (Methods for Analyzing Impacts from Sonar and Other Transducers – Accounting for Mitigation).

Although masking of biologically relevant sounds by the limited number of sonars and other transducers operated in sea turtle hearing range is possible, this may only occur in certain circumstances. Sea turtles most likely use sound to detect nearby broadband, continuous environmental sounds, such as the sounds of waves crashing on the beach. The use characteristics of most low-frequency active sonars, including limited band width, beam directionality, limited beam width, relatively low source levels, low duty cycle, and limited duration of use, would both greatly limit the potential for a sea turtle to detect these sources and limit the potential for masking of broadband, continuous environmental sounds. In addition, broadband sources within sea turtle hearing range, such as countermeasures used during anti-submarine warfare, would typically be used in off-shore areas, not in near-shore areas where detection of beaches or concentrated vessel traffic is relevant.

Designated leatherback turtle critical habitat, which includes the physical and biological features of leatherback turtle critical habitat (i.e., the occurrence of prey species, primarily jellyfish), overlaps the Study Area as described in Section 3.5.1.4 (Leatherback Sea Turtle [*Dermochelys coriacea*]). As discussed in Section 3.8.2.1.1 (Impacts from Sonar and Other Transducers) of the Marine Invertebrates section, impacts to marine invertebrates (e.g., jellyfish) from acoustic stressors (i.e., sonar and other transducers) would be insignificant. As a result, activities would not prevent a turtle from feeding as these activities are not continuous and most active sources are outside of sea turtle and prey species hearing range (as described in the 2015 NWTT Final EIS/OEIS Section 3.8.2.2, Invertebrate Hearing and Vocalization). Only jellyfish in very close proximity to low-frequency sources could be exposed for a short duration, however, these exposures would not affect the overall prey availability for leatherback turtles. Impacts to prey species, if any, would be minimal, thus sonar and other transducers would have no discernable impact on the condition, distribution, diversity, and abundance and density of prey species necessary to support individual as well as population growth, reproduction, and development of leatherback turtles in the Study Area.

Considering the above factors and the mitigation measures that would be implemented as described in Chapter 5 (Mitigation), long-term consequences to sea turtle individuals or populations would not be expected.

Pursuant to the ESA, the use of sonar and other transducers during training activities as described under Alternative 1 would have no effect on leatherback turtle critical habitat, but may affect the ESA-listed leatherback turtle. The Navy has consulted with NMFS as required by section 7(a)(2) of the ESA.

Impacts from Sonar and Other Transducers Under Alternative 1 During Testing Activities

Leatherback turtles present in the Study Area may be exposed to sound from sonar and other transducers associated with testing activities throughout the year. Leatherback turtles are highly migratory and lead a pelagic existence, and they tend to prefer foraging in productive offshore waters, such as waters off the coast of Washington and Oregon in the NWTT Offshore Area.

General categories and characteristics of sonar systems and the number of hours these sonars would be operated during testing under Alternative 1 are described in Section 3.0.3.1.1 (Sonar and Other Transducers). Activities using sonars and other transducers would be conducted as described in Chapter 2 (Description of Proposed Action and Alternatives) and Appendix A (Navy Activities Descriptions). Overall use of sonar and other transducers in this Supplemental compared with the totals analyzed in the 2015 NWTT Final EIS/OEIS are described in Table 3.0-2.

Under Alternative 1, testing activities would fluctuate each year to account for the natural variation of testing cycles and deployment schedules. Testing activities using low-frequency sonar and other transducers within sea turtle hearing (< 2 kHz) would take place throughout the NWTT Study Area, and would fluctuate very little between years. The use of sources in this frequency range are more common during testing activities than training activities; however, these sources would occur more frequently in the NWTT Inland Waters, where leatherback turtles typically do not occupy. The general impacts from sonar and other transducers during testing would be similar in severity to those described during training. In addition, some new systems using new technologies would be tested under Alternative 1.

The quantitative analysis, using the number of hours of sonar and other transducers for a maximum year of testing activities under Alternative 1, predicts that no leatherback turtles are likely to be exposed to the high received levels of sound from sonars or other transducers that could cause TTS or PTS.

The *ANSI Sound Exposure Guidelines* estimate that the risk of a sea turtle responding to a low-frequency sonar (less than 1 kHz) is low regardless of proximity to the source, and that there is no risk of a sea turtle responding to a mid-frequency sonar (1 to 10 kHz) (Popper et al., 2014). A sea turtle could respond to sounds detected within their limited hearing range if they are close enough to the source. The few studies of sea turtle reactions to sounds, discussed in Section 3.5.2.1.1.5 (Behavioral Reactions), suggest that a behavioral response could consist of temporary avoidance, increased swim speed, or changes in depth, or that there may be no observable response. Use of sonar and other transducers would typically be transient and temporary. There is no evidence to suggest that any behavioral response would persist after a sound exposure. It is assumed that a stress response could accompany any behavioral response.

Implementation of mitigation may further reduce the already low risk of auditory impacts on sea turtles. Depending on the sonar source, mitigation includes powering down the sonar or ceasing active sonar transmission if a sea turtle is observed in the mitigation zone, as discussed in Section 3.5.2.1.2.1 (Methods for Analyzing Impacts from Sonar and Other Transducers – Accounting for Mitigation).

Although masking of biologically relevant sounds by the limited number of sonars and other transducers operated in sea turtle hearing range is possible, this may only occur in certain circumstances. Sea turtles most likely use sound to detect nearby broadband, continuous environmental sounds, such as the sounds of waves crashing on the beach. The use characteristics of most low-frequency active sonars, including limited band width, beam directionality, limited beam width, relatively low source levels, low duty cycle, and limited duration of use, would both greatly limit the potential for a sea turtle to detect these sources and limit the potential for masking of broadband, continuous environmental sounds. In addition, broadband sources within sea turtle hearing range, such as countermeasures used during anti-submarine warfare, would typically be used in off-shore areas and some inshore areas during testing, but not in near-shore areas where detection of beaches or concentrated vessel traffic is relevant.

Designated leatherback turtle critical habitat, which includes the physical and biological features of leatherback turtle critical habitat (i.e., the occurrence of prey species, primarily jellyfish), overlaps the Study Area as described in Section 3.5.1.4 (Leatherback Sea Turtle [*Dermochelys coriacea*]). As discussed in Section 3.8.2.1.1 (Impacts from Sonar and Other Transducers) of the Marine Invertebrates section, impacts to marine invertebrates (e.g., jellyfish) from acoustic stressors (i.e., sonar and other transducers) would be insignificant. As a result, activities would not prevent a turtle from feeding as these activities are not continuous and most active sources are outside of sea turtle and prey species hearing range (as described in the 2015 NWTT Final EIS/OEIS Section 3.8.2.2, Invertebrate Hearing and Vocalization). Only jellyfish in very close proximity to low-frequency sources could be exposed for a short duration, however, these exposures would not affect the overall prey availability for leatherback turtles. Additionally, sonar sources used during testing activities would occur more frequently in the NWTT Inland Waters, where leatherback turtles typically do not occupy. Impacts to prey species, if any, would be minimal, thus sonar and other transducers would have no discernible impact on the condition, distribution, diversity, and abundance and density of prey species necessary to support individual as well as population growth, reproduction, and development of leatherback turtles in the Study Area.

Considering the above factors and the mitigation measures that would be implemented as described in Chapter 5 (Mitigation), long-term consequences to sea turtle individuals or populations would not be expected.

Pursuant to the ESA, the use of sonar and other transducers during testing activities as described under Alternative 1 would have no effect on leatherback turtle critical habitat, but may affect the ESA-listed leatherback turtle. The Navy has consulted with NMFS as required by section 7(a)(2) of the ESA.

3.5.2.1.2.4 Impacts from Sonar and Other Transducers Under Alternative 2

Impacts from Sonar and Other Transducers Under Alternative 2 During Training Activities

Leatherback turtles present in the Study Area may be exposed to sound from sonar and other transducers associated with training activities throughout the year. Leatherback turtles are highly migratory and lead a pelagic existence, and they tend to prefer foraging in productive offshore waters, such as waters off the coast of Washington and Oregon in the NWTT Offshore Area.

As described in Chapter 2 (Description of Proposed Action and Alternatives), Section 3.0.3.1.1 (Sonar and Other Transducers), and Appendix A (Navy Activities Descriptions), training activities under Alternative 2 reflect the maximum number of activities that could occur within a given year. This would result in an overall increase in sonar use compared to Alternative 1, however the hours of sonar and other transducers use in sea turtle hearing range (< 2,000 Hz) would remain the same between Alternative 1 and 2, and would still only occur in the NWTT Offshore Area. Overall, use of sources in this frequency range are less common during training activities than testing activities, and occur less often than sources with higher frequency content.

The quantitative analysis, using the number of hours of sonar and other transducers for a maximum year of training activities under Alternative 2, predicts that no leatherback turtles are likely to be exposed to the high received levels of sound from sonars or other transducers that could cause TTS or PTS.

Considering the above factors and the mitigation measures that would be implemented as described in Chapter 5 (Mitigation), long-term consequences to sea turtle individuals or populations would not be expected.

Pursuant to the ESA, the use of sonar and other transducers during training activities as described under Alternative 2 would have no effect on leatherback turtle critical habitat, but may affect the ESA-listed leatherback turtle.

Impacts from Sonar and Other Transducers Under Alternative 2 During Testing Activities

Leatherback turtles present in the Study Area may be exposed to sound from sonar and other transducers associated with testing activities throughout the year. Leatherback turtles are highly migratory and lead a pelagic existence, and they tend to prefer foraging in productive offshore waters, such as waters off the coast of Washington and Oregon in the NWTT Offshore Area.

As described in Chapter 2 (Description of Proposed Action and Alternatives), Section 3.0.3.1.1 (Sonar and Other Transducers), and Appendix A (Navy Activities Descriptions), testing activities under Alternative 2 reflects the maximum number of activities that could occur within a given year. This would result in an overall increase in sonar use compared to Alternative 1, including sources within sea turtle hearing range (<2,000 Hz). However, the locations, types, and severity of predicted impacts would be similar to those described above in Section 3.5.2.1.2.3 (Impacts from Sonar and Other Transducers Under Alternative 1). The hours of use of sonars and other transducers in this Supplemental compared with the totals analyzed in the 2015 NWTT Final EIS/OEIS are described in Table 3.0-2.

Under Alternative 2, testing activities using low-frequency sonar and other transducers would take place throughout the NWTT Study Area; however, these sources would occur more frequently in the NWTT Inland Waters, where leatherback turtles typically do not occupy. The general impacts from sonar and other transducers during testing would be similar in severity to those described during training. Same as Alternative 1, some new systems using new technologies would be tested under Alternative 2.

The quantitative analysis, using the number of hours of sonar and other transducers for a maximum year of testing activities under Alternative 2, predicts that no leatherback turtles are likely to be exposed to the high received levels of sound from sonars or other transducers that could cause TTS or PTS.

Considering the above factors and the mitigation measures that would be implemented as described in Chapter 5 (Mitigation), long-term consequences to sea turtle individuals or populations would not be expected.

Pursuant to the ESA, the use of sonar and other transducers during testing activities as described under Alternative 2 would have no effect on leatherback turtle critical habitat, but may affect the ESA-listed leatherback turtle.

3.5.2.1.2.5 Impacts from Sonar and Other Transducers Under the No Action Alternative

Under the No Action Alternative, the Navy would not conduct proposed at-sea training and testing activities in the Study Area. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer acoustic stressors (e.g., sonar and other transducers) within the marine environment where activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from sonar and other transducers on sea turtles, but would not measurably improve the overall distribution or abundance of sea turtles.

3.5.2.1.3 Impacts from Vessel Noise

Sea turtles may be exposed to noise from vessel movement. A detailed description of the acoustic characteristics and typical sound levels of vessel noise are in Section 3.0.3.1.2 (Vessel Noise). Vessel movements involve transits to and from ports to various locations within the Study Area, including commercial ship traffic as well as recreational vessels in addition to U.S. Navy vessels. Many ongoing and proposed training and testing activities within the Study Area involve maneuvers by various types of surface ships, boats, and submarines (collectively referred to as vessels).

Section 3.5.2.1.1 (Background) summarizes and synthesizes available information on behavioral reactions, masking, and physiological stress due to noise exposure, including vessel noise (Sections 3.5.2.1.1.2, Hearing Loss; 3.5.2.1.1.3, Physiological Stress; 3.5.2.1.1.4, Masking; and 3.5.2.1.1.5, Behavioral Reactions).

Activities may vary slightly from those previously analyzed in the 2015 NWTT Final EIS/OEIS, but the overall determinations presented remain valid. Increases and decreases shown in Tables 2.5-1 and 2.5-2 for proposed training and testing activities under Alternative 1 and 2 do not appreciably change the impact conclusions presented in the 2015 NWTT Final EIS/OEIS.

Under the No Action Alternative, the Navy would not conduct proposed at-sea training and testing activities in the Study Area. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer acoustic stressors (e.g., vessel noise) within the marine environment where activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from vessel noise on sea turtles, but would not measurably improve the overall distribution or abundance of sea turtles.

Pursuant to the ESA, vessel noise during training and testing activities, as described under Alternative 1 and Alternative 2, would have no effect on leatherback turtle critical habitat, but may affect ESA-listed leatherback turtles. The Navy has consulted with NMFS as required by section 7(a)(2) of the ESA for Alternative 1.

3.5.2.1.4 Impacts from Aircraft Noise

Sea turtles may be exposed to aircraft-generated noise throughout the Study Area. Fixed- and rotary-wing aircraft are used during a variety of training and testing activities throughout the Study Area. Tilt-rotor impacts would be similar to fixed-wing or helicopter impacts depending on the mode of the aircraft. In the Offshore Area where sea turtles occur, helicopter movement would be concentrated around ships and fixed-wing movement would be concentrated in Special Use Airspace. 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 (helicopters) produce low-frequency sound and vibration (Pepper et al., 2003).

A detailed description of aircraft noise as a stressor is in Section 3.0.3.1.3 (Aircraft Noise). Activities may vary slightly from those previously analyzed in the 2015 NWTT Final EIS/OEIS, but the overall determinations presented remain valid. Increases and decreases shown in Tables 2.5-1, 2.5-2, and 2.5-3 for proposed training and testing activities under Alternative 1 and 2 do not appreciably change the impact conclusions presented in the 2015 NWTT Final EIS/OEIS.

Under the No Action Alternative, the Navy would not conduct proposed at-sea training and testing activities in the Study Area. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer acoustic stressors (e.g., aircraft noise) within the marine environment where activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from aircraft noise on sea turtles, but would not measurably improve the overall distribution or abundance of sea turtles.

Pursuant to the ESA, aircraft noise during training and testing activities as described under Alternative 1 and Alternative 2, would have no effect on leatherback turtle critical habitat, but may affect ESA-listed leatherback turtles. The Navy has consulted with NMFS as required by section 7(a)(2) of the ESA for Alternative 1.

3.5.2.1.5 Impacts from Weapon Noise

Sea turtles may be exposed to sounds caused by the firing of weapon, objects in flight, and impact of non-explosive munitions on the water's surface, which are described in Section 3.0.3.1.4 (Weapons Noise). In general, these are impulsive sounds generated in close vicinity to or at the water surface, with the exception of items that are launched underwater. 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 flying through the air. 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 and rapidly fades as the missile or target travels downrange.

Activities may vary slightly from those previously analyzed in the 2015 NWTT Final EIS/OEIS, but the overall determinations presented remain valid. Increases and decreases shown in Tables 2.5-1 and 2.5-2 for proposed training and testing activities under Alternative 1 and 2 do not appreciably change the impact conclusions presented in the 2015 NWTT Final EIS/OEIS. Implementation of mitigation may further reduce the already low risk of auditory impacts on sea turtles from weapon noise during large-caliber gunnery events, as discussed in Section 5.3.2.2 (Weapons Firing Noise).

Under the No Action Alternative, the Navy would not conduct proposed at-sea training and testing activities in the Study Area. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer acoustic stressors (e.g., weapon noise) within the marine environment where activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would remove the potential for impacts from weapon noise on sea turtles, but would not measurably improve the overall distribution or abundance of sea turtles.

Pursuant to the ESA, weapon noise during training and testing activities as described under Alternative 1 and Alternative 2, would have no effect on leatherback turtle critical habitat, but may affect ESA-listed leatherback turtles. The Navy has consulted with NMFS as required by section 7(a)(2) of the ESA for Alternative 1.

3.5.2.2 Explosive Stressors

Explosions in the water or near the water surface can introduce loud, impulsive, broadband sounds into the marine environment. Unlike other acoustic stressors, explosives release energy at a high rate producing a shock wave that can be injurious and even deadly. Therefore, explosive impacts on sea turtles are discussed separately from other acoustic stressors, even though the analysis of explosive impacts will rely on data for sea turtle impacts due to impulsive sound exposure where appropriate.

Explosives are usually described by their net explosive weight, which accounts for the weight and type of explosive material. Additional explanation of the acoustic and explosive terms and sound energy concepts used in this section is found in Appendix D (Acoustic and Explosive Concepts).

This section begins with a summary of relevant data regarding explosive impacts on sea turtles in Section 3.5.2.2.1 (Background). The ways in which an explosive exposure could result in immediate effects or lead to long-term consequences for an animal are explained in Section 3.0.3.7 (Conceptual Framework for Assessing Effects from Acoustic and Explosive Stressors), and this section follows that framework. Studies of the effects of sound and explosives on sea turtles are limited; therefore, where necessary, knowledge of impacts on other species from explosives is used to assess impacts on sea turtles.

Due to new acoustic impact criteria, sea turtle densities, and revisions to the Navy Acoustic Effects Model, the analysis provided in Section 3.5.2.2.2 (Impacts from Explosives) of this Supplemental will supplant the 2015 NWTT Final EIS/OEIS for sea turtles, and may result in changes to estimated impacts since the 2015 NWTT Final EIS/OEIS.

3.5.2.2.1 Background

The sections below include a survey and synthesis of best available science published in peer-reviewed journals, technical reports, and other scientific sources pertinent to impacts on sea turtles potentially resulting from Navy training and testing activities. Sea turtles could be exposed to a range of impacts depending on the explosive source and context of the exposure. In addition to acoustic impacts including temporary or permanent hearing loss, auditory masking, physiological stress, or changes in behavior; potential impacts from an explosive exposure can include non-lethal injury and mortality.

3.5.2.2.1.1 Injury

Because direct studies of explosive impacts on sea turtles have not been conducted, the below discussion of injurious effects is based on studies of other animals, generally mammals. The generalizations that can be made about in-water explosive injuries to other species should be applicable to sea turtles, with consideration of the unique anatomy of sea turtles. For example, it is unknown if the sea turtle shell may afford it some protection from internal injury.

If an animal is exposed to an explosive blast underwater, the likelihood of injury depends on the charge size, the geometry of the exposure (distance to the charge, depth of the animal and the charge), and the size of the animal. In general, an animal would be less susceptible to injury near the water surface because the pressure wave reflected from the water surface would interfere with the direct path pressure wave, reducing positive pressure exposure. However, rapid under-pressure phase caused by the negative surface-reflected pressure wave above an underwater detonation may create a zone of cavitation that may contribute to potential injury. In general, blast injury susceptibility would increase with depth, until normal lung collapse (due to increasing hydrostatic pressure) and increasing ambient pressures again reduce susceptibility.

See Appendix D (Acoustic and Explosive Concepts) for an overview of explosive propagation and an explanation of explosive effects on gas cavities.

Primary blast injury is injury that results from the compression of a body exposed to a blast wave. This is usually observed as barotrauma of gas-containing structures (e.g., lung and gut) and structural damage to the auditory system (Greaves et al., 1943; Office of the Surgeon General, 1991; Richmond et al., 1973). The lungs are typically the first site to show any damage, while the solid organs (e.g., liver, spleen, and kidney) are more resistant to blast injury (Clark & Ward, 1943). Recoverable injuries would include slight lung injury, such as capillary interstitial bleeding, and contusions to the gastrointestinal tract. More severe injuries would significantly reduce fitness and likely cause death in the wild. Rupture of the lung may also introduce air into the vascular system, producing air emboli that can cause a stroke or heart attack by restricting oxygen delivery to critical organs. In this discussion, primary blast injury to auditory tissues is considered gross structural tissue injury distinct from noise-induced hearing loss, which is considered below in Section 3.5.2.2.1.2 (Hearing Loss).

Data on observed injuries to sea turtles from explosives is generally limited to animals found following explosive removal of offshore structures (Viada et al., 2008), which can attract sea turtles for feeding opportunities or shelter. Klima et al. (1988) observed a turtle mortality subsequent to an oil platform removal blast, although sufficient information was not available to determine the animal's exposure. Klima et al. (1988) also placed small sea turtles (less than 7 kilograms) at varying distances from piling detonations. Some of the turtles were immediately knocked unconscious or exhibited vasodilation over the following weeks, but others at the same exposure distance exhibited no effects.

Incidental injuries to sea turtles due to military explosions have been documented in a few instances. In one incident, a single 1,200-pound (lb.) trinitrotoluene (TNT) underwater charge was detonated off Panama City, FL in 1981. The charge was detonated at a mid-water depth of 120 ft. Although details are limited, the following were recorded: at a distance of 500–700 ft., a 400 lb. sea turtle was killed; at 1,200 ft., a 200–300 lb. sea turtle experienced “minor” injury; and at 2,000 ft. a 200–300 lb. sea turtle was not injured (O'Keeffe & Young, 1984). In another incident, two “immature” green sea turtles (size unspecified) were found dead about 100-150 ft. away from detonation of 20 lb. of C-4 in a shallow water environment.

Results from limited experimental data suggest two explosive metrics are predictive of explosive injury: peak pressure and impulse.

Impulse as a Predictor of Explosive Injury

Without measurements of the explosive exposures in the above incidents, it is difficult to draw conclusions about what amount of explosive exposure would be injurious to sea turtles. Studies of observed in-water explosive injuries showed that terrestrial mammals were more susceptible than comparably sized fish with swim bladders (Yelverton & Richmond, 1981), and that fish with swim bladders may have increased susceptibility to swim bladder oscillation injury depending on exposure geometry (Goertner, 1978; Wiley et al., 1981). Therefore, controlled tests with a variety of terrestrial mammals (mice, rats, dogs, pigs, sheep and other species) are the best available data sources on actual injury to similar-sized animals due to underwater exposure to explosions.

In the early 1970s, the Lovelace Foundation for Medical Education and Research conducted a series of tests in an artificial pond to determine the effects of underwater explosions on mammals, with the goal of determining safe ranges for human divers. The resulting data were summarized in two reports (Richmond et al., 1973; Yelverton et al., 1973). Specific physiological observations for each test animal are documented in Richmond et al. (1973). Gas-containing internal organs, such as lungs and intestines, were the principle damage sites in submerged terrestrial mammals, consistent with earlier studies of mammal exposures to underwater explosions (Clark & Ward, 1943; Greaves et al., 1943).

In the Lovelace studies, acoustic impulse was found to be the metric most related to degree of injury, and size of an animal’s gas-containing cavities was thought to play a role in blast injury susceptibility. The proportion of lung volume to overall body size is similar between sea turtles and terrestrial mammals, so the magnitude of lung damage in the tests may approximate the magnitude of injury to sea turtles when scaled for body size. Measurements of some shallower diving sea turtles (Hochscheid et al., 2007) show lung to body size ratios that are larger than terrestrial animals, whereas the lung to body mass ratio of the deeper diving leatherback sea turtle is smaller (Lutcavage et al., 1992). The use of test data with smaller lung to body ratios to set injury thresholds may result in a more conservative estimate of potential for damaging effects (i.e., lower thresholds) for animals with larger lung to body ratios.

For these shallow exposures of small terrestrial mammals (masses ranging from 3.4 to 50 kilograms) to underwater detonations, Richmond et al. (1973) reported that no blast injuries were observed when exposures were less than 6 lb. per square in. per millisecond (psi-ms) (40 pascal-seconds [Pa-s]), no instances of slight lung hemorrhage occurred below 20 psi-ms (140 Pa-s), and instances of no lung damage were observed in some exposures at higher levels up to 40 psi-ms (280 Pa-s). An impulse of 34 psi-ms (230 Pa-s) resulted in about 50 percent incidence of slight lung hemorrhage. About half of the animals had gastrointestinal tract contusions (with slight ulceration, i.e., some perforation of the mucosal layer) at exposures of 25–27 psi-ms (170–190 Pa-s). Lung injuries were found to be slightly more prevalent than gastrointestinal tract injuries for the same exposure.

The Lovelace subject animals were exposed near the water surface; therefore, depth effects were not discernible in this data set. In addition, this data set included only small terrestrial animals, whereas adult sea turtles may be substantially larger and have respiratory structures adapted for the high pressures experienced at depth. Goertner (1982) examined how lung cavity size would affect susceptibility to blast injury by considering both size and depth in a bubble oscillation model of the lung, which is assumed to be applicable to sea turtles as well for this analysis. Animal depth relates to injury susceptibility in two ways: injury is related to the relative increase in explosive pressure over hydrostatic pressure, and lung collapse with depth reduces the potential for air cavity oscillatory damage. The time period over which an impulse must be delivered to cause damage is assumed to be related to the natural oscillation period of an animal's lung, which depends on lung size. Based on a study of green sea turtles, Berkson (1967) predicted sea turtle lung collapse would be complete around 80–160 m depth.

Peak Pressure as a Predictor of Explosive Trauma

High instantaneous peak pressures can cause damaging tissue distortion. Goertner (1982) suggested a peak overpressure gastrointestinal tract injury criterion because the size of gas bubbles in the gastrointestinal tract are variable, and their oscillation period could be short relative to primary blast wave exposure duration. The potential for gastrointestinal tract injury, therefore, may not be adequately modeled by the single oscillation bubble methodology used to estimate lung injury due to impulse. Like impulse, however, high instantaneous pressures may damage many parts of the body, but damage to the gastrointestinal tract is used as an indicator of any peak pressure-induced injury due to its vulnerability.

Older military reports documenting exposure of human divers to blast exposure generally describe peak pressure exposures around 100 lb. psi (237 dB re 1 µPa peak) to feel like a slight pressure or stinging sensation on skin, with no enduring effects (Christian & Gaspin, 1974). Around 200 psi, the shock wave felt like a blow to the head and chest. Data from the Lovelace Foundation experiments show instances of gastrointestinal tract contusions after exposures up to 1147 psi peak pressure, while exposures of up to 588 psi peak pressure resulted in many instances of no observed gastrointestinal tract effects. The lowest exposure for which slight contusions to the gastrointestinal tract were reported was 237 dB re 1 µPa peak. As a vulnerable gas-containing organ, the gastrointestinal tract is vulnerable to both high peak pressure and high impulse, which may vary to differing extents due to blast exposure conditions (i.e., animal depth, distance from the charge). This likely explains the range of effects seen at similar peak pressure exposure levels and shows the utility of considering both peak pressure and impulse when analyzing the potential for injury due to explosives.

The *ANSI Sound Exposure Guidelines* (Popper et al., 2014) recommended peak pressure guidelines for sea turtle injury from explosives. Lacking any direct data for sea turtles, these recommendations were based on fish data. Of the fish data available, the working group conservatively chose the study with the lowest peak pressures associated with fish mortality to set guidelines (Hubbs & Rechnitzer, 1952), and did not consider the Lovelace studies discussed above.

3.5.2.2.1.2 Hearing Loss

An underwater explosion produces broadband, impulsive sound that can cause noise-induced hearing loss, typically quantified as threshold shift, which persists after cessation of the noise exposure. This noise-induced hearing loss may manifest as TTS or PTS. Because studies on inducing threshold shift in sea turtles are very limited (e.g., alligator lizards: Dew et al., 1993; Henry & Mulroy, 1995) and have not been conducted on any of the sea turtles present in the Study Area, auditory threshold shift in sea turtles is considered to be consistent with general knowledge about noise-induced hearing loss described in Section 3.0.3.7 (Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities).

Little is known about how sea turtles use sound in their environment. The ANSI Sound Exposure Guidelines (Popper et al., 2014) do not suggest numeric sound exposure thresholds for auditory effects on sea turtles due to lack of data. Rather, the guidelines qualitatively advise that sea turtles are less likely to incur TTS or PTS with increasing distance from an explosive. The guidelines also suggest that data from fishes may be more relevant than data from marine mammals when estimating auditory impacts on sea turtles, because, in general, fish hearing range is more similar to the limited hearing range of sea turtles. As shown in Section 3.5.1.2 (Hearing and Vocalization), sea turtle hearing is most sensitive around 100–400 Hz in-water, is limited over 1 kHz, and is much less sensitive than that of any marine mammal.

3.5.2.2.1.3 Physiological Stress

A stress response is a suite of physiological changes that are meant to help an organism mitigate the impact of a stressor. If the magnitude and duration of the stress response is too great or too long, it can have negative consequences to the animal (e.g., decreased immune function, decreased reproduction). Physiological stress is typically analyzed by measuring stress hormones, other biochemical markers, or vital signs. Physiological stress has been measured for sea turtles during nesting (Flower et al., 2015; Valverde et al., 1999) and capture and handling (Flower et al., 2015; Gregory & Schmid, 2001), but the stress caused by acoustic exposure has not been studied for sea turtles. Therefore, the stress response in sea turtles in the Study Area due to acoustic exposures is considered to be consistent with general knowledge about physiological stress responses described in Section 3.0.3.7 (Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities).

Marine animals naturally experience stressors within their environment and as part of their life histories. Changing weather and ocean conditions, exposure to diseases and naturally occurring toxins, lack of prey availability, social interactions with members of the same species, nesting, and interactions with predators all contribute to stress. Anthropogenic sound-producing activities have the potential to provide additional stressors beyond those that naturally occur.

Due to the limited information about acoustically induced stress responses, the Navy conservatively assumes in its effect analysis that any physiological response (e.g., hearing loss or injury) or significant behavioral response is also associated with a stress response.

3.5.2.2.1.4 Masking

As described in Section 3.0.3.7 (Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities), auditory masking occurs when one sound, distinguished as the “noise,” interferes with the detection or recognition of another sound or limits the distance over which other biologically relevant sounds can be detected. Masking only occurs when the sound source is operating; therefore, direct masking effects stop immediately upon cessation of the sound-producing activity. Any unwanted sound above ambient noise and within an animal’s hearing range may potentially cause masking which can interfere with an animal’s ability to detect, understand, or recognize biologically relevant sounds of interest.

Masking occurs in all vertebrate groups and can effectively limit the distance over which an animal can communicate and detect biologically relevant sounds. The effect of masking has not been studied for marine sea turtles. The potential for masking in sea turtles would be limited to certain sound exposures due to their limited hearing range to broadband low frequency sounds and lower sensitivity to noise in the marine environment. Only continuous human-generated sounds that have a significant low-frequency component, are not of brief duration, and are of sufficient received level could create a meaningful masking situation. While explosives produce intense, broadband sounds with significant low-frequency content, these sounds are very brief with limited potential to mask relevant sounds.

There is evidence that sea turtles may rely primarily on senses other than hearing for interacting with their environment, such as vision (Narazaki et al., 2013) and magnetic orientation (Avens, 2003; Putman et al., 2015). Any effect of masking may be mediated by reliance on other environmental inputs.

3.5.2.2.1.5 Behavioral Reactions

There are no observations of behavioral reactions by sea turtles to exposure to explosive sounds. Impulsive signals, particularly at close range, have a rapid rise time and higher instantaneous peak pressure than other signal types, making them more likely to cause startle responses or avoidance responses. Although explosive sources are more energetic than air guns, the few studies of sea turtles' responses to air guns, which are not used during Navy training or testing activities, may show the types of behavioral responses that sea turtles may have towards explosives. General research findings regarding behavioral reactions from sea turtles due to exposure to impulsive sounds, such as those associated with explosions, are discussed in detail in Behavioral Reactions to Impulsive Sound Sources under Section 3.5.2.1 (Acoustic Stressors).

3.5.2.2.1.6 Long-Term Consequences

For sea turtles present in the Study Area, long-term consequences to individuals and populations due to acoustic exposures have not been studied. Therefore, long-term consequences to sea turtles due to explosive exposures are considered following Section 3.0.3.7 (Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities).

Long-term consequences to a population are determined by examining changes in the population growth rate. Physical effects that could lead to a reduction in the population growth rate include mortality or injury, which could remove animals from the reproductive pool, and permanent hearing impairment, which could impact navigation. The long-term consequences due to individual behavioral reactions and short-term instances of physiological stress are especially difficult to predict because individual experience over time can create complex contingencies. It is more likely that any long-term consequences to an individual would be a result of costs accumulated over a season, year, or life stage due to multiple behavioral or stress responses resulting from exposures to multiple stressors over significant periods of time. Conversely, some sea turtles may habituate to or become tolerant of repeated acoustic exposures over time, learning to ignore a stimulus that in the past did not accompany any overt threat. For example, loggerhead sea turtles exposed to air guns with a source SPL of 179 dB re 1 µPa initially exhibited avoidance reactions. However, they may have habituated to the sound source after multiple exposures since a habituation behavior was retained when exposures were separated by several days (Moein Bartol et al., 1995). More research is needed to better understand the long-term consequences of human-made noise on sea turtles, although intermittent exposures are assumed to be less likely to have lasting consequences.

3.5.2.2.2 Impacts from Explosives

Sea turtles could be exposed to energy, sound, and fragments from explosions in the water and near the water surface associated with the proposed activities. Energy and sound from an explosion are capable of causing mortality, injury, hearing loss, a behavioral response, masking, or physiological stress, depending on the level and duration of exposure. The death of an animal would eliminate future reproductive potential, which is considered in the analysis of potential long-term consequences to the population. Exposures that result in non-auditory injuries may limit an animal's ability interpret the surrounding environment. Impairment of these abilities can decrease an individual's chance of survival or affect its ability to reproduce. Temporary threshold shift can also impair an animal's abilities, although the individual may recover quickly with little significant effect.

Overall, the locations, types, and severity of predicted impacts for the use of explosives during training and testing activities would be similar to what is currently conducted, with the addition of a new testing activity described in Table 2.5-1 and 2.5-2. The activities that use explosive munitions would occur in the same general locations and in a similar manner as previously analyzed in the 2015 NWTT Final EIS/OEIS, with one exception. A new mine countermeasure and neutralization testing activity would occur in the Offshore Area approximately two times per year and would use explosives within the water column (see Chapter 2, Description of Proposed Action and Alternatives). Although activities may vary in the number of events or ordnances from those previously analyzed, the overall determinations presented in the 2015 NWTT Final EIS/OEIS remain valid (with the exception of leatherback turtle Critical Habitat), and has been developed further under this Supplemental.

The quantitative analysis has been updated since the 2015 NWTT Final EIS/OEIS; therefore, the following analysis is written in full to reflect the new criteria and thresholds, as described in the technical report *Quantifying Acoustic Impacts on Marine Mammals and Sea Turtles: Methods and Analytical Approach for Phase III Training and Testing* (U.S. Department of the Navy, 2017b).

3.5.2.2.2.1 Methods for Analyzing Impacts from Explosives

Potential impacts considered are mortality, injury, hearing loss due to threshold shift (permanent or temporary), masking of other biologically relevant sounds, physiological stress, and changes in behavior. The Navy's quantitative analysis to determine impacts to sea turtles and marine mammals uses the Navy Acoustic Effects Model to produce initial estimates of the number of times these animals may experience these effects; these estimates are further refined by considering animal avoidance of sound-producing activities and implementation of mitigation. The steps of this quantitative analysis take into account:

- criteria and thresholds used to predict impacts from explosives (see below);
- the density and spatial distribution of sea turtles; and,
- the influence of environmental parameters (e.g., temperature, depth, salinity) on sound propagation and explosive energy when estimating the received sound level and pressure on the animals.

A further detailed explanation of this analysis is provided in the technical report titled *Quantifying Acoustic Impacts on Marine Mammals and Sea Turtles: Methods and Analytical Approach for Phase III Training and Testing* (U.S. Department of the Navy, 2017b).

Criteria and Thresholds used to Predict Impacts on Sea Turtles from Explosives

Mortality and Injury from Explosives

As discussed above in Section 3.5.2.2.1.1 (Injury), two metrics have been identified as predictive of injury: impulse and peak pressure. Peak pressure contributes to the "crack" or "stinging" sensation of a blast wave, compared to the "thump" associated with received impulse. Older military reports documenting exposure of human divers to blast exposure generally describe peak pressure exposures around 100 psi (237 dB re 1 µPa SPL peak) to feel like slight pressure or stinging sensation on skin, with no enduring effects (Christian & Gaspin, 1974).

Two sets of thresholds are provided for use in non-auditory injury assessment. The exposure thresholds are used to estimate the number of animals that may be affected during Navy training and testing activities (Table 3.5-1). The thresholds for the farthest range to effect are based on the received level at which one percent risk is predicted and are useful for assessing potential effects to sea turtles and marine mammals, and the range at which mitigation could be effective. Increasing animal mass and increasing animal depth both increase the impulse thresholds (i.e., decrease susceptibility), whereas smaller mass and decreased animal depth reduce the impulse thresholds (i.e., increase susceptibility). For impact assessment, sea turtle populations are assumed to be 5 percent adult and 95 percent sub-adult. This adult to sub-adult population ratio is estimated from what is known about the population age structure for sea turtles. Sea turtles typically lay multiple clutches of 100 or more eggs with little parental investment and generally have low survival in early life. However, sea turtles that are able to survive past early life generally have high age-specific survival in later life.

The derivation of these injury criteria and the species mass estimates are provided in the technical report *Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase III)* (U.S. Department of the Navy, 2017a).

Table 3.5-1: Criteria to Quantitatively Assess Non-Auditory Injury due to Underwater Explosions

Impact Category	*Exposure Threshold*	*Threshold for Farthest Range to Effect*[2]
Mortality[1]	$144M^{1/3}\left(1+\frac{D}{10.1}\right)^{1/6}$ Pa-s	$103M^{1/3}\left(1+\frac{D}{10.1}\right)^{1/6}$ Pa-s
Injury[1]	$65.8M^{1/3}\left(1+\frac{D}{10.1}\right)^{1/6}$ Pa-s	$47.5M^{1/3}\left(1+\frac{D}{10.1}\right)^{1/6}$ Pa-s
	243 dB re 1 µPa SPL peak	237 dB re 1 µPa SPL peak

[1] Impulse delivered over 20% of the estimated lung resonance period. See U.S. Department of the Navy (2017a).
[2] Threshold for one percent risk used to assess mitigation effectiveness.
Note: dB re 1 µPa = decibels referenced to 1 micropascal, SPL = sound pressure level, M = animal mass (kg), D = animal depth (m), and Pa-s = Pascal-second

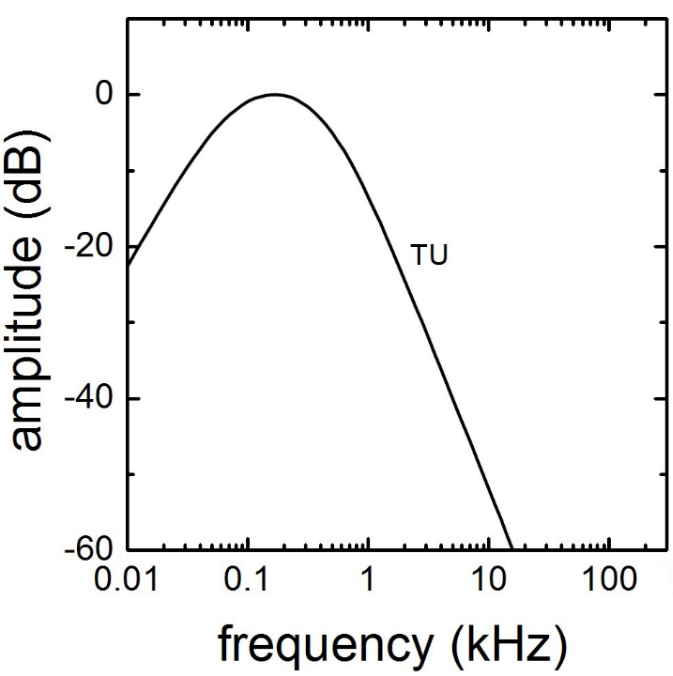
When explosive munitions (e.g., a bomb or missile) detonates, fragments of the weapon are thrown at high-velocity from the detonation point, which can injure or kill sea turtles if they are struck. Risk of fragment injury reduces exponentially with distance as the fragment density is reduced. Fragments underwater tend to be larger than fragments produced by in-air explosions (Swisdak & Montanaro, 1992). Underwater, the friction of the water would quickly slow these fragments to a point where they no longer pose a threat. On the other hand, the blast wave from an explosive detonation moves efficiently through the seawater. Because the ranges to mortality and injury due to exposure to the blast wave are likely to far exceed the zone where fragments could injure or kill an animal, the above thresholds are assumed to encompass risk due to fragmentation.

Fragments produced by exploding munitions at or near the surface may present a high-speed strike hazard for an animal at or near the surface. In water, however, fragmentation velocities decrease rapidly due to drag (Swisdak & Montanaro, 1992). Because blast waves propagate efficiently through water, the range to injury from the blast wave would likely extend beyond the range of fragmentation risk.

Auditory Weighting Functions

Animals are not equally sensitive to noise at all frequencies. To capture the frequency-dependent nature of the effects of noise, auditory weighting functions are used. Auditory weighting functions are mathematical functions that adjust received sound levels to emphasize ranges of best hearing and de-emphasize ranges with less or no auditory sensitivity. The adjusted received sound level is referred to as a weighted received sound level.

The auditory weighting function for sea turtles is shown in Figure 3.5-7. The derivation of this weighting function is described in the technical report *Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase III)* (U.S. Department of the Navy, 2017a). The frequencies around the top portion of the function, where the amplitude is closest to zero, are emphasized, while the frequencies below and above this range (where amplitude declines) are de-emphasized, when summing acoustic energy received by a sea turtle.



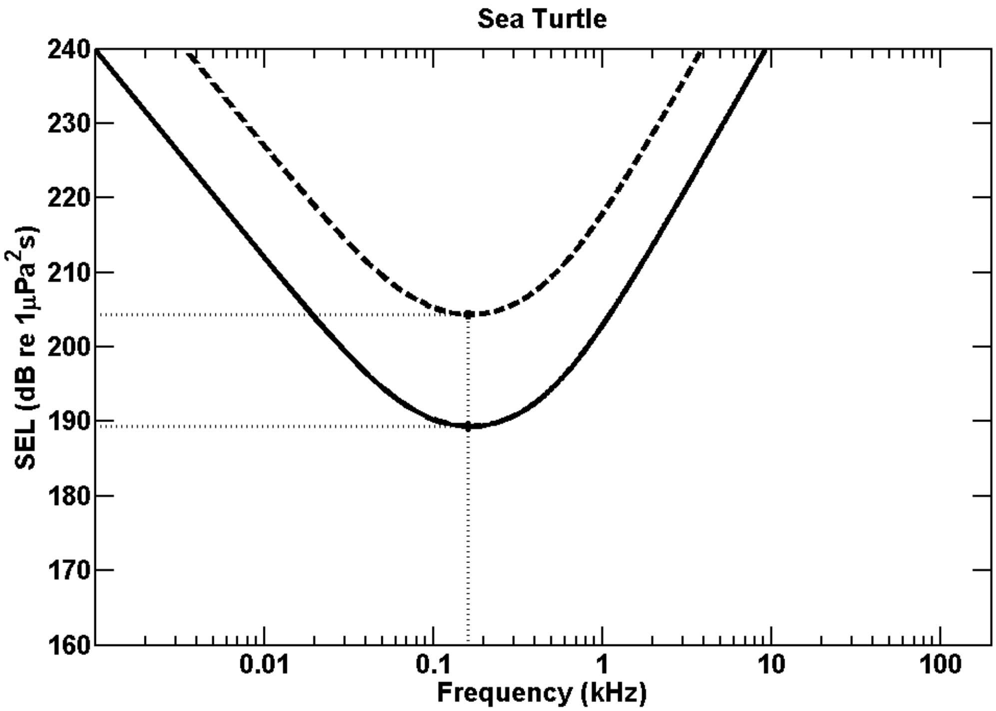
Source: U.S. Department of the Navy (2017a)
Notes: dB = decibels, kHz = kilohertz, TU = sea turtle hearing group

Figure 3.5-7: Auditory Weighting Functions for Sea Turtles

Hearing Loss from Explosives

No studies of hearing loss have been conducted on sea turtles. Therefore, sea turtle susceptibility to hearing loss due to an acoustic exposure is evaluated using knowledge about sea turtle hearing abilities in combination with non-impulsive auditory effect data from other species (marine mammals and fish). This yields sea turtle exposure functions, shown in Figure 3.5-8, which are mathematical functions that relate the SELs for onset of TTS or PTS

to the frequency of the sonar sound exposure. The derivation of the sea turtle exposure functions are provided in the technical report *Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase III)* (U.S. Department of the Navy, 2017a).



Notes: kHz = kilohertz, SEL = Sound Exposure Level, dB re 1 µPa²s = decibels referenced to 1 micropascal squared second. The solid black curve is the exposure function for TTS onset and the dashed black curve is the exposure function for PTS onset. Small dashed lines and asterisks indicate the SEL thresholds and most sensitive frequency for TTS and PTS.

Figure 3.5-8: TTS and PTS Exposure Functions for Impulsive Sounds

For impulsive sounds, hearing loss in other species has also been observed to be related to the unweighted peak pressure of a received sound. Because this data does not exist for sea turtles, unweighted peak pressure thresholds for TTS and PTS were developed by applying relationships observed between impulsive peak pressure TTS thresholds and auditory sensitivity in marine mammals to sea turtles. This results in dual-metric hearing loss criteria for sea turtles for impulsive sound exposure: the SEL-based exposure functions in Figure 3.5-8 and the peak pressure thresholds in Table 3.5-2. The derivation of the sea turtle impulsive peak pressure TTS and PTS thresholds are provided in the technical report *Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase III)* (U.S. Department of the Navy, 2017a).

Table 3.5-2: TTS and PTS Peak Pressure Thresholds Derived for Sea Turtles Exposed to Impulsive Sounds

Auditory Effect	*Unweighted Peak Pressure Threshold*
TTS	226 dB re 1 µPa SPL peak
PTS	232 dB re 1 µPa SPL peak

Notes: dB re 1 µPa = decibels referenced to 1 micropascal,
PTS = permanent threshold shift, SPL = sound pressure level,
TTS = temporary threshold shift

<u>Accounting for Mitigation</u>

The Navy will implement mitigation measures to avoid or reduce potential impacts from explosives on sea turtles, as described in Section 5.3.3 (Explosive Stressors). The benefits of mitigation are conservatively factored into the analysis for Alternative 1 and Alternative 2 of the Proposed Action for training and testing. The Navy's mitigation measures are identical for both action alternatives.

Procedural mitigation measures include delaying or ceasing applicable detonations when a sea turtle is observed in a mitigation zone. The mitigation zones for explosives extend beyond the respective average ranges to mortality. The mitigation zones encompass the estimated ranges to mortality for a given explosive. Therefore, the impact analysis quantifies the potential for mitigation to reduce the risk of mortality due to exposure to explosives. Two factors are considered when quantifying the effectiveness of mitigation: (1) the extent to which the type of mitigation proposed for a sound-producing activity (e.g., active sonar) allows for observation of the mitigation zone prior to and during the activity; and (2) the sightability of each species that may be present in the mitigation zone, which is determined by species-specific characteristics and the viewing platform. A detailed explanation of the analysis is provided in the technical report *Quantifying Acoustic Impacts on Marine Mammals and Sea Turtles: Methods and Analytical Approach for Phase III Training and Testing* (U.S. Department of the Navy, 2017b).

In the quantitative analysis, consideration of mitigation measures means that, for activities where mitigation is feasible, model-estimated mortality is considered mitigated to the level of injury. The impact analysis does not analyze the potential for mitigation to reduce TTS or behavioral effects, even though mitigation could also reduce the likelihood of these effects. In practice, mitigation also protects all unobserved (below the surface) animals in the vicinity, including other species, in addition to the observed animal. However, the analysis assumes that only animals sighted at the water surface would be protected by the applied mitigation. The analysis, therefore, does not capture the protection afforded to all marine species that may be near or within the mitigation zone.

The Navy will also implement mitigation measures for explosive activities within mitigation areas, as described in Appendix K (Geographic Mitigation Assessment). Mitigation areas are designed to help avoid or reduce impacts during biologically important life processes within particularly important habitat areas. The benefits of mitigation areas are discussed qualitatively in terms of the context of impact avoidance or reduction. Should national security present a requirement to conduct activities that the Navy would otherwise prohibit in a particular mitigation area, naval units will obtain permission from the appropriate designated Command authority prior to commencement of the activity. The Navy will provide NMFS with advance notification and include information about the event in its annual activity reports to NMFS.

3.5.2.2.2.2 Impact Ranges from Explosives

The following section provides the range (distance) over which specific physiological or behavioral effects are expected to occur based on the explosive criteria and the explosive propagation calculations from the Navy Acoustic Effects Model (Section 3.5.2.2.2.1, Methods for Analyzing Impacts from Explosives). The range to effects is shown for a range of explosive bins, from E1 (up to 0.25 lb. net explosive weight) to E11 (greater than 500 lb.–650 lb. net explosive weight). Ranges are determined by modeling the distance that noise from an explosion will need to propagate to reach exposure level thresholds specific to a hearing group that will cause TTS, PTS, non-auditory injury, and mortality. Range to effects is important information in not only predicting impacts from explosives, but also in verifying the accuracy of model results against real-world situations and assessing the level of impact that will be mitigated within applicable mitigation zones.

Table 3.5-3 shows the minimum, average, and maximum ranges due to varying propagation conditions to non-auditory injury based on the larger of the range to slight lung injury or gastrointestinal tract injury for representative animal masses ranging from 250 to 1,000 kg and different explosive bins ranging from 0.25 to 650 lb. net explosive weight. Animals within these water volumes 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. Ranges to mortality, based on animal mass, are shown in Table 3.5-4.

The following tables (Table 3.5-5 and Table 3.5-6) show the minimum, average, and maximum ranges to onset of auditory and behavioral effects based on the thresholds described in Section 3.5.2.2.2.1 (Methods for Analyzing Impacts from Explosives – Criteria and Thresholds Used to Predict Impacts on Sea Turtles from Explosives). Ranges are provided for a representative source depth and cluster size (the number of rounds fired [or buoys dropped] within a very short duration) for each bin. 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 PTS 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. For additional information on how ranges to impacts from explosions were estimated, see the technical report *Quantifying Acoustic Impacts on Marine Mammals and Sea Turtles: Methods and Analytical Approach for Phase III Training and Testing Ranges* (U.S. Department of the Navy, 2017b).

Table 3.5-3: Ranges to Non-Auditory Injury[1] (in meters) for Sea Turtles Exposed to Explosives as a Function of Animal Mass

Bin[2]	Ranges to Non-Auditory Injury (m)[1]	
	Animal Mass of 250 kg	Animal Mass of 1,000 kg
E1	12 (11–13)	12 (11–13)
E2	16 (15–16)	16 (15–16)
E3	25 (25–45)	25 (25–45)
E4	31 (30–50)	31 (30–50)
E5	40 (40–40)	40 (40–40)
E7	79 (75–120)	79 (75–120)
E8	93 (90–110)	93 (90–110)
E10	155 (150–160)	155 (150–160)
E11	247 (190–270)	174 (170–260)

[1]Average distance (m) to non-auditory injury is depicted above the minimum and maximum distances which are in parentheses. The ranges depicted are the further of the ranges for gastrointestinal tract injury or slight lung injury for an explosive bin and animal mass interval combination.

[2]Bin (net explosive weight, lb.): E1 (0.1–0.25), E2 (> 0.25–0.5), E3 (> 0.5–2.5), E4 (> 2.5–5), E5 (> 5–10), E7 (> 20–60), E8 (> 60–100), E10 (> 250–500), E11 (> 500–650)

Note: kg = kilogram(s)

Table 3.5-4: Ranges to Mortality (in meters) for Sea Turtles Exposed to Explosives as a Function of Animal Mass[1]

Bin[2]	*Ranges to Mortality (m)*	
	Animal Mass of 250 kg[1]	*Animal Mass of 1,000 kg[1]*
E1	1 (1–1)	0 (0–0)
E2	2 (2–3)	1 (1–1)
E3	6 (6–10)	2 (2–5)
E4	8 (7–9)	4 (4–5)
E5	8 (7–8)	4 (3–4)
E7	29 (25–35)	16 (14–20)
E8	40 (40–40)	21 (21–21)
E10	27 (25–30)	16 (16–17)
E11	96 (70–100)	49 (45–50)

[1]Average distance (m) to mortality is depicted above the minimum and maximum distances which are in parentheses.
[2]Bin (net explosive weight, lb.): E1 (0.1–0.25), E2 (> 0.25–0.5), E3 (> 0.5–2.5), E4 (> 2.5–5), E5 (> 5–10), E7 (> 20–60), E8 (> 60–100), E10 (> 250–500), E11 (> 500–650)

Table 3.5-5: Peak Pressure Based Ranges to TTS and PTS (in meters) for Sea Turtles Exposed to Explosives

Range to Effects for Explosives Bin: Sea turtles[1]			
Bin[2]	***Source Depth (meters)***	***Range to PTS (meters)***[1]	***Range to TTS (meters)***[1]
E1	0.1	37 (35—40)	69 (65—70)
E2	0.1	48 (45—50)	88 (80—90)
E3[3]	18.25 Offshore Area	80 (80—85)	154 (150—200)
E4	10	100 (100—100)	190 (190—190)
	30	105 (100—140)	262 (190—675)
	70	106 (100—160)	206 (190—350)
	90	103 (100—150)	197 (190—320)
E5	0.1	128 (120—130)	243 (230—250)
E7	10	255 (250—260)	471 (440—500)
	30	419 (240—1,025)	722 (440—1,025)
E8	45.75	434 (280—975)	956 (525—2,025)
E10	0.1	481 (470—490)	863 (850—875)
E11	91.4	929 (525—1,775)	2,122 (1,000—3,775)
	200	563 (525—800)	1,606 (1,000—3,525)

[1]Distances in meters (m). Average distance is shown with the minimum and maximum distances due to varying propagation environments in parentheses.
[2]Bin (net explosive weight, lb.): E1 (0.1–0.25), E2 (> 0.25–0.5), E3 (> 0.5–2.5), E4 (> 2.5–5), E5 (> 5–10), E7 (> 20–60), E8 (> 60–100), E10 (> 250–500), E11 (> 500–650)
Notes: PTS = permanent threshold shift, TTS = temporary threshold shift
[3]Distances for bin E3 are provided for the Offshore Area only since sea turtle analyses were based on occurrence in the Offshore Area only.

Table 3.5-6: SEL Based Ranges (in meters) to TTS and PTS for Sea Turtles Exposed to Explosives

Range to Effects for Explosives Bin: Sea turtles[1]				
Bin[2]	***Source Depth (meters)***	***Cluster Size***	***Range to PTS (meters)[1]***	***Range to TTS (meters)[1]***
E1	0.1	1	0 (0—0)	0 (0—0)
E2	0.1	1	0 (0—0)	1 (1—1)
E3[3]	18.25 Offshore Area	1	3 (3—3)	17 (16—17)
E4	10	2	7 (7—7)	51 (50—55)
	30	2	7 (7—7)	47 (45—55)
	70	2	7 (7—7)	37 (35—50)
	90	2	7 (7—7)	36 (35—45)
E5	0.1	1	1 (1—1)	7 (7—8)
		8	3 (3—4)	18 (17—21)
E7	10	1	40 (40—40)	232 (190—290)
	30	1	30 (30—30)	254 (190—420)
E8	45.75	1	40 (40—55)	283 (260—400)
E10	0.1	1	14 (13—21)	87 (60—440)
E11	91.4	1	155 (150—200)	1,108 (775—2,275)
	200	1	111 (110—120)	872 (800—925)

[1]Distances in meters (m). Average distance is shown with the minimum and maximum distances due to varying propagation environments in parentheses.
[2]Bin (net explosive weight, lb.): E1 (0.1–0.25), E2 (> 0.25–0.5), E3 (> 0.5–2.5), E4 (> 2.5–5), E5 (> 5–10), E7 (> 20–60), E8 (> 60–100), E10 (> 250–500), E11 (> 500–650)
Notes: PTS = permanent threshold shift, SEL = sound exposure level, TTS = temporary threshold shift
[3]Distances for bin E3 are provided for the Offshore Area only since sea turtle analyses were based on occurrence in the Offshore Area only.

3.5.2.2.2.3 Impacts from Explosives Under Alternative 1

Impacts from Explosives Under Alternative 1 During Training Activities

Leatherback turtles present in the Study Area may be exposed to sound or energy from explosions associated with training activities throughout the year. Leatherback turtles are highly migratory and lead a pelagic existence, and they tend to prefer foraging in productive offshore waters, such as waters off the coast of Washington and Oregon in the NWTT Offshore Area.

Activities using explosives would be conducted as described in Chapter 2 (Description of Proposed Action and Alternatives) and Appendix A (Navy Activities Descriptions). General characteristics, quantities, and net explosive weights of in-water explosives used during training activities under Alternative 1 are provided in Section 3.0.3.2 (Explosive Stressors). Quantities and locations of fragment-producing explosives during training activities under Alternative 1 are shown in Section 3.0.3.4.4 (Military Expended Materials). The number of explosive sources in this Supplemental compared with the totals analyzed in the 2015 NWTT Final EIS/OEIS are described in Table 3.0-7.

Under Alternative 1, there could be fluctuation in the amount of explosions that could occur annually, although potential impacts would be similar from year to year. Training activities involving explosives would be concentrated in the NWTT Offshore Area. The Navy's mitigation requires detonations to occur greater than 50 NM from shore in the NWTT Offshore Area during training activities.

The quantitative analysis predicts no leatherback turtles are likely to be exposed to the levels of explosive sound and energy that could cause TTS, PTS, injury, or mortality during a maximum year of training under Alternative 1 (U.S. Department of the Navy, 2017b). As discussed in Section 5.3.3 (Explosive Stressors), procedural mitigation includes ceasing explosive detonations (e.g., ceasing deployment of an explosive bomb) if a sea turtle is observed in the mitigation zone whenever and wherever applicable activities occur. In addition to this procedural mitigation, the Navy will implement mitigation to avoid or reduce impacts from explosions on seafloor resources in mitigation areas throughout the Study Area, as described in Appendix K (Geographic Mitigation Assessment). This will further reduce the potential for impacts on sea turtles that shelter and feed on live hard bottom, artificial reefs, and shipwrecks.

Sea turtle hearing is less sensitive than other marine animals (i.e., marine mammals), and the role of their underwater hearing is unclear. Sea turtle's limited hearing range (<2 kHz) is most likely used to detect nearby broadband, continuous environmental sounds, such as the sounds of waves crashing on the beach, that may be important for identifying their habitat. Recovery from a hearing threshold shift begins almost immediately after the noise exposure ceases. A temporary threshold shift is expected to take a few minutes to a few days, depending on the severity of the initial shift, to fully recover (U.S. Department of the Navy, 2017a). 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 sea turtle's very limited hearing range, reducing the distance over which relevant sounds, such as beach sounds, may be detected for the duration of the threshold shift.

Some sea turtles may behaviorally respond to the sound of an explosive. A sea turtle's behavioral response to a single detonation or explosive cluster is expected to be limited to a short-term (seconds to minutes) startle response, as the duration of noise from these events is very brief. Limited research and observations from air gun studies (see Section 3.5.2.2.2.1, Methods for Analyzing Impacts from Explosives) 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 beyond 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.

A physiological stress response is assumed 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 could reduce an individual's fitness.

Designated leatherback turtle critical habitat, which includes the physical and biological features of leatherback turtle critical habitat (i.e., the occurrence of prey species, primarily jellyfish), overlaps with the NWTT Study Area as described in Section 3.5.1.4 (Leatherback Sea Turtle [*Dermochelys coriacea*]). Most, although not all, detonations would occur greater than 50 NM from shore in the Offshore Area of the NWTT Study Area. As discussed in the Section 3.8.2.2.1.1 (Impacts from Explosives under Alternative 1) of the Marine Invertebrates section, impacts to pelagic marine invertebrates (e.g., jellyfish) from explosions would be insignificant. Only jellyfish in very close proximity to a blast could be exposed for a brief duration; however, these exposures would not affect the overall prey availability for leatherback turtles. Impacts, if any, to prey species would be minimal, thus explosions would have no discernible impact on the condition, distribution, diversity, and abundance and density of prey species necessary to support individual as well as population growth, reproduction, and development of leatherback turtles in the Study Area.

Considering the above factors and the mitigation measures that would be implemented as described in Chapter 5 (Mitigation) and Appendix K (Geographic Mitigation Assessment), long-term consequences to sea turtle individuals or populations would not be expected.

Pursuant to the ESA, the use of explosives during training activities as described under Alternative 1 may affect the ESA-listed leatherback turtle and leatherback turtle critical habitat. The Navy has consulted with NMFS as required by section 7(a)(2) of the ESA.

Impacts from Explosives Under Alternative 1 During Testing Activities

Leatherback turtles present in the Study Area may be exposed to sound or energy from explosions associated with testing activities throughout the year. Leatherback turtles are highly migratory and lead a pelagic existence, and they tend to prefer foraging in productive offshore waters, such as waters off the coast of Washington and Oregon in the NWTT Offshore Area.

Activities using explosives would be conducted as described in Chapter 2 (Description of Proposed Action and Alternatives) and Appendix A (Navy Activities Descriptions). General characteristics, quantities, and net explosive weights of in-water explosives used during testing activities under Alternative 1 are provided in Section 3.0.3.2 (Explosive Stressors). Quantities and locations of fragment-producing explosives during testing activities under Alternative 1 are shown in Section 3.0.3.4.4 (Military Expended Materials). The number of explosive sources in this Supplemental compared with the totals analyzed in the 2015 NWTT Final EIS/OEIS are described in Table 3.0-7.

Under Alternative 1, the amount of explosions during testing activities would be the same year to year. All testing involving explosives would occur in the Offshore Area, and with the exception of mine countermeasure and neutralization testing (new testing activities in Phase III), explosive testing activities would occur at distances greater than 50 NM from shore. This new activity would occur closer to shore than other activities analyzed in the 2015 NWTT Final EIS/OEIS that involved the use of in-water explosives. This activity would occur greater than 3 NM from shore in the Quinault Range Site, or greater than 12 NM from shore elsewhere in the Offshore Area but would not occur off the coast of California. This activity would occur in water depths shallower than 1,000 ft. (typically 300 ft.). Explosives would not be used in the Olympic Coast National Marine Sanctuary. Section 5.3.3 (Explosive Stressors) outlines the procedural mitigation measures for explosive stressors to reduce potential impacts on biological resources.

The general impacts from explosives during testing would be similar in severity to those described above in Section 3.5.2.2.2.3 (Impacts from Explosives Under Alternative 1 – Impacts from Explosives Under Alternative 1 During Training Activities), however explosives are used less frequently during testing activities than during training activities; therefore, there may be slightly fewer impacts, if any, during testing activities.

The quantitative analysis predicts that no leatherback turtles are likely to be exposed to the levels of explosive sound and energy that could cause TTS, PTS, injury, or mortality during a maximum year of testing activities under Alternative 1 (U.S. Department of the Navy, 2017b). As discussed in Section 5.3.3 (Explosive Stressors), procedural mitigation includes ceasing explosive detonations (e.g., delaying detonation of an explosive sonobuoy) if a sea turtle is observed in the mitigation zone whenever and wherever applicable activities occur. In addition to procedural mitigation, the Navy will implement mitigation to avoid or reduce impacts from explosions on seafloor resources in mitigation areas throughout the Study Area, as described in Appendix K (Geographic Mitigation Assessment). This will further reduce the potential for impacts on sea turtles that shelter and feed on live hard bottom, artificial reefs, and shipwrecks.

Sea turtle hearing is less sensitive than other marine animals (e.g., marine mammals), and the role of their underwater hearing is unclear. Sea turtle's limited hearing range (<2 kHz) is most likely used to detect nearby broadband, continuous environmental sounds, such as the sounds of waves crashing on the beach, that may be important for identifying their habitat. Recovery from a hearing threshold shift begins almost immediately after the noise exposure ceases. A temporary threshold shift is expected to take a few minutes to a few days, depending on the severity of the initial shift, to fully recover. 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 explosives could occur across a sea turtle's very limited hearing range, reducing the distance over which relevant sounds, such as beach sounds, may be detected for the duration of the threshold shift.

Some sea turtles may behaviorally respond to the sound of an explosive. A sea turtle's behavioral response to a single detonation or explosive cluster is expected to be limited to a short-term (seconds to minutes) startle response, as the duration of noise from these events is very brief. Limited research and observations from air gun studies (see Section 3.5.2.2.2.1, Methods for Analyzing Impacts from Explosives) 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 beyond 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.

A physiological stress response is assumed 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 could reduce an individual's fitness.

Designated leatherback turtle critical habitat, which includes the physical and biological features of leatherback turtle critical habitat (i.e., the occurrence of prey species, primarily jellyfish), overlaps with the NWTT Study Area as described in Section 3.5.1.4 (Leatherback Sea Turtle [*Dermochelys coriacea*]). As described above, most, although not all, detonations would occur greater than 50 NM from shore in the NWTT Study Area. Procedural mitigation for jellyfish aggregations during torpedo explosive testing activities would help reduce impacts to leatherback turtle critical habitat in the area where critical habitat and torpedo explosive testing activities may overlap in waters greater than 50 NM from shore. As discussed in the Section 3.8.2.2.1.1 (Impacts from Explosives under Alternative 1) of the Marine Invertebrates section, impacts to pelagic marine invertebrates (e.g., jellyfish) from explosions would be insignificant. Only jellyfish in very close proximity to a blast could be exposed for a brief duration; however, these exposures would not affect the overall prey availability for leatherback turtles. Impacts, if any, to prey species would be minimal, thus explosions would have no discernible impact on the condition, distribution, diversity, and abundance and density of prey species necessary to support individual as well as population growth, reproduction, and development of leatherback turtles in the Study Area.

Considering the above factors and the mitigation measures that would be implemented as described in Chapter 5 (Mitigation) and Appendix K (Geographic Mitigation Assessment), long-term consequences to sea turtle individuals or populations would not be expected.

Pursuant to the ESA, the use of explosives during testing activities as described under Alternative 1 may affect the ESA-listed leatherback turtle and leatherback turtle critical habitat. The Navy has consulted with NMFS as required by section 7(a)(2) of the ESA.

3.5.2.2.2.4 Impacts from Explosives Under Alternative 2

Impacts from Explosives Under Alternative 2 During Training Activities

Leatherback turtles present in the Study Area may be exposed to sound or energy from explosions associated with training activities throughout the year. Leatherback turtles are highly migratory and lead a pelagic existence, and they tend to prefer foraging in productive offshore waters, such as waters off the coast of Washington and Oregon in the NWTT Offshore Area.

As described in Chapter 2 (Description of Proposed Action and Alternatives), Section 3.0.3.2 (Explosive Stressors), and Appendix A (Navy Activities Descriptions), training activities under Alternative 2 reflects the maximum number of testing activities that could occur within a given year. This would result in an increase of explosive use compared to Alternative 1. The locations, types, and severity of predicted impacts would similar to those described above in Section 3.5.2.2.2.3 (Impacts from Explosives Under Alternative 1 - Impacts from Explosives Under Alternative 1 During Training Activities), with additional anti-submarine warfare exercises occurring in offshore locations. The number of explosive sources in this Supplemental compared with the totals analyzed in the 2015 NWTT Final EIS/OEIS are described in Table 3.0-7.

The quantitative analysis predicts no leatherback turtles are likely to be exposed to the levels of explosive sound and energy that could cause TTS, PTS, injury, or mortality during a maximum year of training under Alternative 2.

Considering the above factors and the mitigation measures that would be implemented as described in Chapter 5 (Mitigation) and Appendix K (Geographic Mitigation Assessment), long-term consequences to sea turtle individuals or populations would not be expected.

Pursuant to the ESA, the use of explosives during training activities as described under Alternative 2 may affect the ESA-listed leatherback turtle and leatherback turtle critical habitat.

Impacts from Explosives Under Alternative 2 During Testing Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Section 3.0.3.2 (Explosive Stressors), and Appendix A (Navy Activities Descriptions), testing activities involving the use of explosives is identical under Alternative 1 and Alternative 2; therefore, the locations, types, and severity of predicted impacts would be the same as those described above in Section 3.5.2.2.2.3 (Impacts from Explosives Under Alternative 1 – Impacts from Explosives Under Alternative 1 During Testing Activities). The number of explosive sources in this Supplemental compared with the totals analyzed in the 2015 NWTT Final EIS/OEIS are described in Table 3.0-7.

The quantitative analysis predicts that no leatherback turtles are likely to be exposed to the levels of explosive sound and energy that could cause TTS, PTS, injury, or mortality during a maximum year of training activities under Alternative 2.

Considering the above factors and the mitigation measures that would be implemented as described in Chapter 5 (Mitigation) and Appendix K (Geographic Mitigation Assessment), long-term consequences to sea turtle individuals or populations would not be expected.

Pursuant to the ESA, the use of explosives during testing activities as described under Alternative 2 may affect the ESA-listed leatherback turtle and leatherback turtle critical habitat.

3.5.2.2.2.5 Impacts from Explosives Under the No Action Alternative

Under the No Action Alternative, the Navy would not conduct proposed at-sea training and testing activities in the Study Area. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer explosive stressors within the marine environment where activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would remove the potential for explosive impacts on sea turtles, but would not measurably improve the overall distribution or abundance of sea turtles.

3.5.2.3 Energy Stressors

The energy stressors that may impact sea turtles include in-water electromagnetic devices and lasers. As shown in Table 3.0-9, activities that use in-water devices would only occur within Inland Waters (where sea turtles are not expected to occur); therefore, impacts from in-water devices are not analyzed for sea turtles. Lasers are the only energy stressor that may potentially impact sea turtles. As discussed in Section 3.0.3.3.2.1 (Low-Energy Lasers), analysis has shown that low-energy lasers would not affect animals and therefore do not require further analysis.

High-energy lasers were not covered in the 2015 NWTT Final EIS/OEIS and represent a new activity analyzed in this Supplemental. As discussed in Section 3.0.3.3.2.2 (High-Energy Lasers), high-energy lasers can be divided into high-energy laser weapons and laser-based optical communication systems. Both of these systems would be tested in in the Offshore Area; however, testing of laser-based optical communication systems was discussed in Section 3.0.3.3.2.2 (High-Energy Lasers) and dismissed from further evaluation. The primary concern for high-energy laser weapons systems is the potential for a sea turtle to be struck with the laser beam at or near the water's surface, where extended exposure could result in injury or death. The potential for exposure to a high-energy laser beam decreases as the water depth increases. Because high-energy laser weapons platforms are typically helicopters and ships, sea turtles would likely transit away or submerge in response to other stressors, such as ship or aircraft noise, although some sea turtles may not exhibit a response to an oncoming vessel or aircraft, increasing the risk of contact with the laser beam. The Navy conducted statistical modeling to estimate the probability of a leatherback sea turtle being struck by a high-energy laser during testing activities (high-energy laser weapons are not proposed for training activities) (see Appendix F, Military Expended Material and Direct Strike Impact Analyses). As a basis for modeling the probability of high-energy laser strike, the Navy used estimates for loggerhead sea turtles (U.S. Department of the Navy, 2018). The modeling resulted in no estimated exposures to a high-energy laser strike (see Appendix F, Military Expended Material and Direct Strike Impact Analyses, Table F-4). Based on the modeling results and other factors that would decrease likelihood of exposure, there is a reasonable assumption that no strike of sea turtles would occur.

3.5.2.3.1 Impacts from In-Water Electromagnetic Devices

As shown in Table 3.0-9, activities that use in-water devices would only occur within Inland Waters (where sea turtles are not expected to occur); therefore, impacts from in-water devices are not analyzed for sea turtles.

3.5.2.3.2 Impacts from High-Energy Lasers

This section provides the modeling results to estimate potential exposures to sea turtles from testing activities that use high-energy laser weapons on sea turtles in the Offshore Area.

3.5.2.3.2.1 Impacts from High-Energy Lasers Under Alternative 1

Impacts from High-Energy Lasers Under Alternative 1 for Training Activities

High-energy laser weapons would not be used during training activities under Alternative 1, so there would be no impacts.

Impacts from High-Energy Lasers Under Alternative 1 for Testing Activities

As discussed in Section 3.0.3.3.2.2 (High-Energy Lasers) and shown in Table 3.0-10, under Alternative 1 there would be up to 55 testing activities per year involving the use of high-energy laser weapons. One of those 55 activities is a test of a laser-based optical communication system, which was discussed in Section 3.0.3.3.2.2 and dismissed from further evaluation. The remaining 54 annual testing activities would involve the use of high-energy laser weapons in the Offshore portion of the Study Area. As stated previously, high-energy laser weapons proposed under Alternative 1 testing activities would have no impact on leatherback sea turtles. This conclusion is based on modeling results in Appendix F (Military Expended Material and Direct Strike Impact Analyses, see Table F-4), which estimate no exposures to sea turtles over the course of each year of testing activities, as well as the location of where laser-based optical communication system testing would occur (Inland Waters where no sea turtles are anticipated to occur).

The single PCE identified for designated critical habitat for the Pacific leatherback sea turtle (the occurrence of prey species, primarily scyphomedusae of the order Semaeostomeae of sufficient condition, distribution, diversity, abundance, and density necessary to support individual as well as population growth, reproduction, and development) would not be impacted. Therefore, there would be no impacts on designated critical habitat for the leatherback sea turtle.

Pursuant to the ESA, the use of high-energy laser weapons during testing activities as described under Alternative 1 would have no effect on leatherback sea turtles and would have no effect on designated critical habitat for the leatherback sea turtle.

3.5.2.3.2.2 Impacts from High-Energy Lasers under Alternative 2

Impacts from High-Energy Lasers Under Alternative 2 for Training Activities

No high-energy laser weapons are proposed for training activities under Alternative 2.

Impacts from High-Energy Lasers Under Alternative 2 for Testing Activities

As shown in Table 3.0-10, a total 54 testing activities involving the use of high-energy laser weapons are proposed to be conducted in the Offshore Area under Alternative 2, the same as under Alternative 1. As stated previously, high-energy laser weapons proposed under Alternative 1 testing activities would have no impact on leatherback sea turtles. This conclusion is based on modeling results in Appendix F (Military Expended Material and Direct Strike Impact Analyses, see Table F-4), which estimate no exposures to sea turtles over the course of each year of testing activities, Inland Waters where no sea turtles are anticipated to occur).

Because of the unlikely exposure of sea turtle prey items to high-energy laser weapons, the single PCE identified for designated critical habitat for the Pacific leatherback sea turtle (the occurrence of prey species, primarily scyphomedusae of the order Semaeostomeae of sufficient condition, distribution, diversity, abundance, and density necessary to support individual as well as population growth, reproduction, and development) would not be impacted.

Pursuant to the ESA, the use of high-energy laser weapons during testing activities as described under Alternative 2 would have no effect on leatherback sea turtles and would have no effect on designated critical habitat for the leatherback sea turtle.

3.5.2.3.2.3 Impacts from High-Energy Lasers Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Energy stressors, as listed above, would not be introduced into the marine environment. Therefore, existing environmental conditions would remain unchanged after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer energy stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from energy stressors on individual leatherback sea turtles, but would not measurably improve the status of leatherback sea turtle populations or subpopulations. Similarly, there would not be any measurable change in the PCEs under the No Action Alternative for leatherback critical habitat.

3.5.2.4 Physical Disturbance and Strike Stressors

The physical disturbance and strike stressors that may impact sea turtles include (1) vessels and in-water devices, (2) military expended materials, and (3) seafloor devices. The annual number of activities including vessels and in-water devices, the annual number of military expended materials, and the annual number of activities including seafloor devices are shown in Tables 3.0-12 through 3.0-18. Section 5.3.4 (Physical Disturbance and Strike Stressors) in Chapter 5 (Mitigation) and Section 2.3.3 (Standard Operating Procedures) describe the measures included as part of the proposed action that are part of mitigation measures and standard operating procedures to reduce or avoid potential impacts on sea turtles from physical disturbance and strike stressors.

3.5.2.4.1 Impacts from Vessels and In-Water Devices

Since the release of the 2015 NWTT Final EIS/OEIS, updated information is available regarding vessel traffic in and around major port facilities within the NWTT Study Area. Data from the ports of Vancouver, Seattle, and Tacoma indicated there were in excess of 7,000 commercial vessel transits in 2017 associated with visits to just those ports (The Northwest Seaport Alliance, 2018; Vancouver Fraser Port Authority, 2017). This number of vessel transits does not account for other vessel traffic in the Strait of Juan de Fuca or Puget Sound resulting from commercial ferries, tourist vessels, or recreational vessels. Additional commercial traffic in the NWTT Study Area also includes vessels transiting offshore along the Pacific coast, bypassing ports in Canada and Washington, traffic associated with ports to the south along the coast of Washington and in Oregon, and in addition to vessel traffic in Southeast Alaska. This level of commercial vessel traffic for the ports of Vancouver, Seattle, and Tacoma is approximately the same as was presented in the 2015 NWTT Final EIS/OEIS.

In the NWTT Study Area, the existing marine environment is dominated by non-Navy vessel traffic given the Navy has in total, the following homeported operational vessels: 2 aircraft carriers, 7 destroyers, 14 submarines, and 22 smaller security vessels. Appendix A (Navy Activities Descriptions) describes the number of vessels used during the various types of Navy's proposed activities. Activities involving Navy vessel movement would be widely dispersed throughout the Study Area.

3.5.2.4.1.1 Impacts from Vessels and In-Water Devices Under Alternative 1

<u>Impacts from Vessels and In-Water Devices Under Alternative 1 for Training Activities</u>

Under Alternative 1, the combined number of proposed training activities in the Offshore Area involving the movement of vessels and the use of in-water devices would increase (Table 3.0-12 and Table 3.0-13) compared to those proposed in the 2015 NWTT Final EIS/OEIS. Vessel movement would decrease slightly in the Offshore Area (from 1,156 to 1,144 annual activities). The activities would occur in the same locations and in a similar manner as were analyzed previously. There is an overall increase in the use of in-water devices (Table 3.0-13), all of which are associated with small, slow-moving unmanned underwater vehicles. Because the increases are to activities in which the in-water devices are small and slow moving, the impacts on leatherback sea turtles would be similar. The proposed increase of approximately 100 in-water devices would not change that conclusion.

Exposure to vessels and in-water devices used in training and testing activities may cause short-term disturbance to an individual turtle because if a turtle were struck, it could lead to injury or death. As demonstrated by scars on all species of sea turtles, they are not always able to avoid being struck; therefore, vessel strikes are a potential cause of mortality for these species. Although the likelihood of being struck is minimal, sea turtles that overlap with Navy exercises are more likely to encounter vessels. Exposure to vessels may change an individual's behavior, growth, survival, annual reproductive success, or lifetime reproductive success (fitness). Exposure to vessels is not expected to result in population-level impacts.

Vessel movements and in-water device use would occur under Alternative 1 within designated critical habitat for the leatherback sea turtle. The single PCE essential for the conservation of leatherbacks in the marine waters of the U.S. west coast is the occurrence of prey species in sufficient numbers and quality to sustain leatherback foraging activities. While some of the leatherback sea turtle's preferred prey may be impacted by vessels during training activities, effects are expected to be minor and temporary with no overall impacts on prey availability, and would have no impact to the overall prey density in designated leatherback sea turtle critical habitat. Therefore, there would be no measurable impacts on critical habitat resulting from vessel or in-water device use in the Study Area.

The analysis in Section 3.5.3.3 (Physical Disturbance and Strike Stressors) in the 2015 NWTT Final EIS/OEIS concluded that the physical disturbance or strike from a military vessel, in-water device, military expended material, or seafloor device is unlikely. There are no records of any military vessel strikes to sea turtles in the Study Area during training or testing activities. In areas outside the Study Area (e.g., Hawaii and Southern California), there have been recorded military vessel strikes of sea turtles. However, these are areas where the number of military vessels is much higher and training and testing activities occur more often than in the Study Area.

As stated in the 2015 NWTT Final EIS/OEIS, the impact of vessels and in-water devices on leatherback sea turtles would remain inconsequential due to (1) the wide dispersal of large vessels in open ocean areas and the widespread locations of where activities that use in-water devices would occur, (2) the low realistic potential of certain in-water devices to strike living marine resources because they either move slowly through the water column (e.g., most UUVs) or are closely monitored by observers manning the towing platform, and (3) the scattered distribution of turtles at sea.

Because of the unlikely exposure of sea turtle prey items to vessel transits and in-water device use, the single PCE identified for designated critical habitat for the Pacific leatherback sea turtle (the occurrence of prey species, primarily scyphomedusae of the order Semaeostomeae of sufficient condition, distribution, diversity, abundance, and density necessary to support individual as well as population growth, reproduction, and development) would not be impacted.

In 2015, NMFS provided the Navy with a biological opinion on proposed training and testing activities included in the 2015 NWTT Final EIS/OEIS. The NMFS's biological opinion concluded that no takes would likely occur from physical disturbance and strike stressors. The activities described under Alternative 1 in this Supplemental would not be sufficient to modify the physical disturbance and strike conclusions provided in NMFS's 2015 Biological Opinion.

Pursuant to the ESA, the use of vessels and in-water devices during training activities under Alternative 1 may affect the ESA-listed leatherback sea turtle. The Navy has consulted with NMFS as required by section 7(a)(2) of the ESA on physical disturbance and strike stressors. These activities would have no effect on designated critical habitat.

Impacts from Vessels and In-Water Devices Under Alternative 1 for Testing Activities

Under Alternative 1, the combined number of proposed testing activities in the Offshore Area involving the movement of vessels and the use of in-water devices (Table 3.0-12 and Table 3.0-13) would increase compared to those proposed in the 2015 NWTT Final EIS/OEIS. Vessel movement would increase in the Offshore Area (from 181 to 283 annual activities).

There is also an overall increase in the use of in-water devices during testing activities (Table 3.0-13), all of which are associated with small, slow-moving unmanned underwater vehicles. The proposed increase of in-water devices would not change the conclusion presented in the 2015 NWTT Final EIS/OEIS. The activities would occur in the same locations and in a similar manner as were analyzed previously.

In spite of these increases in the Offshore portion of the Study Area, and as described in the 2015 NWTT Final EIS/OEIS, these vessel and in-water device activities remain unlikely to result in a strike to any leatherback sea turtles. The proposed increase of vessel and in-water device activities would not change that conclusion. As stated in the 2015 NWTT Final EIS/OEIS, the impact of vessels and in-water devices on leatherback sea turtles would be inconsequential due to (1) the wide dispersal of large vessels in open ocean areas and the widespread locations of where activities that use in-water devices would occur, (2) the low realistic potential of certain in-water devices to strike living marine resources because they either move slowly through the water column (e.g., most UUVs) or are closely monitored by observers manning the towing platform, and (3) the scattered distribution of turtles at sea.

Because of the unlikely exposure of sea turtle prey items to vessel transits and in-water device use, the single PCE identified for designated critical habitat for the Pacific leatherback sea turtle (the occurrence of prey species, primarily scyphomedusae of the order Semaeostomeae of sufficient condition, distribution, diversity, abundance, and density necessary to support individual as well as population growth, reproduction, and development) would not be impacted.

Pursuant to the ESA, the use of vessels and in-water devices during testing activities under Alternative 1 may affect the ESA-listed leatherback sea turtle. The Navy has consulted with NMFS, as required by section 7(a)(2) of the ESA, on the use of vessels and in-water devices. These activities would have no effect on leatherback critical habitat.

3.5.2.4.1.2 Impacts from Vessels and In-Water Devices Under Alternative 2

Impacts from Vessels and In-Water Devices Under Alternative 2 for Training Activities

Under Alternative 2, the combined number of proposed training activities involving the movement of vessels and the use of in-water devices would be slightly greater than Alternative 1 (Table 3.0-12 and Table 3.0-13) and greater than those proposed in the 2015 NWTT Final EIS/OEIS. Vessel movement would increase in the Offshore Area compared to Alternative 1 (1,144 for Alternative 1 compared to 1,249 for Alternative 2), and increases (1,156 to 1,249) compared to levels presented in the 2015 NWTT Final EIS/OEIS (Table 3.0-12). There would also be a slight total increase in the use of in-water devices compared to Alternative 1 (541 for Alternative 1 compared to 547) and an increase from levels presented in the 2015 NWTT Final EIS/OEIS (495 to 547) (Table 3.0-13).

All of the increased in-water device activities are associated with small, slow-moving unmanned underwater vehicles. Because the increases are to activities in which the in-water devices are unlikely to have an impact to leatherback sea turtles (small, slow-moving in-water devices), the impacts to leatherback sea turtles would be similar. The proposed increase to in-water devices would not change that conclusion. The activities would occur in the same locations and in a similar manner as were analyzed previously. As stated in the 2015 NWTT Final EIS/OEIS, the impact of vessels and in-water devices on leatherback sea turtles would remain inconsequential due to(1) the wide dispersal of large vessels in open ocean areas and the widespread locations of where activities that use in-water devices would occur, (2) the low realistic potential of certain in-water devices to strike living marine resources because they either move slowly through the water column (e.g., most UUVs) or are closely monitored by observers manning the towing platform, and (3) the scattered distribution of turtles at sea. As stated above under Alternative 1, NMFS's biological opinion on proposed training and testing activities included in the 2015 NWTT Final EIS/OEIS concluded that no takes of leatherback sea turtle would likely occur from physical disturbance and strike stressors, and no adverse effects on designated critical habitat would occur. The activities described under Alternative 2 in this Supplemental would not be sufficient to modify the physical disturbance and strike conclusions provided in NMFS's 2014 Biological Opinion.

Pursuant to the ESA, the use of vessels and in-water devices during training activities under Alternative 2 may affect the ESA-listed leatherback sea turtle and would have no effect on designated critical habitat.

Impacts from Vessels and In-Water Devices Under Alternative 2 for Testing Activities

Under Alternative 2, the number of proposed testing activities in the Offshore Area involving the combined movement of vessels and the use of in-water devices would increase compared to Alternative 1 and those proposed in the 2015 NWTT Final EIS/OEIS (Table 3.0-12 and Table 3.0-13). Vessel movement would increase in the Offshore Area compared to Alternative 1 (from 181 to 295) and would increase compared to numbers presented in the 2015 NWTT Final EIS/OEIS (from 181 to 295 annual activities).

There would also be an increase in the use of in-water devices compared to Alternative 1 (215 for Alternative 1 compared to 224) and an increase from levels presented in the 2015 NWTT Final EIS/OEIS (156 to 224) (Table 3.0-13).

The activities would occur in the same locations and in a similar manner as were analyzed previously. In spite of these increases, and as described in the 2015 NWTT Final EIS/OEIS, these vessel and in-water device activities remain unlikely to result in a strike to any leatherback sea turtles. The proposed increase of vessel and in-water device activities would not change that conclusion. As stated in the 2015 NWTT Final EIS/OEIS, the impact of vessels and in-water devices on leatherback sea turtles would remain inconsequential due to (1) the wide dispersal of large vessels in open ocean areas and the widespread locations of where activities that use in-water devices would occur, (2) the low realistic potential of certain in-water devices to strike living marine resources because they either move slowly through the water column (e.g., most UUVs) or are closely monitored by observers manning the towing platform, and (3) scattered distribution of turtles at sea.

Pursuant to the ESA, the use of vessels and in-water devices during testing activities under Alternative 2 may affect the ESA-listed leatherback sea turtle and would have no effect on designated critical habitat.

3.5.2.4.1.3 Impacts from Vessels and In-Water Devices Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Physical disturbance and strike stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer physical disturbance and strike stressors within the marine environment where Navy training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen potential impacts from vessels and in-water devices on individual leatherback sea turtles but would not measurably improve the status of leatherback sea turtle populations. Similarly, there would not be any measurable change in the PCEs under the No Action Alternative for leatherback critical habitat.

3.5.2.4.2 Impacts from Military Expended Materials

For the analysis of impacts from military expended material as physical disturbance stressors, see Section 3.5.3.3.3 (Impacts from Military Expended Materials) in the 2015 NWTT Final EIS/OEIS, and the NMFS Biological Opinion for the 2015 NWTT Final EIS/OEIS (National Marine Fisheries Service, 2015; National Oceanic and Atmospheric Administration, 2015a). Since the 2015 NWTT Final EIS/OEIS, there has been no new or emergent science that would change in any way the rationale for the dismissal of impacts from military expended material as presented in the 2015 analyses. There have been no known instances of physical disturbance or strike to any sea turtles as a result of training and testing activities involving the use of military expended materials prior to or since the 2015 NWTT Final EIS/OEIS.

3.5.2.4.2.1 Impacts from Military Expended Materials Under Alternative 1

Impacts from Military Expended Materials Under Alternative 1 for Training Activities

Under Alternative 1 and as presented in Section 3.0 (Introduction), the use of military expended materials during training activities would decrease in comparison to the 2015 NWTT Final EIS/OEIS (Tables 3.0-14 through 3.0-17). When the amount of military expended materials (Tables 3.0-14 through 3.0-17) is combined, the number of items proposed to be expended in the Offshore Area under Alternative 1 decreases compared to ongoing activities. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. While the number military expended materials used during training activities would change under this Supplemental, the analysis presented in the 2015 NWTT Final EIS/OEIS and the NMFS Biological Opinion for the 2015 NWTT Final EIS/OEIS (National Marine Fisheries Service, 2015; National Oceanic and Atmospheric Administration, 2015a) remains valid; physical disturbance and strike impacts on sea turtles resulting from military expended materials are not anticipated.

Pursuant to the ESA, the use of military expended materials during training activities under Alternative 1 may affect the ESA-listed leatherback sea turtle. The Navy has consulted with NMFS as required by section 7(a)(2) of the ESA on the use of military expended materials. These activities would have no effect on designated critical habitat.

Impacts from Military Expended Materials Under Alternative 1 for Testing Activities

Under Alternative 1 and as presented in Section 3.0 (Introduction), the use of military expended materials during testing activities in the Offshore Area would increase in comparison to the 2015 NWTT Final EIS/OEIS (Tables 3.0-14 through 3.0-17). While the number of military expended materials used during testing activities would change under this Supplemental, the analysis presented in the 2015 NWTT Final EIS/OEIS and the NMFS Biological Opinion for the 2015 NWTT Final EIS/OEIS (National Marine Fisheries Service, 2015; National Oceanic and Atmospheric Administration, 2015a) remains valid; physical disturbance and strike impacts sea turtles resulting from military expended materials are not expected.

Pursuant to the ESA, the use of military expended materials during testing activities under Alternative 1 may affect the ESA-listed leatherback sea turtle. The Navy has consulted with NMFS as required by section 7(a)(2) of the ESA on the use of military expended materials. These activities would have no effect on designated critical habitat.

3.5.2.4.2.2 Impacts from Military Expended Materials Under Alternative 2

Impacts from Military Expended Materials Under Alternative 2 for Training Activities

Under Alternative 2, the number of military materials that would be expended during training activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from Tables 3.0-14 through 3.0-17 are combined, the number of items proposed to be expended under Alternative 2 increase compared to both Alternative 1 and ongoing activities. While the number of military expended materials used during training activities in the Offshore Area would change under this Supplemental, the analysis presented in the 2015 NWTT Final

EIS/OEIS and the NMFS Biological Opinion for the 2015 NWTT Final EIS/OEIS (National Marine Fisheries Service, 2015; National Oceanic and Atmospheric Administration, 2015a) remains valid; physical disturbance and strike impacts sea turtles resulting from military expended materials are not expected.

Pursuant to the ESA, the use of military expended materials during training activities under Alternative 2 may affect the ESA-listed leatherback sea turtle and would have no effect on designated critical habitat.

Impacts from Military Expended Materials Under Alternative 2 for Testing Activities

Under Alternative 2, when the amount of military expended materials from Tables 3.0-14 through 3.0-17 are combined, the number of items proposed to be expended would increase compared to Alternative 1 and ongoing activities. While the number of military expended materials used during testing activities in the Offshore Area would change under this Supplemental, the analysis presented in the 2015 NWTT Final EIS/OEIS and the NMFS Biological Opinion for the 2015 NWTT Final EIS/OEIS (National Marine Fisheries Service, 2015c; National Oceanic and Atmospheric Administration, 2015a) remains valid; physical disturbance and strike impacts on sea turtles resulting from military expended materials are not expected.

Pursuant to the ESA, the use of military expended materials during testing activities under Alternative 2 may affect the ESA-listed leatherback sea turtle and would have no effect on designated critical habitat.

3.5.2.4.2.3 Impacts from Military Expended Materials Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Physical disturbance and strike stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer physical disturbance and strike stressors within the marine environment where Navy training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would remove the potential for impacts from military expended material on individual leatherback sea turtles, but would not measurably improve the status of leatherback sea turtle populations.

3.5.2.4.3 Impacts from Seafloor Devices

For the analysis of impacts from military expended material as physical disturbance stressors, see Section 3.5.3.3.4 (Impacts from Seafloor Devices) in the 2015 NWTT Final EIS/OEIS, and the NMFS Biological Opinion for the 2015 NWTT Final EIS/OEIS (National Marine Fisheries Service, 2015; National Oceanic and Atmospheric Administration, 2015a). The only seafloor devices proposed for use in the Offshore Area are mine shapes and anchors. Since the 2015 NWTT Final EIS/OEIS, there has been no new or emergent science that would change in any way the rationale for the dismissal of impacts from seafloor devices as presented in the 2015 analyses. There have been no known instances of physical disturbance or strike to any sea turtles as a result of training and testing activities involving the use of seafloor devices prior to or since the 2015 NWTT Final EIS/OEIS.

3.5.2.4.3.1 Impacts from Seafloor Devices Under Alternative 1

Impacts from Seafloor Devices Under Alternative 1 for Training Activities

There are no Offshore Area training activities under any Alternative in which seafloor devices would be used. Therefore, there are no impacts on sea turtles that may be present in the Study Area from training activities.

Impacts from Seafloor Devices Under Alternative 1 for Testing Activities

Under Alternative 1 and as presented in Section 3.0 (Introduction), testing activities in the Offshore Area using seafloor devices would decrease in comparison to the 2015 NWTT Final EIS/OEIS (Tables 3.0-18). While the number of testing activities using seafloor devices would change under this Supplemental, the analysis presented in the 2015 NWTT Final EIS/OEIS and the NMFS Biological Opinion for the 2015 NWTT Final EIS/OEIS (National Marine Fisheries Service, 2015; National Oceanic and Atmospheric Administration, 2015a) remains valid; physical disturbance and strike impacts on sea turtles resulting from seafloor devices are not expected.

Pursuant to the ESA, the use of seafloor devices during testing activities under Alternative 1 may affect the ESA-listed leatherback sea turtle. The Navy has consulted with NMFS as required by section 7(a)(2) of the ESA on seafloor devices. These activities would have no effect on designated critical habitat.

3.5.2.4.3.2 Impacts from Seafloor Devices Under Alternative 2

Impacts from Seafloor Devices Under Alternative 2 for Training Activities

There are no Offshore Area training activities under any Alternative in which seafloor devices would be used. Therefore, there are no impacts on sea turtles that may be present in the Study Area from training activities.

Impacts from Seafloor Devices Under Alternative 2 for Testing Activities

Under Alternative 2, the total number of testing activities that include the use of seafloor devices in the Offshore Area would decrease compared to what was analyzed in the 2015 NWTT Final EIS/OEIS and the NMFS Biological Opinion for the 2015 NWTT Final EIS/OEIS (National Marine Fisheries Service, 2015; National Oceanic and Atmospheric Administration, 2015a), and increase slightly as compared to Alternative 1. While the number of testing activities using seafloor devices would change under this Supplemental, the analysis presented in the 2015 NWTT Final EIS/OEIS, and the NMFS Biological Opinion for the 2015 NWTT Final EIS/OEIS (National Marine Fisheries Service, 2015; National Oceanic and Atmospheric Administration, 2015a) remains valid; physical disturbance and strike impacts to sea turtles resulting from seafloor devices are not expected.

Pursuant to the ESA, the use of seafloor devices during testing activities under Alternative 2 may affect the ESA-listed leatherback sea turtle and would have no effect on designated critical habitat.

3.5.2.4.3.3 Impacts from Seafloor Devices Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Physical disturbance and strike stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer physical disturbance and strike stressors within the marine environment where Navy training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would remove the potential for impacts from seafloor devices on individual leatherback sea turtles but would not measurably improve the status of leatherback sea turtle populations.

3.5.2.5 Entanglement Stressors

The entanglement stressors that may impact leatherback sea turtles include (1) wires and cables and (2) decelerators/parachutes. Since the publication of the 2015 NWTT Final EIS/OEIS, the Navy has developed systems for testing disruption and stopping of target ship propulsion systems.

Biodegradable polymer is a new stressor not previously analyzed in other resources sections of this Supplemental, but would only be used in the Inland Waters portion of the Study Area. Because leatherback sea turtles do not occur in inland waters, leatherback sea turtles would not be at risk of entanglement by biodegradable polymers and are therefore not discussed further as a potential stressor for sea turtles.

For the analysis of wires and cables and decelerators/parachutes as entanglement stressors, see Section 3.5.3.4 (Entanglement Stressors) in the 2015 NWTT Final EIS/OEIS and the NMFS Biological Opinion for the 2015 NWTT Final EIS/OEIS (National Marine Fisheries Service, 2015; National Oceanic and Atmospheric Administration, 2015a).

3.5.2.5.1 Impacts from Wires and Cables

Wires and cables include fiber optic cables, guidance wires, and sonobuoy wires, as detailed in Table 3.0-19 in this Supplemental and the 2015 NWTT Final EIS/OEIS. Since the 2015 NWTT Final EIS/OEIS, there has been no new or emergent science that would change in any way the rationale for the dismissal of wires and cables as presented in the 2015 analyses. There have been no known instances of entanglement of any marine mammals as a result of training and testing activities involving the use of wires and cables associated with Navy training and testing activities prior to or since the 2015 NWTT Final EIS/OEIS. Wires and cables are generally not expected to cause disturbance to sea turtles because of: (1) the number of wires and cables expended being relatively low in the Offshore Area (as shown in Table 3.0-19), decreasing the likelihood of encounter; (2) the physical characteristics of wires and cables; and (3) the behavior of the species, as sea turtles are unlikely to become entangled in an object that is resting on the seafloor. Exposure to wires and cables is not expected to result in population-level impacts for leatherback sea turtles. Activities involving fiber optic cables and guidance wires are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of prey species at the population level.

3.5.2.5.1.1 Impacts from Wires and Cables Under Alternative 1

<u>Impacts from Wires and Cables Under Alternative 1 for Training Activities</u>

Under Alternative 1 and as presented in Section 3.0 (Introduction), the use of wires and cables during training activities in the Offshore Area would increase in comparison to the 2015 NWTT Final EIS/OEIS (Table 3.0-19). While the number of wires and cables used during training activities would change under this Supplemental, the analysis presented in the 2015 NWTT Final EIS/OEIS and the NMFS Biological Opinion for the 2015 NWTT Final EIS/OEIS (National Marine Fisheries Service, 2015; National Oceanic and Atmospheric Administration, 2015a) remains valid; entanglement impacts to sea turtles resulting from wires and cables are not expected.

Pursuant to the ESA, the use of wires and cables during training activities under Alternative 1 may affect the ESA-listed leatherback sea turtle. The Navy has consulted with NMFS as required by section 7(a)(2) of the ESA on the use of wires and cables. These activities would have no effect on designated critical habitat.

Impacts from Wires and Cables Under Alternative 1 for Testing Activities

Testing activities under Alternative 1 that expend wires and cables would generally occur in a similar manner in the same locations, and in numbers that are not a significant change from the analyses presented in 2015. As a result, the impacts on sea turtles would be expected to be the same given the previous conclusions were not tied to the number of activities occurring. Exposure to wires and cables used in testing activities may cause short-term or long-term disturbance to an individual turtle because if a sea turtle were to become entangled in a wire or cable, it could free itself or it could lead to injury or death. Exposure to wires or cables may change an individual's behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment. However, wires and cables are generally not expected to cause disturbance to sea turtles because of: (1) the number of wires and cables expended being relatively low in the Offshore Area (as shown in Table 3.0-19), decreasing the likelihood of encounter; (2) the physical characteristics of wires and cables; and (3) the behavior of the species, as sea turtles are unlikely to become entangled in an object that is resting on the seafloor. Exposure to wires and cables is not expected to result in population-level impacts for leatherback sea turtles. Activities involving fiber optic cables and guidance wires are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of prey species at the population level.

Pursuant to the ESA, the use of wires and cables during testing activities under Alternative 1 may affect the ESA-listed leatherback sea turtle. The Navy has consulted with NMFS as required by section 7(a)(2) of the ESA on the use of wires and cables. These activities would have no effect on designated critical habitat.

3.5.2.5.1.2 Impacts from Wires and Cables Under Alternative 2

Impacts from Wires and Cables Under Alternative 2 for Training Activities

Under Alternative 2, the number of wires and cables that would be expended during training activities in the Offshore Area would increase compared to what was analyzed in the 2015 NWTT Final EIS/OEIS (Table 3.0-19). As with the 2015 NWTT Final EIS/OEIS and under Alternative 1, no fiber optic cables are proposed under Alternative 2 training activities. Two guidance wires are proposed to be expended in the Offshore Area under Alternative 2, none were proposed in the previous analysis. As shown in Table 3.0-19, the expenditure of sonobuoy wires in the Offshore Area is proposed to increase slightly (by 40 sonobuoy wires). Because the number and locations of these wires and cables is similar to those analyzed in the 2015 NWTT Final EIS/OEIS, the impacts to leatherback sea turtles would be expected to be the same as analyzed under Alternative 1.

Pursuant to the ESA, the use of wires and cables during training activities under Alternative 2 may affect the ESA-listed leatherback sea turtle and would have no effect on designated critical habitat.

Impacts from Wires and Cables Under Alternative 2 for Testing Activities

Under Alternative 2, the number of expended wires and cables expended in the Offshore Area would increase compared to what was analyzed in the 2015 NWTT Final EIS/OEIS (16 additional fiber optic cables, 60 additional guidance wires, and 5,207 additional sonobuoy wires). Compared to Alternative 1, Alternative 2 testing activities would expend an additional 40 guidance wires and an additional 2,206 sonobuoy wires. Testing activities under Alternative 2 that expend wires and cables would generally occur in a similar manner in the same locations, and in numbers that are not a significant change from the analyses presented in 2015. As a result, the impacts on sea turtles would be expected to be the same given the previous conclusions were not tied to the number of expended wires and cables. Exposure to wires and cables used in testing activities may cause short-term or long-term disturbance to an individual turtle because if a sea turtle were to become entangled in a wire or cable, it could free itself or it could lead to injury or death. Exposure to wires or cables may change an individual's behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness), or species recruitment. However, wires and cables are generally not expected to cause disturbance to sea turtles because of: (1) the number of wires and cables expended being relatively low in the Offshore Area (as shown in Table 3.0-19), decreasing the likelihood of encounter; (2) the physical characteristics of wires and cables; and (3) the behavior of the species, as sea turtles are unlikely to become entangled in an object that is resting on the seafloor. Exposure to wires and cables is not expected to result in population-level impacts for leatherback sea turtles. Activities involving fiber optic cables and guidance wires are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of prey species at the population level.

Pursuant to the ESA, the use of wires and cables during testing activities under Alternative 2 may affect the ESA-listed leatherback sea turtle and would have no effect on designated critical habitat.

3.5.2.5.1.3 Impacts from Wires and Cables Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Entanglement stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer entanglement stressors within the marine environment where Navy training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would remove the potential for impacts from wires and cables on individual leatherback sea turtles, but would not measurably improve the status of leatherback sea turtle populations. Similarly, there would not be any measurable change in the PCEs under the No Action Alternative for leatherback critical habitat.

3.5.2.5.2 Impacts from Decelerators/Parachutes

Decelerators/parachutes include small, medium, large, and extra-large decelerator parachutes (Table 3.0-20).

3.5.2.5.2.1 Impacts from Decelerators/Parachutes Under Alternative 1

Impacts from Decelerators/Parachutes Under Alternative 1 for Training Activities

Under Alternative 1, the number of decelerators/parachutes that would be expended during training activities in the Offshore Area is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. As shown in Table 3.0-20, the expenditure of all size decelerators/parachutes in the Offshore Area is proposed to increase slightly. The activities that expend decelerators/parachutes would generally occur in the same locations and in a similar manner as were analyzed previously. Because the number and locations of these decelerators/parachutes is similar to those analyzed in the 2015 NWTT Final EIS/OEIS, the impacts to leatherback sea turtles would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS, the impact of decelerators/parachutes on leatherback sea turtles would be inconsequential because of (1) the low densities of leatherback sea turtles present in the Offshore Area, (2) the unlikely event of a sea turtle being at the exact point where the decelerator/parachute lands, and (3) the negative buoyancy of decelerator/parachute constituents (reducing the probability of contact with sea turtles near the surface). Exposure to decelerators and parachutes is not expected to result in population-level impacts for leatherback sea turtles. Activities involving decelerators and parachutes are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of prey species at the population level.

Pursuant to the ESA, the use of decelerators/parachutes during training activities under Alternative 1 may affect the ESA-listed leatherback sea turtle. The Navy has consulted with NMFS as required by section 7(a)(2) of the ESA on the use of decelerators/parachutes. These activities would have no effect on designated critical habitat.

Impacts from Decelerators/Parachutes Under Alternative 1 for Testing Activities

Under Alternative 1, the number of decelerators/parachutes that would be expended during testing activities in the Offshore Area is increased compared to the number proposed for use in the 2015 NWTT Final EIS/OEIS. As shown in Table 3.0-20, the expenditure of small decelerators/parachutes is proposed to increase from 1,068 to 1,711. The activities that expend decelerators/parachutes would generally occur in the same locations and in a similar manner as were analyzed previously. Despite the increase in the number of decelerators/parachutes under Alternative 1 testing activities, entanglement of leatherback sea turtles is unlikely because of (1) the low densities of leatherback sea turtles present in the Offshore Area, (2) the unlikely event of a sea turtle being at the exact point where the decelerator/parachute lands, and (3) the negative buoyancy of decelerator/parachute constituents (reducing the probability of contact with sea turtles near the surface). Exposure to decelerators and parachutes is not expected to result in population-level impacts for leatherback sea turtles. Activities involving decelerators and parachutes are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of prey species at the population level.

Pursuant to the ESA, the use of decelerators/parachutes during testing activities under Alternative 1 may affect the ESA-listed leatherback sea turtle. The Navy has consulted with NMFS as required by section 7(a)(2) of the ES on the use of decelerators/parachutes. These activities would have no effect on designated critical habitat.

3.5.2.5.2.2 Impacts from Decelerators/Parachutes Under Alternative 2

Impacts from Decelerators/Parachutes Under Alternative 2 for Training Activities

Under Alternative 2, the number of decelerators/parachutes that would be expended during training activities in the Offshore Area is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. As shown in Table 3.0-20, the expenditure of all size decelerators/parachutes in the Offshore Area is proposed to increase slightly (increase of 466 small decelerators and parachutes, with no increases in the number of medium-size decelerators/parachutes or large parachutes). Compared to Alternative 1, Alternative 2 training activities would expend in the Offshore Area 40 additional small decelerators/parachutes, 20 additional medium decelerators/parachutes, and 47 additional large parachutes. The activities that expend decelerators/parachutes would generally occur in the same locations and in a similar manner as were analyzed previously. Because the number and locations of these decelerators/parachutes is similar to those analyzed in the 2015 NWTT Final EIS/OEIS, the impacts to leatherback sea turtles would be expected to be the same as those analyzed above under Alternative 1 training activities.

Pursuant to the ESA, the use of decelerators/parachutes during training activities under Alternative 2 may affect the ESA-listed leatherback sea turtle and would have no effect on designated critical habitat.

Impacts from Decelerators/Parachutes Under Alternative 2 for Testing Activities

Under Alternative 2, the number of decelerators/parachutes that would be expended during testing activities in the Offshore Area would increase (see Table 3.0-20) compared to the number proposed for use in the 2015 NWTT Final EIS/OEIS. Compared to Alternative 1, Alternative 2 testing activities would expend in the Offshore Area the same number of small decelerators/parachutes, with no medium-size decelerators/parachutes or large parachutes expended. The activities that expend decelerators/parachutes would generally occur in the same locations and in a similar manner as were analyzed previously. Because the number and locations of these decelerators/parachutes is similar to those analyzed in the 2015 NWTT Final EIS/OEIS, the impacts to leatherback sea turtles would be expected to be the same as those analyzed above under Alternative 1 testing activities.

Pursuant to the ESA, the use of decelerators/parachutes during testing activities under Alternative 2 may affect the ESA-listed leatherback sea turtle and would have no effect on designated critical habitat.

3.5.2.5.2.3 Impacts from Decelerators/Parachutes Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Entanglement stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer entanglement stressors within the marine environment where Navy training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would remove the potential for impacts from decelerators/parachutes on individual leatherback sea turtles, but would not measurably improve the status of leatherback sea turtle populations. Similarly, there would not be any measurable change in the PCEs under the No Action Alternative for leatherback critical habitat.

3.5.2.6 Ingestion Stressors

The ingestions stressors that may impact leatherback sea turtles include military expended materials from munitions (non-explosive practice munitions and fragments from high-explosives) and military expended materials – other than munitions (fragments from targets, chaff and flare components, and decelerators/parachutes). Larger non-explosive practice munitions (such as bombs and large-caliber munitions) are not considered ingestible by sea turtles, and are therefore not discussed as a potential stressor for sea turtles. Biodegradable polymer is a new stressor not previously analyzed in other resources sections of this Supplemental, but would only be used in the Inland Waters portion of the Study Area. Because leatherback sea turtles do not occur in inland waters, leatherback sea turtles would not be at risk of ingesting biodegradable polymers and are therefore not discussed further as a potential stressor for sea turtles.

3.5.2.6.1 Impacts from Military Expended Materials – Munitions

Ingestion impacts from military expended materials – munitions were analyzed in the 2015 NWTT Final EIS/OEIS and are discussed in this Supplemental in Section 3.0.3.6 (Ingestion Stressors). Since the 2015 NWTT Final EIS/OEIS, there has been no new or emergent science that would change in any way the analysis of military expended materials – munitions as ingestion stressors as discussed in the 2015 analyses. There have been no known instances of ingestion of military expended materials by any sea turtles prior to or since the 2015 NWTT Final EIS/OEIS.

3.5.2.6.1.1 Impacts from Military Expended Materials – Munitions Under Alternative 1

Impacts from Military Expended Materials – Munitions Under Alternative 1 for Training Activities

Under Alternative 1 and as presented in Section 3.0 (Tables 3.0-14 and 3.0-16), training use of military expended materials – munitions would decrease in comparison to ongoing activities and as discussed in the 2015 NWTT Final EIS/OEIS. When the amounts of military expended materials from munitions are combined, the number of items proposed to be expended under Alternative 1 decreases from ongoing activities. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts on leatherback sea turtles would be expected to be the same.

While training use of military expended material would change under this Supplemental, the analysis presented in the 2015 NWTT Final EIS/OEIS and the NMFS Biological Opinion for the 2015 NWTT Final EIS/OEIS (National Marine Fisheries Service, 2015; National Oceanic and Atmospheric Administration, 2015a) would not change. NMFS determined that the likelihood of a sea turtle ingesting expended materials was so low as to be discountable and therefore was not likely to adversely affect leatherback sea turtles. Further, jellyfish, the sea turtle's preferred prey, are filter feeders and would not ingest expended materials. Thus, the critical habitat PCEs would not be impacted from expended materials. Given that, under Alternative 1, the use of military expended materials – munitions has decreased in comparison to the 2015 analyses, impacts on sea turtles from military expended materials – munitions as ingestion stressors are not expected.

Pursuant to the ESA, the use of munitions during training activities, as described under Alternative 1, may affect ESA-listed leatherback sea turtles. The Navy has consulted with NMFS as required by section 7(a)(2) of the ESA on activities that expend munitions. These activities would have no effect on designated critical habitat.

Impacts from Military Expended Materials – Munitions Under Alternative 1 for Testing Activities

Under Alternative 1 and as presented in Section 3.0 (Tables 3.0-14 and 3.0-17), testing use of military expended materials – munitions would increase in comparison to ongoing activities and as discussed in the 2015 NWTT Final EIS/OEIS. When considering materials of ingestible size for sea turtles, the number of items proposed to be expended under Alternative 1 is less than ongoing testing activities analyzed in the 2015 NWTT Final EIS/OEIS. While testing use of military expended material would change under this Supplemental, the analysis presented in the 2015 NWTT Final EIS/OEIS and the NMFS Biological Opinion for the 2015 NWTT Final EIS/OEIS (National Marine Fisheries Service, 2015; National Oceanic and Atmospheric Administration, 2015a) would not change. NMFS determined that the likelihood of leatherback sea turtles ingesting expended materials was so low as to be discountable and therefore was not likely to adversely affect ESA-listed species. Further, jellyfish, the sea turtle's preferred prey, are filter feeders and would not ingest expended materials. Thus, the critical habitat PCEs would not be impacted from expended materials.

Pursuant to the ESA, the use of munitions during testing activities, as described under Alternative 1, may affect ESA-listed leatherback sea turtles. The Navy has consulted with NMFS as required by section 7(a)(2) of the ESA on activities that expend munitions. These activities would have no effect on designated critical habitat.

3.5.2.6.1.2 Impacts from Military Expended Materials – Munitions Under Alternative 2

Impacts from Military Expended Materials – Munitions Under Alternative 2 for Training Activities

Under Alternative 2, the number of military expended materials – munitions that would be used during training activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS (Table 3.0-14 and Table 3.0-16). When the amounts of military expended materials from munitions are combined, the number of items proposed to be expended under Alternative 2 increases from ongoing activities compared to what was analyzed in the 2015 NWTT Final EIS/OEIS and the NMFS Biological Opinion for the 2015 NWTT Final EIS/OEIS (National Marine Fisheries Service, 2015; National Oceanic and Atmospheric Administration, 2015a), and compared to Alternative 1. While training use of military expended material would change under this Supplemental, the analysis presented in the 2015 NWTT Final EIS/OEIS and the NMFS Biological Opinion for the 2015 NWTT Final EIS/OEIS (National Marine Fisheries Service, 2015; National Oceanic and Atmospheric Administration, 2015a) would not change. NMFS determined that the likelihood of leatherback sea turtles ingesting expended materials was so low as to be discountable and therefore was not likely to adversely affect ESA-listed species. Further, jellyfish, the sea turtle's preferred prey, are filter feeders and would not ingest expended materials. Thus, the critical habitat PCEs would not be impacted from expended materials. As with Alternative 1, impacts from ingestion of military expended materials – munitions under Alternative 2 for training activities are not expected.

Pursuant to the ESA, the use of munitions during training activities, as described under Alternative 2, may affect the ESA-listed leatherback sea turtle, but would have no effect on designated critical habitat.

Impacts from Military Expended Materials – Munitions Under Alternative 2 for Testing Activities

Under Alternative 2 and as presented in Section 3.0 (Introduction, Tables 3.0-14 and 3.0-16), testing use of military expended materials – munitions would increase in comparison to ongoing activities and are the same as under Alternative 1 in this Supplemental. While testing use of military expended materials – other than munitions would change under this Supplemental, the analysis presented in the 2015 NWTT Final EIS/OEIS and the NMFS Biological Opinion for the 2015 NWTT Final EIS/OEIS (National Marine Fisheries Service, 2015; National Oceanic and Atmospheric Administration, 2015a) would not change. NMFS determined that the likelihood of leatherback sea turtles ingesting expended materials was so low as to be discountable and therefore was not likely to adversely affect ESA-listed species. Further, jellyfish, the sea turtle's preferred prey, are filter feeders and would not ingest expended materials. Thus, the critical habitat PCEs would not be impacted from military expended materials – munitions. As with Alternative 1, impacts from ingestion of military expended materials – munitions under Alternative 2 for testing activities are not expected.

Pursuant to the ESA, the use of munitions during testing activities, as described under Alternative 2, may affect the ESA-listed leatherback sea turtle, but would have no effect on designated critical habitat.

3.5.2.6.1.3 Impacts from Military Expended Materials – Munitions Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Ingestion stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer ingestion stressors within the marine environment where Navy training and testing activities have historically been conducted.

Therefore, discontinuing training and testing activities under the No Action Alternative would remove the potential for impacts from military expended materials on individual leatherback sea turtles, but would not measurably improve the status of leatherback sea turtle populations. Similarly, there would not be any measurable change in the PCEs under the No Action Alternative for leatherback critical habitat.

3.5.2.6.2 Impacts from Military Expended Materials – Other than Munitions

3.5.2.6.2.1 Impacts from Military Expended Materials – Other than Munitions Under Alternative 1

Impacts from Military Expended Materials – Other than Munitions Under Alternative 1 for Training Activities

Under Alternative 1, the number of military expended materials – other than munitions that would be used during training activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS (Table 3.0-17, Table 3.0-20, and Table 3.0-22). When the amounts of military expended materials – other than munitions (fragments from targets, chaff and flare components, and decelerators/parachutes) are combined, the number of items proposed to be expended under Alternative 1 increases slightly from ongoing activities.

While training use of military expended material – other than munitions would change under this Supplemental, the analysis presented in the 2015 NWTT Final EIS/OEIS and the NMFS Biological Opinion for the 2015 NWTT Final EIS/OEIS (National Marine Fisheries Service, 2015; National Oceanic and Atmospheric Administration, 2015a) would not change. NMFS determined that the likelihood of leatherback sea turtles ingesting expended materials was so low as to be discountable and therefore was not likely to adversely affect ESA-listed species. Further, jellyfish, the sea turtle's preferred prey, are filter feeders and would not ingest expended materials. Thus, the critical habitat PCEs would not be impacted from expended materials – other than munitions.

Pursuant to the ESA, the use of military expended materials – other than munitions during training activities, as described under Alternative 1, may affect the ESA-listed leatherback sea turtle. The Navy has consulted with NMFS as required by section 7(a)(2) of the ESA on the use of military expended materials – other than munitions. These activities would have no effect on designated critical habitat.

Impacts from Military Expended Materials – Other than Munitions Under Alternative 1 for Testing Activities

Under Alternative 1, the number of military expended materials – other than munitions that would be used during testing activities increases compared to the number proposed for use in the 2015 NWTT Final EIS/OEIS (Table 3.0-17, Table 3.0-20, Table 3.0-21, and Table 3.0-22).

While testing use of military expended material – other than munitions would change under this Supplemental, the analysis presented in the 2015 NWTT Final EIS/OEIS and the NMFS Biological Opinion for the 2015 NWTT Final EIS/OEIS (National Marine Fisheries Service, 2015; National Oceanic and Atmospheric Administration, 2015a) would not change. NMFS determined that the likelihood of leatherback sea turtles ingesting expended materials was so low as to be discountable and therefore was not likely to adversely affect ESA-listed species. Further, jellyfish, the sea turtle's preferred prey, are filter feeders and would not ingest expended materials. Thus, the critical habitat PCEs would not be impacted from military expended materials – other than munitions. Therefore, impacts under Alternative 1 testing activities as ingestion stressors from the use of military expended materials – other than munitions are not expected.

Pursuant to the ESA, the use of military expended materials – other than munitions during testing activities, as described under Alternative 1, may affect the ESA-listed leatherback sea turtle. The Navy has consulted with NMFS as required by section 7(a)(2) of the ESA on the use of military expended materials – other than munitions. These activities would have no effect on designated critical habitat.

3.5.2.6.2.2 Impacts from Military Expended Materials – Other than Munitions Under Alternative 2

Impacts from Military Expended Materials – Other than Munitions Under Alternative 2 for Training Activities

Under Alternative 2 and as presented in Section 3.0 (Introduction, Tables 3.0-15, 3.0-17, 3.0-20, 3.0-21, and 3.0-22), training use of military expended materials – other than munitions would slightly increase in comparison to ongoing activities and Alternative 1. While training use of military expended material would change under this Supplemental, the analysis presented in Section 3.5.3.5 (Ingestion Stressors) in the 2015 NWTT Final EIS/OEIS and the NMFS Biological Opinion for the 2015 NWTT Final EIS/OEIS (National Marine Fisheries Service, 2015; National Oceanic and Atmospheric Administration, 2015a) would not change. NMFS determined that the likelihood of a leatherback sea turtle ingesting expended materials was so low as to be discountable and therefore was not likely to adversely affect the leatherback sea turtle. Further, jellyfish, the sea turtle's preferred prey, are filter feeders and would not ingest expended materials. Thus, the critical habitat PCEs would not be impacted from expended materials – other than munitions. Impacts on sea turtles from military expended materials – other than munitions as ingestion stressors are not expected.

Pursuant to the ESA, the use of military expended materials – other than munitions during training activities, as described under Alternative 2, may affect the ESA-listed leatherback sea turtle, but would have no effect on designated critical habitat.

Impacts from Military Expended Materials – Other than Munitions Under Alternative 2 for Testing Activities

Under Alternative 2 and as presented in Section 3.0 (Introduction, Tables 3.0-15, 3.0-17, 3.0-20, 3.0-21, and 3.0 22), testing use of military expended materials – other than munitions would increase in comparison to ongoing activities and would increase compared to Alternative 1 testing activities in this Supplemental. While testing use of military expended material – other than munitions would change under this Supplemental, the analysis presented in the 2015 NWTT Final EIS/OEIS and the NMFS Biological Opinion for the 2015 NWTT Final EIS/OEIS (National Marine Fisheries Service, 2015; National Oceanic and Atmospheric Administration, 2015a) would not change. NMFS determined that the likelihood of leatherback sea turtles ingesting expended materials was so low as to be discountable and therefore was not likely to adversely affect ESA-listed species. Further, jellyfish, the sea turtle's preferred prey, are filter feeders and would not ingest expended materials. Thus, the critical habitat PCEs would not be impacted from military expended materials – other than munitions As with Alternative 1, impacts from ingestion of military expended materials – other than munitions under Alternative 2 for testing activities are not expected.

Pursuant to the ESA, the use of military expended materials – other than munitions during testing activities, as described under Alternative 2, may affect the ESA-listed leatherback sea turtle, but would have no effect on designated critical habitat.

3.5.2.6.2.3 Impacts from Military Expended Materials – Other than Munitions Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Ingestion stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer ingestion stressors within the marine environment where Navy training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would remove the potential for impacts from military expended materials on individual leatherback sea turtles, but would not measurably improve the status of leatherback sea turtle populations. Similarly, there would not be any measurable change in the PCE under the No Action Alternative for leatherback critical habitat.

3.5.2.7 Secondary Stressors

As discussed in Section 3.5.3.6 (Secondary Stressors) of the 2015 NWTT Final EIS/OEIS, secondary stressors from military training and testing activities could pose indirect impacts on sea turtles via habitat degradation or an effect on prey availability. These stressors include (1) explosives and explosives byproducts (including unexploded ordnance), (2) metals, (3) chemicals, and (4) other materials. Analyses of the potential impacts on sediments and water quality from the proposed training and testing activities are discussed in detail in Section 3.1 (Sediments and Water Quality) of the 2015 NWTT Final EIS/OEIS. The analysis of explosives, explosives byproducts, metals, and chemicals, and their potential to indirectly impact sea turtles has not appreciably changed and is presented in detail in Section 3.5.3.6 (Secondary Stressors) of the 2015 NWTT Final EIS/OEIS given the previous conclusions were not tied to the number of activities occurring but to the nature of these stressors. The findings from multiple studies subsequent to the 2015 NWTT EIS/OEIS have reinforced the previous conclusion that the relatively low solubility of most explosives and their degradation products, metals, and chemicals means that concentrations of these contaminants in the marine environment, including those associated with either high-order or low-order detonations, are relatively low and readily diluted. For example, in the Study Area the concentration of unexploded ordnance, explosion byproducts, metals, and other chemicals would never exceed that of a World War II dump site. A series of studies of a World War II dump site off Hawaii have demonstrated only minimal concentrations of degradation products were detected in the adjacent sediments and that there was no detectable uptake in sampled organisms living on or in proximity to the site (Briggs et al., 2016; Edwards et al., 2016; Hawaii Undersea Military Munitions Assessment, 2010; Kelley et al., 2016; Koide et al., 2016). It has also been documented that the degradation products of Royal Demolition Explosive are not toxic to marine organisms at realistic exposure levels (Rosen & Lotufo, 2010). Any remnant undetonated components from explosives such as TNT, royal demolition explosive, and high-melting explosive experience rapid biological and photochemical degradation in marine systems (Cruz-Uribe et al., 2007; Juhasz & Naidu, 2007; Pavlostathis & Jackson, 2002; Singh et al., 2009; Walker et al., 2006). As another example, the Canadian Forces Maritime Experimental and Test Ranges near Nanoose, British Columbia, began operating in 1965 conducting test events for both U.S. and Canadian forces that included many of the same test events that are conducted in the NWTT Study Area. Environmental analyses of the impacts from years of testing at Nanoose were documented in 1996 and 2005 (Environmental Science Advisory Committee, 2005). These analyses concluded the Navy test activities, "…had limited and perhaps negligible effects on the natural environment" (Briggs et al., 2016; Edwards et al., 2016; Environmental Science Advisory Committee, 2005; Kelley et al., 2016). Based on these and other similar applicable findings from multiple Navy ranges as discussed in detail in Section 3.1 (Sediments and Water Quality) of this Supplemental, indirect impacts on sea turtles from the training and testing activities in the NWTT Study Area would be negligible and would have no long-term effect on habitat or prey.

Pursuant to the ESA, secondary stressors resulting from training and testing activities as described under the Alternative 1 and Alternative 2 may affect, leatherback sea turtles, and would have no effect on designated critical habitat. The Navy has consulted with NMFS as required by section 7(a)(2) of the ESA for secondary stressors under Alternative 1.

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3.6 Birds

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3.6 Birds

This section analyzes potential impacts on birds (e.g., seabirds, shorebirds, upland terrestrial birds) found in the Northwest Training and Testing (NWTT) Study Area. For purposes of this Supplemental Environmental Impact Statement (EIS)/Overseas EIS (OEIS) (Supplemental), the Study Area for birds remains the same as that identified in the 2015 NWTT Final EIS/OEIS, which for birds includes the Offshore Area; Inland Waters; and Western Behm Canal, Alaska. Section 2.1 (Description of the Northwest Training and Testing Study Area) provides detailed descriptions of these areas. Similar to the 2015 NWTT Final EIS/OEIS, this section provides an overview of the species, distribution, and occurrence of birds that are either resident or migratory through the Study Area, as well as new information released since the publication of the 2015 Final EIS/OEIS.

Section 3.6.2 (Environmental Consequences) of this Supplemental analyzes potential impacts of the Proposed Action on birds in the Study Area and summarizes the combined impacts on these birds and determinations under the Endangered Species Act (ESA), Migratory Bird Treaty Act (MBTA), and the Bald and Golden Eagle Protection Act.

3.6.1 Affected Environment

As presented in the 2015 NWTT Final EIS/OEIS, the habitat found within the Study Area supports a wide diversity of resident and migratory seabirds, shorebirds, waterfowl, passerines, and raptors. Descriptions of the climate, productivity, and oceanographic conditions were presented in the 2015 NWTT Final EIS/OEIS and are summarized below for each major component of the Study Area:

- Offshore Area. As described in Section 2.1.1 (Description of the Offshore Area) of the 2015 NWTT Final EIS/OEIS, the Olympic Military Operations Area (MOA) overlays both land and sea (extending to 3 Nautical Miles [NM] off the Washington coast). The MOA lower limit is 6,000 feet (ft.) above mean sea level but not below 1,200 ft. above ground level at the higher terrain elevations of the mountains, and the upper limit is up to but not including 18,000 ft. above mean sea level. Above the Olympic MOA is the Olympic Air Traffic Control Assigned Airspace (ATCAA), which starts at 18,000 ft. The ATCAA has an upper limit of 35,000 ft. The Washington coastline within the Offshore Area contains numerous bays and inlets that provide sheltered waters for wintering waterfowl and seabirds, including ducks, gulls, and shorebirds. Along the coastline, winter bird populations are generally three times higher than the summer populations, which mostly include gulls and alcids (Calambokidis & Steiger, 1990; Falxa & Raphael, 2016). For the purposes of this Supplemental, the Offshore Area also includes the inland terrestrial areas underlying the Olympic MOA. The Offshore Area contains important nesting and foraging areas for resident and migrating birds.
- Inland Waters. The shorelines of the inland estuaries are generally rocky, with small beaches at the mouths of streams and rivers. Extensive mudflats associated with river deltas support large populations of shorebirds and waterfowl in the winter (Nysewander et al., 2005; Ward et al., 2015). The numerous bays and inlets provide sheltered waters for wintering waterfowl, shorebirds, and seabirds. The beaches and mudflats within Puget Sound are an important stopover and wintering habitat for numerous migratory birds.
- Western Behm Canal, Alaska. Similar to the Inland Waters of Washington, Behm Canal, which surrounds Revillagigedo Island, supports large populations of shorebirds and seabirds. Extensive mudflats associated with river deltas support seasonally large populations of shorebirds and waterfowl (Ames et al., 2000). About 200 marine and coastal bird species are common to the

southeast Alaska portion of the Study Area. Loons, grebes, cormorants, sea ducks, bald eagles, gulls, and alcids are year-round residents of the region.

The 2015 NWTT Final EIS/OEIS lists representative bird species known to occur or anticipated to occur within the Study Area. The information regarding these species' presence or absence in the Study Area has not changed since the publication of the 2015 NWTT Final EIS/OEIS. Although the species list presented in the 2015 Final EIS/OEIS remains valid, the list has been updated in this Supplemental to reflect additional species that may occur within the Study Area.

Three ESA-listed bird species may occur within the Study Area (Table 3.6-1): marbled murrelet (*Brachyramphus marmoratus*), short-tailed albatross (*Phoebastria albatrus*), and northern spotted owl (*Strix occidentalis caurina*). The short-tailed albatross is listed as endangered throughout its range. The marbled murrelet is listed as threatened in Washington, Oregon, and California; it is not an ESA-listed species in Alaska. The northern spotted owl is listed as threatened throughout its range. Any updated information on these species in regards to regulatory status and life history information is included in the species-specific discussions below.

Table 3.6-1: Status and Presence of ESA-listed Bird Species and Their Critical Habitat That May Occur in the Northwest Training and Testing Study Area

Species and Regulatory Status		Presence in the Study Area			
Common Name (Scientific Name)	**ESA Status**	**Critical Habitat**	**Offshore Area[1]**	**Inland Waters**	**Western Behm Canal[2]**
Marbled murrelet (*Brachyramphus marmoratus*)	Threatened	Coastal and under the Olympic MOA[3]	✓	✓	✓
Short-tailed albatross (*Phoebastria albatrus*)	Endangered	None designated in Study Area	✓		
Northern spotted owl (*Strix occidentalis caurina*)	Threatened	Under the Olympic MOA[3]	✓		

Notes:
[1]The Olympic MOA overlies both land and sea (extending to 3 NM off the Washington coast), and include areas above 6,000 ft. MSL but not below 1,200 ft. above ground level at the higher terrain elevations of the mountains.
[2]The marbled murrelet is not ESA-listed in Alaska; it is listed as threatened in Washington, Oregon, and California.
[3]Potential overlap in coastal and inland areas beneath the Olympic MOA.

Although the northern spotted owl occurs within the Study Area, the majority of proposed activities would occur within the marine environment well offshore of terrestrial habitat that would support spotted owls. Since the publication of the 2015 NWTT Final EIS/OEIS, there have been no updates to the regulatory status, life history information, or species-specific threats that would alter the analysis from the 2015 NWTT Final EIS/OEIS. In addition, while the current Proposed Action includes aircraft overflights of spotted owl habitat underlying the Olympic MOA, these aircraft overflights are not expected to adversely affect spotted owls. The 2016 Biological Opinions (BO) issued by the United States Fish and Wildlife Service (USFWS) determined that the response of northern spotted owls to aircraft overflights conducting training missions in the airspace over the Olympic Peninsula would not result in flushing or failed attempts by adults to feed nestlings, and determined that the effects would be considered insignificant (U.S. Fish and Wildlife Service, 2016, 2018). The BO conclusions were based on the altitude of aircraft overflights and not number or frequency of overflights. Both BOs concluded that the proposed aircraft operations may affect, but would not adversely affect, northern spotted owls in the Study Area. The altitude of proposed aircraft operations over the Olympic Peninsula would not change under the current Proposed Action and there are no other changes to the Proposed Action that would affect these conclusions. Therefore, the analysis and effects determination for the northern spotted owl from the 2016 and 2018 BOs remain valid.

3.6.1.1 Overview of Birds within the Study Area

Twelve major taxonomic groups (orders) of birds represented in the Study Area may be impacted by NWTT activities. Birds may be found in air, at the water's surface, or within the water column of the Study Area. The birds within the Study Area are divided into six categories, based loosely on their geographic distribution and feeding habits: seabirds, shorebirds, wading birds, waterfowl, landbirds, and raptors. Landbirds, represented by passerines in the order Passeriformes, are an additional category since 2015 and include the common perching birds such as sparrows, jays, chickadees, and thrushes. Raptors are also an additional category since 2015 and include hawks, bald eagle (*Haliaeetus leucocephalus*), osprey (*Pandion haliaetus*), and owls. These birds of prey inhabit forests and wetlands, with some species (e.g., bald eagle and osprey) associated with aquatic habitats throughout the Study Area in the Offshore Area, Inland Waters, and Western Behm Canal, Alaska (Table 3.6-2 of the 2015 Final NWTT EIS/OEIS has been verified by updated references (American Ornithological Society, 2019; Sibley, 2014).

The distribution of each group within the Study Area is presented in Table 3.6-3 of the 2015 NWTT Final EIS/OEIS. Table 3.6-2 of this Supplemental (a new table) lists additional species that have new science to support their occurrence in additional areas identified since the Navy's 2015 NWTT Final EIS/OEIS.

3.6.1.1.1 Group Size

The Navy conducted a literature search for new information since the publication of the 2015 NWTT Final EIS/OEIS on group size that may change the analysis of potential impacts on birds. No new information is available on group size that would alter the analysis from the 2015 NWTT Final EIS/OEIS. As such, the description regarding group size presented in the 2015 NWTT Final EIS/OEIS remains valid. A summary of group size information for bird groups and specific species is included below.

A variety of group sizes and diversity may be encountered throughout the Study Area, ranging from migration of an individual bird to large concentrations of mixed-species flocks. Depending on season, location, and time of day, the number of birds observed (group size) will vary and will likely fluctuate from year to year. During spring and fall periods, diurnal and nocturnal migrants would likely occur in large groups as they migrate over open water.

Most seabird species nest in groups (colonies) on the ground of coastal areas or oceanic islands, where breeding colonies number from a few individuals to thousands (U.S. Geological Survey, 2016). Outside of the breeding season, most seabirds within the order Procellariformes are solitary, though they may join mixed-species flocks while foraging and can be associated with whales and dolphins (Onley & Scofield, 2007) or areas where prey density is high (U.S. Fish and Wildlife Service, 2005a). During the breeding season, these seabirds usually form large nesting colonies. Similarly, birds within the order Pelecaniformes are typically colonial and foraging occurs either singly or in small groups. However, in the order Charadriiformes, foraging can range from singles or pairs (e.g., family Alcidae) (Lorenz et al., 2016; U.S. Fish and Wildlife Service, 2017) and can extend upward into larger groups (e.g., family Laridae) in which juveniles accompany adults to post-breeding foraging areas.

Table 3.6-2: Representative Birds of the Northwest Training and Testing Study Area

Order/Family	Common Name	Scientific Name	Location within Study Area			
			Inland Waters	Offshore Area (coastal/inland)	Offshore Area (pelagic)	Western Behm Canal
Order PROCELLARIIFORMES						
Family DIOMEDEIDAE	Short-tailed albatross	*Phoebastria albatrus*			X	
	Laysan albatross	*Phoebastria immutabilis*			X	
	Black-footed albatross*	*Phoebastria nigripes*		X*	X	X*
Family PROCELLARIIDAE	Northern fulmar	*Fulmarus glacialis*			X	
	Pink-footed shearwater	*Puffinus creatopus*			X	
	Flesh-footed shearwater	*Puffinus carneipes*			X	
	Manx shearwater	*Puffinus puffinus*		X	X	
	Buller's shearwater	*Puffinus bulleri*			X	
	Sooty shearwater	*Puffinus griseus*		X	X	
	Short-tailed shearwater	*Puffinus tenuirostris*			X	
Family HYDROBATIDAE	Fork-tailed storm-petrel	*Oceanodroma furcata*		X	X	X
	Leach's storm-petrel	*Oceanodroma leucorhoa*		X	X	
Order PELECANIFORMES						
Family PELECANIDAE	Brown pelican	*Pelecanus occidentalis*	X	X		
Family PHALACROCORACIDAE	Brandt's cormorant	*Phalacrocorax penicillatus*	X	X		X
	Double-crested cormorant	*Phalacrocorax auritus*	X	X		X
	Pelagic cormorant	*Phalacrocorax pelagicus*	X	X		X
Order CICONIIFORMES						
Family ARDEIDAE	Great blue heron*	*Ardea herodias*	X	X*	X*	X
	American bittern*	*Botaurus lentiginosus*	X	X*		X*
Order PASSERIFORMES						
Family ALAUDIDAE	Streaked horned lark*	*Eremophila alpestris strigata*	X	X		
Family CORVIDAE	Steller's jay*	*Cyanocitta stelleri*	X	X		
Family PARIDAE	Black-capped chickadee*	*Poecile atricapillus*	X	X		
Family TYRANNIDAE	Olive-sided flycatcher*	*Contopus cooperi*	X	X		
Family TURDIDAE	Varied thrush*	*Ixoreus naevius*	X	X		
Family EMBERIZIDAE	Spotted towhee*	*Pipilo maculatus*	X	X		
	Dark-eyed junco*	*Junco hyemalis*	X	X		
Family ICTERIDAE	Western meadowlark*	*Sturnella neglecta*	X	X		

Table 3.6-2: Representative Birds of the Northwest Training and Testing Study Area (continued)

Order/Family	Common Name	Scientific Name	Location within Study Area			
			Inland Waters	Offshore Area (coastal/inland)	Offshore Area (pelagic)	Western Behm Canal
Order CICONIIFORMES						
Family ARDEIDAE	Great blue heron*	*Ardea herodias*	X	X*	X*	X
	American bittern*	*Botaurus lentiginosus*	X	X*		X*
Order CHARADRIIFORMES						
Family LARIDAE	Bonaparte's gull	*Larus philadelphia*	X	X		X
	Heermann's gull	*Larus heermanni*	X	X		
	Mew gull	*Larus canus*	X	X		X
	Ring-billed gull	*Larus delawarensis*	X	X		X
	California gull	*Larus californicus*	X	X	X	X
	Herring gull	*Larus argentatus*	X	X		X
	Thayer's gull	*Larus thayeri*	X	X	X	X
	Western gull	*Larus occidentalis*	X	X		
	Glaucous-winged gull	*Larus glaucescens*	X	X		X
	Glaucous gull	*Larus hyperboreus*	X	X		X
	Red-legged kittiwake	*Rissa brevirostris*		X	X	
	Sabine's gull	*Xema sabini*		X	X	
	Black-legged kittiwake	*Rissa tridactyla*		X	X	X
	Caspian tern	*Hydroprogne caspia*	X	X		X
	Common tern	*Sterna hirundo*	X	X		
	Arctic tern*	*Sterna paradisaea*	X*	X*	X	
	Aleutian tern*	*Sterna aleutica*				X*
	Red phalarope	*Phalaropus fulicarius*		X	X	
	Red-necked phalarope	*Phalaropus lobatus*	X	X	X	X
Family STERCORARIIDAE	Pomarine jaeger	*Stercorarius pomarinus*			X	
	Parasitic jaeger	*Stercorarius parasiticus*	X	X	X	X
	Long-tailed jaeger	*Stercorarius longicaudus*			X	
	South polar skua	*Stercorarius maccormicki*			X	

Table 3.6-2: Representative Birds of the Northwest Training and Testing Study Area (continued)

Order/Family	Common Name	Scientific Name	Location within Study Area			
			Inland Waters	Offshore Area (coastal/inland)	Offshore Area (pelagic)	Western Behm Canal
Family ALCIDAE	Common murre	*Uria aalge*	X	X	X	X
	Thick-billed murre*	*Uria lomvia*	X*	X*		X
	Pigeon guillemot	*Cepphus columba*	X	X		X
	Kittlitz's murrelet	*Brachyramphus brevirostris*				X
	Marbled murrelet	*Brachyramphus marmoratus*	X	X	X	X
	Xantus's murrelet*	*Synthliboramphus hypoleucus*		X*	X	
	Ancient murrelet	*Synthliboramphus antiquus*	X	X	X	X
	Cassin's auklet*	*Ptychoramphus aleuticus*	X*	X	X	X*
	Parakeet auklet	*Aethia psittacula*			X	
	Rhinoceros auklet	*Cerorhinca monocerata*	X	X	X	X
	Horned puffin*	*Fratercula corniculata*	X*	X*	X	X*
	Tufted puffin	*Fratercula cirrhata*	X	X	X	X
Family SCOLOPACIDAE	Surfbird	*Aphriza virgata*	X	X		X
	Western sandpiper	*Calidris mauri*	X	X		X
	Spotted sandpiper	*Actitis macularia*	X	X		X
	Least sandpiper	*Calidris minutilla*	X	X		X
	Rock sandpiper	*Calidris ptilocnemis*	X	X		X
	Red knot	*Calidris canutus*	X	X		X
	Short-billed dowitcher	*Limnodromus griseus*	X	X		X
	Ruddy turnstone	*Arenaria interpres*	X	X		X
	Sanderling	*Calidris alba*	X	X		X
	Wandering tattler	*Tringa incana*	X	X		X
	Greater yellowlegs	*Tringa melanoleuca*	X	X		X
	Solitary sandpiper	*Tringa solitaria*	X	X		X
	Lesser yellowlegs	*Tringa flavipes*	X	X		X
	Whimbrel	*Numenius phaeopus*	X	X		X
	Black turnstone	*Arenaria melanocephala*	X	X		X
	Semipalmated sandpiper	*Calidris pusilla*	X	X		X
	Baird's sandpiper	*Calidris bairdii*	X	X		X

Table 3.6-2: Representative Birds of the Northwest Training and Testing Study Area (continued)

Order/Family	Common Name	Scientific Name	Location within Study Area			
			Inland Waters	Offshore Area (coastal/inland)	Offshore Area (pelagic)	Western Behm Canal
Family SCOLOPACIDAE	Pectoral sandpiper	*Calidris melanotos*	X	X		X
	Dunlin	*Calidris alpina*	X	X		X
	Stilt sandpiper	*Calidris himantopus*	X			
	Ruff	*Philomachus pugnax*	X	X		
	Marbled godwit	*Limosa fedoa*	X	X		X
	Long-billed dowitcher	*Limnodromus scolopaceus*	X	X		X
	Wilson's snipe	*Gallinago delicata*	X	X		X
Family CHARADRIIDAE	Black-bellied plover	*Pluvialis squatarola*	X	X		X
	Semipalmated plover	*Charadrius semipalmatus*	X	X		X
	Killdeer	*Charadrius vociferus*	X	X		X
	Western snowy plover	*Charadrius nivosus*				
	American golden plover	*Pluvialis dominica*	X	X		
	Pacific golden plover	*Pluvialis fulva*	X	X		X
Family HAEMATOPODIDAE	Black oystercatcher	*Haematopus bachmani*	X	X		X
Family RECURVIROSTRIDAE	Black-necked stilt*	*Himantopus mexicanus*	X	X*		
Order GAVIIFORMES						
Family GAVIIDAE	Yellow-billed loon	*Gavia adamsii*	X	X		X
	Common loon	*Gavia immer*	X	X		X
	Pacific loon	*Gavia pacifica*	X	X		X
	Red-throated loon	*Gavia stellata*	X	X		X
Order GRUIFORMES						
Family RALLIDAE	American coot	*Fulica americana*	X	X		X
	Sora	*Porzana carolina*	X	X		
	Virginia rail	*Rallus limicola*	X	X		
Order PODICIPEDIFORMES						
Family PODICIPEDIDAE	Pied-billed grebe	*Podilymbus podiceps*	X	X		X
	Western grebe	*Aechmophorus occidentalis*	X	X		X
	Horned grebe	*Podiceps auritus*	X	X		X
	Red-necked grebe	*Podiceps grisegena*	X	X	X	X
	Eared grebe	*Podiceps nigricollis*	X	X		
	Clark's grebe	*Aechmophorus clarkii*	X	X		

Table 3.6-2: Representative Birds of the Northwest Training and Testing Study Area (continued)

Order/Family	Common Name	Scientific Name	Location within Study Area			
			Inland Waters	Offshore Area (coastal/inland)	Offshore Area (pelagic)	Western Behm Canal
Order ANSERIFORMES						
Family ANATIDAE	Wood duck*	*Aix sponsa*	X	X*		X*
	Northern pintail	*Anas acuta*	X			X
	Green-winged teal	*Anas crecca*	X			X
	Mallard*	*Anas platyrhynchos*	X	X*	X	X
	Greater scaup	*Aythya marila*	X	X		X
	Canvasback*	*Aythya valisineria*	X	X*		
	Bufflehead*	*Bucephala albeola*	X	X*		X
	Long-tailed duck	*Clangula hyemalis*	X	X		X
	Harlequin duck	*Histrionicus histrionicus*	X	X		X
	White-winged scoter	*Melanitta deglandi*	X	X		X
	Black scoter	*Melanitta americana*	X	X		X
	Surf scoter	*Melanitta perspicillata*	X	X		X
	Common merganser*	*Mergus merganser*	X	X*		X
	Red-breasted merganser	*Mergus serrator*	X	X		X
	Ruddy duck	*Oxyura jamaicensis*	X			
	Gadwall	*Mareca strepera*	X			X
	Eurasian widgeon	*Mareca penelope*	X			X
	American widgeon	*Mareca americana*	X			X
	Blue-winged teal	*Spatula discors*	X	X		X
	Cinnamon teal	*Spatula cyanoptera*	X			
	Northern shoveler	*Spatula clypeata*	X			X
	Redhead	*Aythya americana*	X			
	Ring-necked duck	*Aythya collaris*	X			X
	Lesser scaup	*Aythya affinis*	X			X
	Common goldeneye	*Bucephala clangula*	X	X		X
	Barrow’s goldeneye	*Bucephala islandica*	X			X
	Hooded merganser	*Lophodytes cucullatus*	X	X*		X
	Snow goose*	*Anser caerulescens*				
	Greater white-fronted goose	*Anser albifrons*	X	X		

Table 3.6-2: Representative Birds of the Northwest Training and Testing Study Area (continued)

Order/Family	Common Name	Scientific Name	Location within Study Area			
			Inland Waters	Offshore Area (coastal/inland)	Offshore Area (pelagic)	Western Behm Canal
Family ANATIDAE	Trumpeter swan*	*Cygnus buccinator*	X	X*		X
	Tundra swan*	*Cygnus columbianus*	X	X*		
	Canada goose*	*Branta canadensis*	X	X*		X
	Brant*	*Branta bernicla*	X*	X*		X*
Order ACCIPITRIFORMES						
Family ACCIPITRIDAE	Bald eagle*	*Haliaeetus leucocephalus*	X			X
	Sharp-shinned hawk*	*Accipiter striatus*	X			X
	Red-tailed hawk*	*Buteo jamaicensis*	X			X
Family PANDIONIDAE	Osprey*	*Pandion haliaetus*	X			X
Order FALCONIFORMES						
Family FALCONIDAE	American kestrel*	*Falco sparverius*	X			X
	Merlin*	*Falco columbarius*	X			X
	Peregrine falcon*	*Falco peregrinus*	X			X
Order STRIGIFORMES						
Family TYTONIDAE	Barn owl*	*Tyto alba*		X		
Family STRIGIDAE	Great horned owl*	*Bubo virginianus*		X		X
	Northern spotted owl*	*Strix occidentalis caurina*		X		
	Barred owl*	*Strix varia*		X		X
	Northern saw-whet owl*	*Aegolius acadicus*		X		X
	Western screech owl*	*Megascops kennicottii*		X		X
	Northern pygmy owl	*Glaucidium californicum*		X		X

Note: The list of species has been adapted from the 2015 NWTT Final EIS/OEIS with additions (marked with an asterisk [*]) based on suggestions by subject matter experts. The list is not comprehensive of all bird species that occur within the Study Area; rather, it includes representative species of the orders and families of birds that are most likely present in the Study Area.

3.6.1.1.2 Diving Information

Since the publication of the 2015 NWTT Final EIS/OEIS, the Navy conducted a literature search for new information on dive behavior that may change the analysis of potential impacts on birds. No new information is available on dive behavior that would alter the analysis from the 2015 NWTT Final EIS/OEIS. As such, the additional description regarding dive behavior presented in the 2015 NWTT Final EIS/OEIS remains valid. A summary of diving information for bird groups and specific species is included below.

Many of the seabird species found in the Study Area will dive, skim, or grasp prey at the water's surface or within the upper portion (3–6 ft.) of the water column (Cook et al., 2011; Jiménez et al., 2012; Sibley, 2014). Foraging strategies are species specific, such as plunge-diving or pursuit-diving. Plunge-diving, as used by terns and pelicans, is a foraging strategy in which the bird hovers over the water and dives into the water to pursue fish. Diving behavior in terns is limited to plunge-diving during foraging (Hansen et al., 2017). Dive durations are correlated with depth and range from a few seconds in shallow divers to several minutes in alcids (Ponganis, 2015). In general, tern species do not usually dive deeper than 3 ft. Pursuit divers, a common foraging strategy of birds such as murrelets and shearwaters, usually float on the water and dive under to pursue fish and other prey. They most commonly eat fish, squid, and crustaceans (Burger et al., 2004). Marbled murrelets forage by pursuit-diving in relatively shallow waters, usually <30 meters (m) in depth, but are assumed to be capable of diving to a depth of 47 m (U.S. Fish and Wildlife Service, 2016).

3.6.1.1.3 Flight Altitudes

While foraging birds will be present near the water surface, migrating birds may fly at various altitudes. Flight altitudes for birds have traditionally been estimated from on the ground (or boat) observations, or from planes; however, flight altitude information increasingly relies on radar studies and telemetry techniques, where the bird's measured altitude is subtracted from the ground elevation (Poessel et al., 2018). Jongbloed (2016) completed a literature review to determine flight height of marine birds to assess potential risks from wind turbine collisions. This review found that most seabird species fly beneath the rotor blade altitudes of offshore wind turbines, which reduces the risk for collision. Some species such as sea ducks and loons may be commonly seen flying just above the water's surface, but the same species can also be spotted flying high enough (5,800 ft.) that they are barely visible through binoculars (Lincoln et al., 1998). While there is considerable variation, the favored altitude for most small birds appears to be between 500 ft. and 1,000 ft. Radar studies have demonstrated that 95 percent of the migratory movements occur at less than 10,000 ft., with the bulk of the movements occurring under 3,000 ft. (Lincoln et al., 1998). Weather factors may also influence flight heights. Tarroux et al. (2016) examined the flying tactics of Antarctic petrels (*Thalassoica antarctica*) revealing the flexibility of flight strategies. Birds tend to fly higher with favorable wind conditions and fly near ground level during strong winds. Birds were found to adjust their speed and heading during stronger winds to limit drift; however, they were able to tolerate a limited amount of drift. This was also found by Stumpf et al. (2011) for marbled murrelets using radar to quantify flight heights off of the Olympic Peninsula and by Sanzenbacher et al. (2014) off of Northern California. In summary, most marine birds can be expected to fly relatively close to the surface, but may range upwards in altitude depending on a number of factors such as wind speed and direction, precipitation avoidance, time of day or night, foraging behaviors, migration, and distance to coast.

3.6.1.1.4 Distance from Shore

Pelagic ranges, as a function of distance from shore, can range widely for different species and by season. Much of the recent research regarding abundance and distribution as a function of distance from shore for marine birds was conducted to better understand potential impacts on marine birds from offshore energy development. Spiegel et al. (2017) tracked the movements of over 400 individuals of three species (northern gannet [*Morus bassanus*], red-throated loon [*Gavia stellata*], and surf scoter [*Melanitta perspicillata*]) over the course of 5 years off of the mid-Atlantic coast. In general, all three species exhibited a largely near-shore, coastal, or in-shore distribution. Habitat use was concentrated in or around large bays, with the most extensive use at bay mouths. Northern gannets ranged much farther offshore than the other two species and covered a much larger area (including instances of individuals using both the Gulf of Mexico and the mid-Atlantic within a single season). Spiegel et al. (2017) determined that the differences among species distributions were likely due to differences in motility and distribution of their preferred prey.

Pelagic surveys off the coast of Washington were conducted in September–November of 2016, 2017, and 2018 and during January – beginning of April of 2019 (Pearson, 2019). Transects extended out to 38–43 NM from shore. During those surveys 88,110 birds representing 59 species were detected. Common murres (*Uria aalge*), pink-footed shearwaters (*Puffinus creatopus*), northern fulmars (*Fulmarus glacialis*), sooty shearwaters (*Puffinus griseus*), and rhinoceros auklets (*Cerorhinca monocerata*) were the dominate species detected. Storm-petrels, albatross, and Scripps's murrelets (*Synthliboramphus scrippsi*) were found >30 NM from shore; fulmars, skuas, phalaropes, shearwaters, and most alcids were found between 16 and 27 NM from shore; and loons, scoters, cormorants, brown pelican (*Pelecanus occidentalis*), and marbled murrelet were found within 11 NM of shore (Pearson, 2019).

In summary, marine bird distance from shore can depend on a variety of factors, such as physiological abilities of a particular species to tolerate long distance and duration flights, mobility of prey, and seasonal variations in ranges.

3.6.1.1.5 Hearing and Vocalization

The Navy conducted a literature search for new information since the publication of the 2015 NWTT Final EIS/OEIS on bird hearing and vocalizations that may change the analysis of potential impacts on birds. New information regarding hearing sensitivities of waterbirds, including various duck species, is summarized below, along with recent publications that show differences in hearing sensitivities between freshwater divers and ocean pelagic birds. This information is summarized below with an overview of the most current best available science regarding bird hearing and vocalization.

3.6.1.1.5.1 Airborne Hearing in Seabirds

Although hearing range and sensitivity has been measured for many land birds, little is known of seabird hearing. The majority of the published literature on bird hearing focuses on terrestrial birds and their ability to hear in air. A review of 32 terrestrial and marine species indicates that birds generally have greatest hearing sensitivity between 1 and 4 kilohertz (kHz) (Beason, 2004; Dooling, 2002). Very few can hear below 20 hertz (Hz), most have an upper frequency hearing limit of 10 kHz, and none exhibit hearing at frequencies higher than 15 kHz (Dooling, 2002; Dooling & Popper, 2000). Hearing capabilities have been studied for only a few seabirds (Beason, 2004; Beuter et al., 1986; Crowell et al., 2015; Johansen et al., 2016; Larsen et al., 2020; Mooney et al., 2019; Thiessen, 1958; Wever et al., 1969); these studies show that seabird hearing ranges and sensitivity in air are consistent with what is known about bird hearing in general.

Auditory abilities have been measured in 10 diving bird species in-air using electrophysiological techniques (Crowell et al., 2015; Maxwell et al., 2017). All species tested had the best hearing sensitivity from 1 to 3 kHz. The red-throated loon and northern gannet (both non-duck species) had the highest thresholds while the lesser scaup (*Aythya affinis*) and ruddy duck (*Oxyura jamaicensis*) (both duck species) had the lowest thresholds (Crowell et al., 2015). Auditory sensitivity varied amongst the species tested, spanning over 30 decibels (dB) in the frequency range of best hearing. While electrophysiological techniques provide insight into hearing abilities, auditory sensitivity is more accurately obtained using behavioral techniques. Crowell et al. (2016) used behavioral methods to obtain an in-air audiogram of the lesser scaup. Hearing frequency range in air was similar to other birds, with best sensitivity at 2.86 kHz with a threshold of 14 dB referenced to 20 micropascals (re 20 µPa). Maxwell et al. (2017) obtained the behavioral in-air audiogram of a great cormorant (*Phalacrocorax carbo*), and the most sensitive hearing was 18 dB re 20 µPa at 2 kHz.

Crowell et al. (2015) also compared the vocalizations of the same 10 diving bird species to the region of highest sensitivity of in-air hearing. Of the birds studied, vocalizations of only eight species were obtained due to the relatively silent nature of two species. The peak frequency of the vocalizations of seven of the eight species fell within the range of highest sensitivity of in-air hearing. Crowell et al. (2015) suggested that the colonial nesters tested had relatively reduced hearing sensitivity because they relied on individually distinctive vocalizations over short ranges. Additionally, they observed that the species with more sensitive hearing were those associated with freshwater habitats, which are relatively quieter compared to marine habitats with wind and wave noise.

3.6.1.1.5.2 Underwater Hearing in Seabirds

Little is known about the hearing abilities of birds underwater (Dooling & Therrien, 2012). In air, the size of the bird is usually correlated with the sensitivity to sound (Johansen et al., 2016); for example, songbirds tend to be more sensitive to higher frequencies and larger non-songbirds tend to be more sensitive to lower frequencies (Dooling & Popper, 2000). Two studies have tested the ability of a diving bird, a great cormorant, to respond to underwater sounds (Hansen et al., 2017; Johansen et al., 2016). These studies suggests that the cormorant's hearing in air is less sensitive than birds of similar size; however, the hearing capabilities in water are better than what would be expected for a purely in-air adapted ear (Johansen et al., 2016). The frequency range of best hearing underwater was observed to be narrower than the frequency range of best hearing in air, with greatest sensitivity underwater observed around 2 kHz (about 71 dB re 1 µPa based on behavioral responses). Although results were not sufficient to be used to generate an audiogram, Therrien (2014) also examined underwater hearing sensitivity of long-tailed ducks (*Clangula hyemalis*) by measuring behavioral responses. The research showed that auditory thresholds at frequencies within the expected range of best sensitivity (1, 2, and 2.86 kHz) are expected to be between 77 and 127 dB re 1 µPa.

Maxwell et al. (2017) obtained the behavioral in-air audiogram of a great cormorant, and the most sensitive hearing was 18 dB re 20 µPa at 2 kHz. More recently, Larsen et al. (2020) measured auditory evoked potentials and eardrum movement in anesthetized, wild-caught, fledgling great cormorants both in air and underwater. The best average sensitivity was at 1 kHz in both media, where the thresholds were 53 dB re 20 µPa (air) and 84 dB re 1 µPa (water). Statistical analysis showed no difference between sound pressure thresholds in air and underwater, as well as no frequency-medium interaction. The authors suggest that cormorants have anatomical adaptations for underwater hearing; however, the average underwater audiogram obtained in this study does not necessarily support well-developed aquatic hearing. Furthermore, a behavioral audiogram of a single adult great cormorant suggests that absolute thresholds are lower than found by Larsen and colleagues, and shows a best frequency of 2 kHz (Hansen et al., 2017). The differences in audiogram methodology (behavioral vs. auditory evoked potential), life stage (adult vs. fledgling), and arousal state (anesthetized vs. awake), obscure the source of discrepancy between these two studies. The authors suggest additional behavioral (psychophysical) measurements in more individuals.

Mooney et al. (2019) measured auditory brainstem responses (ABRs) from one anesthetized, wild-caught Atlantic puffin (*Fratercula arctica*) and found a hearing range of 0.5–6 kHz, with the best sensitivity in the 1–2 kHz range. That study also measured ABRs from one common murre and found a hearing range of 1–4 kHz, with the best sensitivity at 1 kHz. However, Mooney et al. (2019) were unable to measure ABR responses at 3 kHz for the common murre. Hansen et al. (2020) conducted a series of playback experiments to test whether common murres responded to, and were disrupted by, underwater sound. Underwater broadband sound bursts and mid-frequency naval 53 C sonar signals were presented to two common murres in a quiet pool. The received sound pressure levels varied from 110 to 137 dB re 1 µPa. Both murres showed consistent reactions to sounds of all intensities, as compared to no reactions during control trials. The authors' findings indicate that common murres may be affected by, and therefore potentially also vulnerable to, underwater noise.

Diving birds may not hear as well underwater, compared to other (non-avian) species, based on adaptations to protect their ears from pressure changes (Dooling & Therrien, 2012). Because reproduction and communication with conspecifics occurs in air, adaptations for diving may have evolved to protect in-air hearing ability and may contribute to reduced sensitivity underwater (Hetherington, 2008). There are many anatomical adaptations in diving birds that may reduce sensitivity both in air and underwater. Anatomical ear adaptations are not well investigated, but include cavernous tissue in the meatus and middle ear that may fill with blood during dives to compensate for increased pressure on the tympanum, active muscular control of the meatus to prevent water entering the ear, and interlocking feathers to create a waterproof outer covering (Crowell et al., 2015; Rijke, 1970; Sade et al., 2008). The northern gannet, a plunge diver, has unique adaptations to hitting the water at high speeds, including additional air spaces in the head and neck to cushion the impact and a thicker tympanic membrane than similar-sized birds (Crowell et al., 2015). All of these adaptions could explain the measured higher hearing thresholds of diving birds.

Although important to seabirds in air, it is unknown if seabirds use hearing or vocalizations underwater for foraging, communication, predator avoidance, or navigation (Crowell, 2016; Dooling & Therrien, 2012). Some scientists suggest that birds must rely on vision rather than hearing while underwater (Hetherington, 2008), while others suggest birds must rely on an alternative sense in order to coordinate cooperative foraging and foraging in low light conditions (e.g., night, depth) (Dooling & Therrien, 2012).

Crowell et al. (2015) also compared the vocalizations of the same diving bird species discussed above to the region of highest sensitivity of in-air hearing. Of the birds studied, vocalizations of only eight species were obtained due to the relatively silent nature of two of the species. The peak frequency of the vocalizations of seven of the eight species fell within the range of highest sensitivity of in-air hearing. They suggested that the colonial nesters tested had relatively reduced hearing sensitivity because they relied on individually distinctive vocalizations over short ranges. Additionally, species with more sensitive hearing were those associated with freshwater habitats, which are relatively quieter compared to marine habitats with associated wind and wave noise (Crowell et al., 2015).

3.6.1.1.6 General Threats

The Navy conducted a literature search for new information since the publication of the 2015 NWTT Final EIS/OEIS on general threats that may change the analysis of potential impacts on birds. The 2015 NWTT Final EIS/OEIS analyzed commercial and recreational fishing gear, predation by introduced species, habitat loss, disturbance and degradation of nesting and foraging areas by humans and domesticated animals, noise pollution from construction and other human activities, nocturnal collisions with power lines and artificial lights, collisions with aircraft, and pollution from oil spills and plastic debris. In addition, seabird distribution, abundance, breeding, and other behaviors are affected by cyclical environmental events, such as the El Niño Southern Oscillation and Pacific Decadal Oscillation in the Pacific Ocean (Congdon et al., 2007; Vandenbosch, 2000). Other general threats include exposure to marine polychlorinated biphenyls (PCBs) in prey; changes in prey abundance, availability and quality; harmfal algal blooms, biotoxins and dead zones; derelict fishing gear that causes entanglement; energy development projects leading to mortality; disturbance, injury, and mortality in the marine environment from exposures to elevated sound levels; and climate change in the Pacific Northwest (U.S. Fish and Wildlife Service, 2009).

Since the publication of the 2015 NWTT Final EIS/OEIS, a more complete understanding of potential climate change-related impacts on water quality, which in turn may impact prey base, has been included in this Supplemental and summarized below. Section 3.1 (Sediments and Water Quality) describes the updated information included in this Supplemental in regards to potential impacts on water quality from climate change. These changes (e.g., air and sea temperatures, precipitation, frequency and intensity of storms, pH level of sea water, and sea level rise) may potentially impact seabirds by reducing overall marine productivity and biodiversity, which could affect the food resources, distribution, and reproductive success of seabirds (Aebischer et al., 1990; Congdon et al., 2007; Duffy, 2011; North American Bird Conservation Initiative & U.S. Committee, 2010). These same climate-related changes (e.g., air and sea temperatures, precipitation, frequency and intensity of storms, and sea level rise) may potentially impact landbirds, including shorebirds and those more inland. Other climate change-related threats to birds in general include wildfires. Wildfire frequency in the western forests has nearly quadrupled when compared to the average of the period between 1970 and 1986 (U.S. Fish and Wildlife Service, 2009). The length of the fire season is longer, and the area burned is larger then it has been in the past. Scientists predict that wildfires will increase and that the area burned by fire in the Pacific Northwest will double by the 2040s and triple by the 2080s (U.S. Fish and Wildlife Service, 2009). This increase in fire frequency, duration, and severity would decrease the available habitat for birds. In the long term, climate change could be the largest threat to birds.

Specifically within the Study Area, the Navy's literature search found new information regarding recent regional impacts on seabirds associated with warming ocean temperatures. The National Marine Fisheries Service (2016a) noted a period of elevated air and sea temperatures have acted effectively as a heat wave in the Bering Sea and northern portion of the Gulf of Alaska, where 2016 temperatures represented a short-term climate event on top of a baseline overall warming trend. These warming trends have caused cyclic summer die-offs of seabirds in the past, with die-offs associated with starvation (U.S. Fish and Wildlife Service, 2015). Since 2015, there are reports of dead northern fulmars, black- and red-legged kittiwakes (*Rissa tridactyla* and *Rissa brevirostris*), shearwaters, murres, and auklets washing ashore in Alaska, all showing signs of starvation, likely due to warming temperature effects on prey base (Liao, 2019).

Plastic debris is abundant and pervasive in the world oceans and, because of its durability, is continuing to increase. The ingestion of plastics by seabirds such as albatrosses and shearwaters occurs with high frequency and is of particular concern. Potential impacts to birds and other wildlife from ingesting plastic and other debris include reduced food consumption due to lower available stomach volume and therefore poorer fat deposition and body condition, physical damage to the digestive tract, and obstruction of the digestive tract which may result in starvation. Additional risks of anthropogenic debris ingestion include the transfer of pollutants and bioaccumulation of plastic-derived chemicals in body tissues, toxicity via uptake of persistent organic pollutants absorbed by plastic particles, and the translocation of microscopic plastics to other organ systems (Roman et al., 2016). The rates of plastic ingestion by seabirds are closely related to the concentrations of plastics in different areas of the ocean due to waste discharges and ocean currents and are increasing (Kain et al., 2016; Wilcox et al., 2015).

The impacts from entanglement of marine species in marine debris are clearly profound, and in many cases, entanglements appear to be increasing despite efforts over four decades to reduce the threat. Many coastal states have undertaken certain efforts to reduce entanglement rates through marine debris clean-up measures and installed fishing line recycle centers at boat landings in part due to entanglement of seabirds and other marine species. One such program is Northwest Straits Initiative's Derelict Fishing Gear Program, which removes nets from Puget Sound waters using commercial divers under protocols that were designed in partnership with Washington State Department of Fish and Wildlife and Department of Natural Resources (Northwest Straits Foundation, 2017).

Fishing-related gear, balloons, and plastic bags were estimated to pose the greatest entanglement risk to marine fauna. In contrast, experts identified a broader suite of items of concern for ingestion, with plastic bags and plastic utensils ranked as the greatest threats. Entanglement and ingestion affected a similar range of taxa, although entanglement was rated as slightly worse because it is more likely to be lethal. Contamination was scored the lowest in terms of impact, affecting a smaller portion of the taxa and being rated as having solely non-lethal impacts (Wilcox et al., 2016).

Seabird bycatch from commercial fisheries may also have population-level impacts to seabirds, particularly smaller populations of the ESA-listed marbled murrelet and short-tailed albatross. Total estimated seabird bycatch in the Alaska federal groundfish and halibut fisheries for all gear types and management plans for 2010-2019 showed an annual average of 3 short-tailed albatross and 36 auklets (the category that includes marbled murrelets) caught as bycatch (Krieger & Eich, 2020). However, for the west coast fisheries within the NWTT action area, there were no reports of short-tailed albatross or murrelet bycatch estimates in 2005, 2010, 2011-2013, and 2014-2015 (National Marine Fisheries Service, 2011, 2013, 2016c, 2019).

3.6.1.2 Marbled Murrelet

The marbled murrelet was listed by the USFWS as a threatened species in Washington, Oregon, and California in 1992 (57 Federal Register [FR] 45328); the marbled murrelet is not ESA-listed in Alaska. Terrestrial critical habitat was designated in 1996 (61 FR 26256) and revised in 2011 (76 FR 61599) in mature and old-growth forest nesting habitat within 48 km of the coast in Washington, Oregon, and California (Figure 3.6-1). No critical habitat is currently designated or proposed in the marine environment. There has been no change in the amount of critical habitat since the publication of the 2015 NWTT Final EIS/OEIS.

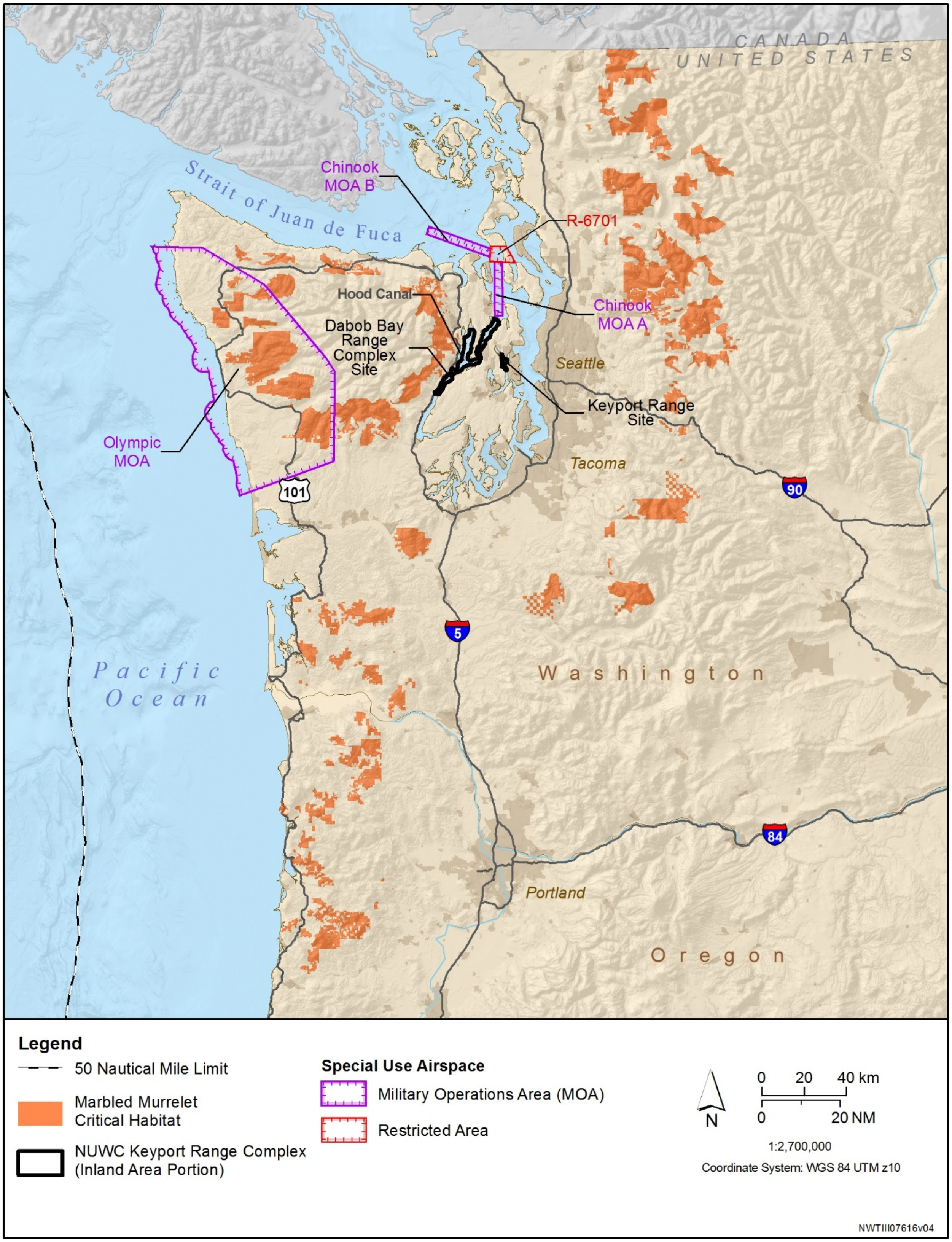

Figure 3.6-1: Critical Habitat for the Marbled Murrelet

As with the 2015 NWTT Final EIS/OEIS, the Study Area analyzed in this Supplemental to address potential impacts on marbled murrelets includes the Offshore Area and Inland Waters in Washington. The Washington Offshore Area primarily includes waters from 3 NM seaward except for an area at Pacific Beach where the Study Area extends to shore (see Figure 2.2-2). As with the 2015 NWTT Final EIS/OEIS, the Study Area analyzed in this Supplemental also includes areas off the coast of Oregon and Northern California from 12 NM from the coastline and extending seaward.

In 1997, the marbled murrelet recovery plan established six marbled murrelet conservation zones (Figure 3.6-2) (U.S. Fish and Wildlife Service, 1997). The conservation zones were established to assist in the design of management actions and the evaluation of impacts at multiple scales and do not have any regulatory requirements.

Murrelets within the Study Area that may be affected by proposed Navy training and testing activities are found in Conservation Zones 1 and 2 (Figure 3.6-2). Conservation Zone 1 includes the Inland Waters portion of the Study Area. This includes all the waters of Puget Sound and most waters of the Strait of Juan de Fuca south of the U.S.-Canada border. Conservation Zone 2 extends the length of the Washington coast.

Conservation Zones 3 and 4 are between the shoreline and the Study Area, but are not within the Offshore area. However, activities occurring in the Study Area offshore of Conservation Zones 3 and 4 could affect marbled murrelets associated with these zones. Additionally, individual marbled murrelets from any of the Conservation Zones (1 through 6) could occur in the Study Area due to the birds' transient nature (U.S. Fish and Wildlife Service, 2016, 2018).

Marbled murrelets are unique among alcids in their use of old-growth forest stands (Falxa & Raphael, 2016). Marbled murrelets do not build a nest but use natural features, such as moss, clumps of mistletoe, or piles of needles as a nest site on tree limbs. Nests are in large conifers in coastal old-growth forests in the Pacific Northwest (Lorenz et al., 2016). Nesting season is asynchronous between April 1 and September 23. During the breeding season, murrelets trend to forage in well-defined areas along the shoreline in relatively shallow marine waters. Important features in nesting habitat are large, mossy limbs in forest canopy (Lorenz et al., 2016).

Since the publication of the 2015 NWTT Final EIS/OEIS, the Navy's literature review, and information included in the 2016 USFWS BO (U.S. Fish and Wildlife Service, 2016), new information is available regarding nesting ecology of marbled murrelet. Falxa and Raphael (2016) assessed various terrestrial and marine factors that were important for murrelet spatial distribution and also determined that prey abundance in waters in close proximity to breeding habitat was likely contributing to murrelet declines. They also studied contributing factors to declining spatial distributions in nesting habitats and determined that fire was the major cause of declines in Washington State on federal properties and timber harvesting the major factor on non-federal lands. Further, Falxa and Raphael (2016) found no similar trends in Oregon and California; spatial distributions in these areas appear to be relatively stable compared to declining distributions in Washington State.

The first observed marbled murrelet ground nest within the listed range was found within Olympic National Park in Washington. This nest was on a cliff and appeared to have similar characteristics as a traditional tree limb nest; however, in the year that it was found, it was not successful as the chick was found at the base of the cliff (Wilk et al., 2016).

Sources: U.S. Fish and Wildlife Service, 1997; 76 FR 61599.

Figure 3.6-2: Marbled Murrelet Critical Habitat and Conservation Zones

Since the publication of the 2015 NWTT Final EIS/OEIS, the Navy's literature review, and information included in the 2016 and 2018 USFWS BOs (U.S. Fish and Wildlife Service, 2016, 2018), new information is available regarding at-sea occurrence of marbled murrelets. Specifically, the foraging range for murrelets may extend farther than previously analyzed, out to 5 km offshore and out to 50 km offshore of Alaska (U.S. Fish and Wildlife Service, 2016); however, murrelets tend to be distributed in marine waters adjacent to areas of suitable breeding habitat (Falxa & Raphael, 2016; Raphael et al., 2007). In addition, marbled murrelets captured on the outer Washington coast had larger marine ranges than those in the Puget Sound/Straits of Juan de Fuca (U.S. Fish and Wildlife Service, 2019).

The occurrence of marbled murrelets in marine waters is driven by prey availability. Prey availability varies depending on a variety of factors, but especially upwelling conditions created by seawater temperature changes and seafloor topography. The foraging habits of marbled murrelets change depending on whether they are nesting and provisioning young. During the breeding season, marbled murrelets generally forage in waters within 1 NM of shore out to depths of about 1,300 ft. and are reported to dive at least as deep as 90 ft., based on their capture in gillnets set at this depth (Raphael et al., 2007; U.S. Fish and Wildlife Service, 2005a). In the 2016 USFWS BO, it was determined that marbled murrelets were reasonably certain to occur <3 to 12 NM from shore in summer and <50 NM from shore in winter (U.S. Fish and Wildlife Service, 2016). Marbled murrelet calculations were not considered for >12 NM in summer, nor >50 NM in winter as occurrences at these distances and during these seasons were determined discountable. For the purposes of the NWTT Phase II consultation, USFWS assumed the breeding season density of murrelets in offshore waters >12 NM to be so low that they are unlikely to be observed. Additionally, USFWS assumed the murrelet population during non-breeding season is mixed and randomly distributed. USFWS was "reasonably certain" that marbled murrelets occur in the offshore waters out to a distance of 50 NM during the winter or non-breeding season (U.S. Fish and Wildlife Service, 2016).

The species' wintering range is poorly understood but includes most of the marine areas used for foraging during the breeding season (Raphael et al., 2007). Murrelets exhibit seasonal redistributions during non-breeding seasons. Generally, murrelets are more dispersed and found farther offshore in winter in some areas, although higher concentrations still occur close to shore and in protected waters (U.S. Fish and Wildlife Service, 2016). The farthest offshore records of murrelet distribution are 60 km off the coast of Northern California in October (2011), 46 km off the coast of Oregon in February (2012) (Adams et al., 2014), and at least 300 km off the coast in Alaska (Piatt et al., 2007); however, these pelagic occurrences are considered rare.

The 2018 marbled murrelet population density estimate for Conservation Zones 1 through 5 is 2.56 birds per square kilometer, and a population size of 22,521 birds (McIver et al., 2020). Overall, the 2001–2019 data show an average annual rate of change of -2.2 percent in Conservation Zone 2 (Offshore Area) (Figure 3.6-2). At the Conservation Zone scale, Zone 2 has a negative slope through 2019, but the confidence interval overlaps zero, indicating no conclusive evidence for a population trend (McIver et al., 2020).

Under the Northwest Forest Plan survey effort, surveys are conducted from shore out to 5 km in Conservation Zones 1 and 3, to 8 km in Conservation Zone 2, and to 3 km in Conservation Zones 4 and 5. Details can be found in Pearson et al. (2018).

Survey data is limited for marbled murrelets beyond 8 km of the nearshore coastal areas, and the proportion and density of the population that occurs offshore during the non-breeding season is still unknown. In order to understand the marine distribution further, the Navy (Pacific Fleet) funded spring and winter line-transect pelagic surveys from 2017 to 2019 off the Washington coast.

However, there are observations of marbled murrelets in the offshore Study Area as indicated in Figure 3.6-3 and Figure 3.6-4. Ongoing surveys and analyses, as well as the review of other data sources, provided information for updating marbled murrelet occurrences in the Study Area since the 2016 and 2018 BOs (Menza et al., 2016; U.S. Fish and Wildlife Service, 2016, 2018) as well as depicting marbled murrelet observations during the breeding season (April 1–September 23) and non-breeding season (September 24 – March 31) based on pelagic surveys conducted by the Washington Department of Fish and Wildlife (2016–2019), U.S. Geological Survey's North Pacific Pelagic Seabird Database (1987–2010), NMFS' Groundfish Observation data (2002–2018), and observations from eBird (1971–2019) (eBird, 2019: https://ebird.org/species/marmur/).

Based on the review of above-mentioned observational data, as well as survey data from the Northwest Forest Plan dataset, assumptions were made regarding the various distances marbled murrelets are likely to occur within the NWTT Offshore areas. These distances are depicted as colored bands in Figure 3.6-3 and Figure 3.6-4 during both the breeding and non-breeding seasons. In addition to these Northwest Forest Plan survey data that depict the "likelihood" of marbled murrelet occurrence, the other marbled murrelet observations are important in assessing how far offshore murrelets may occur.

In their BO for ESA consultation on the Proposed Action in the 2015 NWTT Final EIS/OEIS, the USFWS analyzed the proposed activities for both the "reasonably certain" scenario and the "reasonably worst-case scenario" (U.S. Fish and Wildlife Service, 2016). For the "reasonably certain" scenario, the following ranges were used to calculate number of birds within the NWTT Study Area: marbled murrelets were reasonably certain to occur <3 NM in summer, 3 to 12 NM in summer, and <50 NM in winter. Marbled murrelet calculations were not considered for >12 NM in summer, nor >50 NM in winter as occurrences at these distances and during these seasons were determined discountable. For the purposes of the 2016 ESA consultation, USFWS assumed the breeding season density of murrelets in offshore waters further than 22 km (12 NM) to be so low that they are unlikely to be observed. Additionally, USFWS assumed the murrelet population during non-breeding season is mixed and randomly distributed. USFWS was "reasonably certain" that marbled murrelets occur in the offshore waters out to a distance of 50 NM during the winter.

The Inland Waters are within marbled murrelet Conservation Zone 1 (Figure 3.6-2). Population and density estimates for Conservation Zone 1 are based on USFWS surveys conducted during the 2001–2019 breeding seasons. Overall, the 2001–2019 data show an average annual rate of change of -4.8 percent in Conservation Zone 1 (McIver et al., 2020).

3.6.1.3 Short-Tailed Albatross

The largest of the North Pacific albatrosses, the short-tailed albatross was listed as endangered under the ESA throughout its range in July 2000 (65 FR 46643); critical habitat has not been designated for this species (U.S. Fish and Wildlife Service, 2005b). The species is a surface feeder and scavenger, and predominately takes prey by surface-seizing, not diving (U.S. Fish and Wildlife Service, 2008).

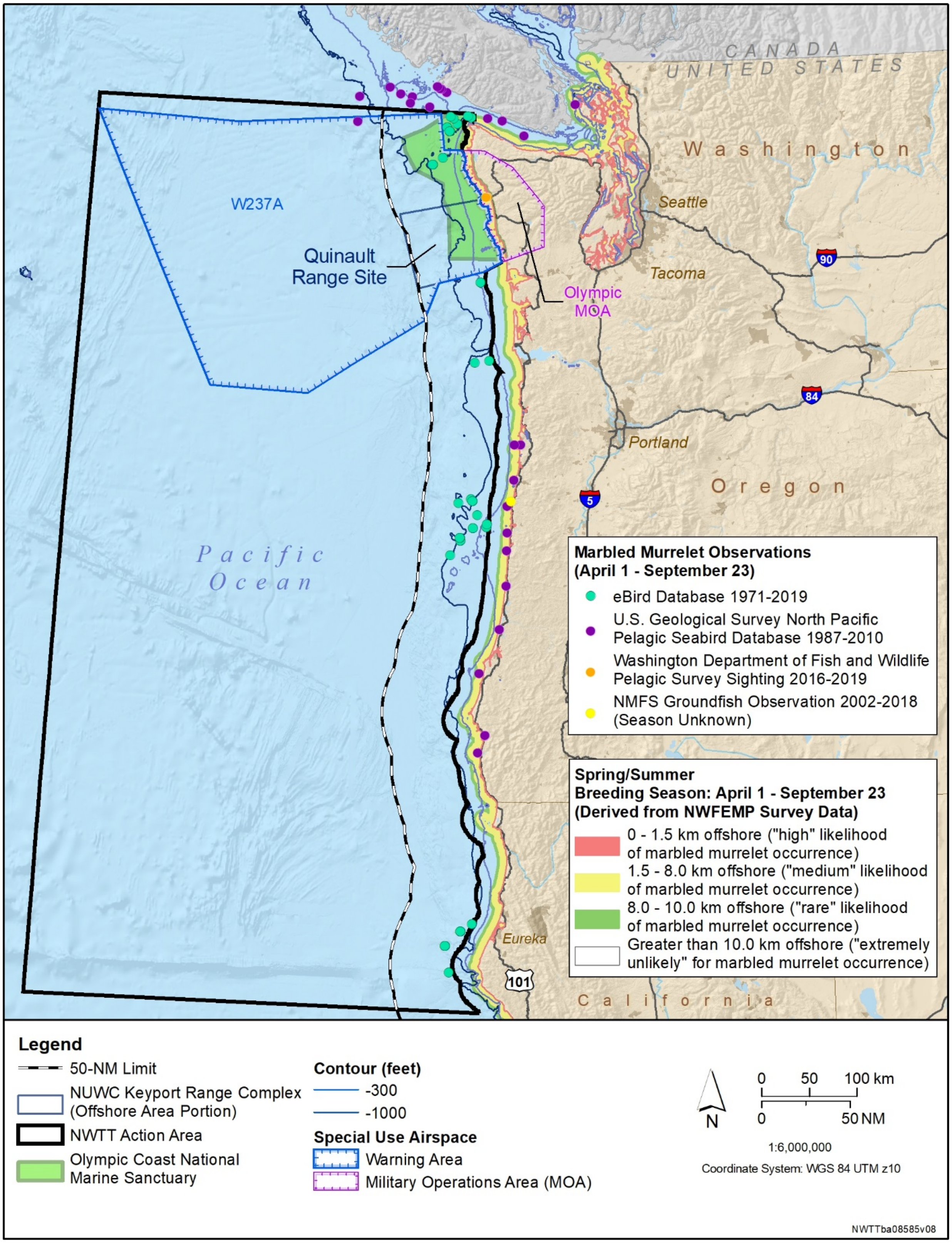

Figure 3.6-3: Occurrences of Marbled Murrelet Within the NWTT Offshore Area During the Breeding Season (April 1–September 23)

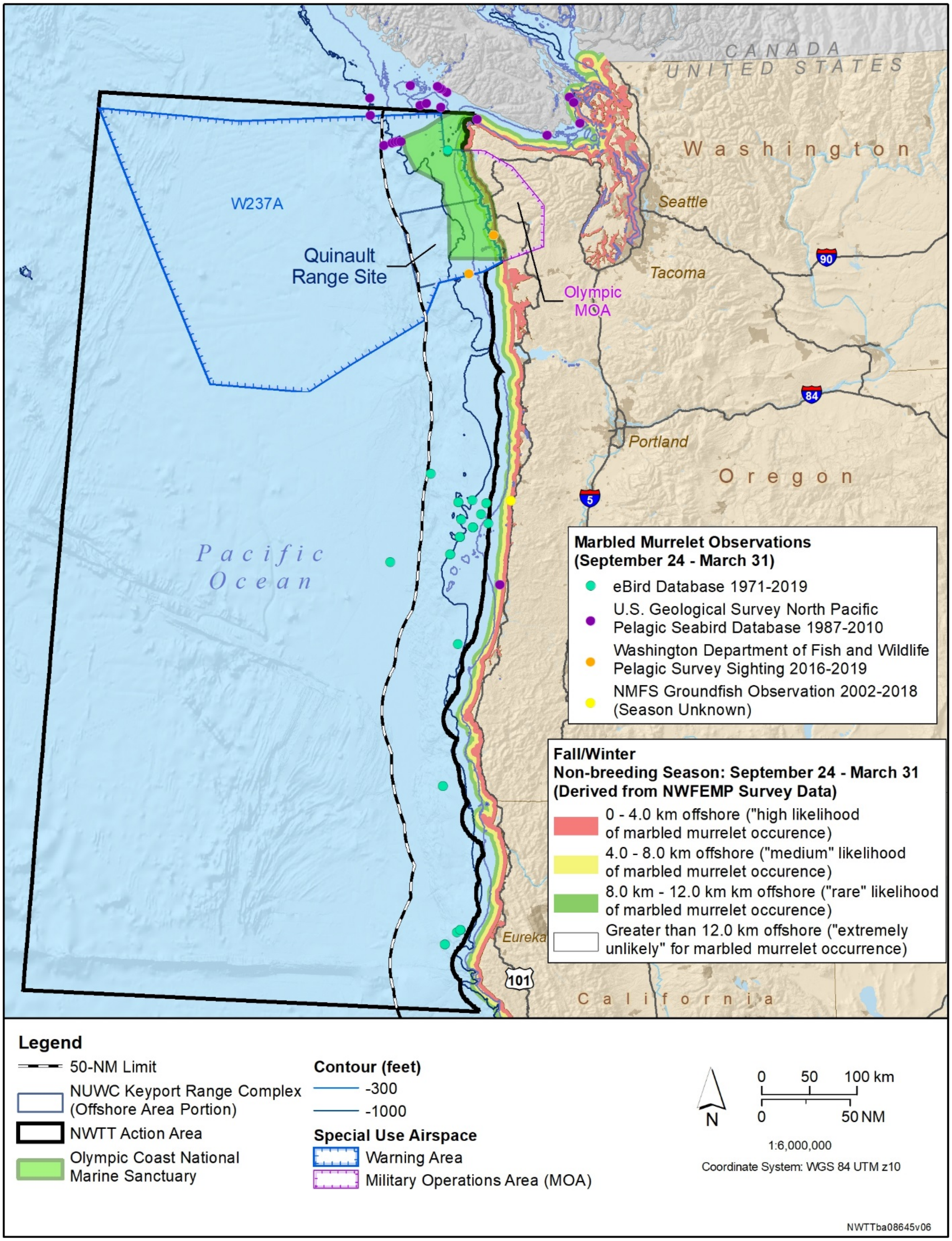

Figure 3.6-4: Occurrences of Marbled Murrelet Within the NWTT Offshore Area During the Non-Breeding Season (September 24–March 31)

Since the publication of the 2015 NWTT Final EIS/OEIS, the 2016 USFWS BO included more recent information regarding nesting ecology and life history information (U.S. Fish and Wildlife Service, 2016); however, these new sources concern recovery efforts and fisheries interactions reductions in the western Pacific outside of the Study Area. New information, however, is available from Orben et al. (2018a), who suggest that juveniles show strong seasonal changes in distributions, traveling more in winter and occupying regions not typically used by adults. While adult short-tailed albatrosses forage over both oceanic and neritic habitats across the North Pacific, concentrating along biologically productive shelf-break areas, juveniles appear to use shelf-based habitats more, especially in the Sea of Okhotsk, Bering Sea, and along the U.S. West Coast. During their initial flight years, juvenile short-tailed albatrosses use a large portion of the North Pacific from tropical to arctic waters, including the transition zone, California Current system, sub-arctic gyres, and the marginal seas: the Bering Sea and Sea of Okhotsk. As juvenile albatrosses age, habitat use switches away from pelagic regions to shelf break and slope habitats, becoming more similar to adult distributions, as anticipated from prior studies summarized in the 2015 NWTT Final EIS/OEIS and 2016 USFWS BO, yet juveniles continue to explore new regions with low levels of spatial fidelity (Orben et al., 2018b; Suryan & Kuletz, 2018).

Juveniles and subadults are most likely to occur in the Offshore Area sporadically, primarily during summer and early fall. Adults may wander into the area outside the breeding season or during years when they do not nest. Although the short-tailed albatross population continues to grow, available data indicate that sightings of this species off the coasts of Washington, Oregon, and Northern California are very rare. For example, eBird, an online, citizen-based checklist program developed by the Cornell Lab of Ornithology and National Audubon Society, has records for sightings of 49 individual short-tailed albatross from 1969 through March 2019 off the coasts of Washington, Oregon, and Northern California (eBird, 2019: https://ebird.org/species/shtalb/). Of the 242 short-tailed albatross sightings recorded during International Pacific Halibut Commission stock assessment surveys from 2002 to 2013, none were in waters off Washington, Oregon, or Northern California (Geernaert, 2013). However, data from U.S. Geological Survey's North Pacific Pelagic Seabird Database (1987–2010) and NMFS' Groundfish Observation data (2002–2018) provide a summary of occurrences within the NWTT Offshore Area, particularly along the 1,000-ft. bathymetric contour and within the 12–50 NM distances offshore (Figure 3.6-5).

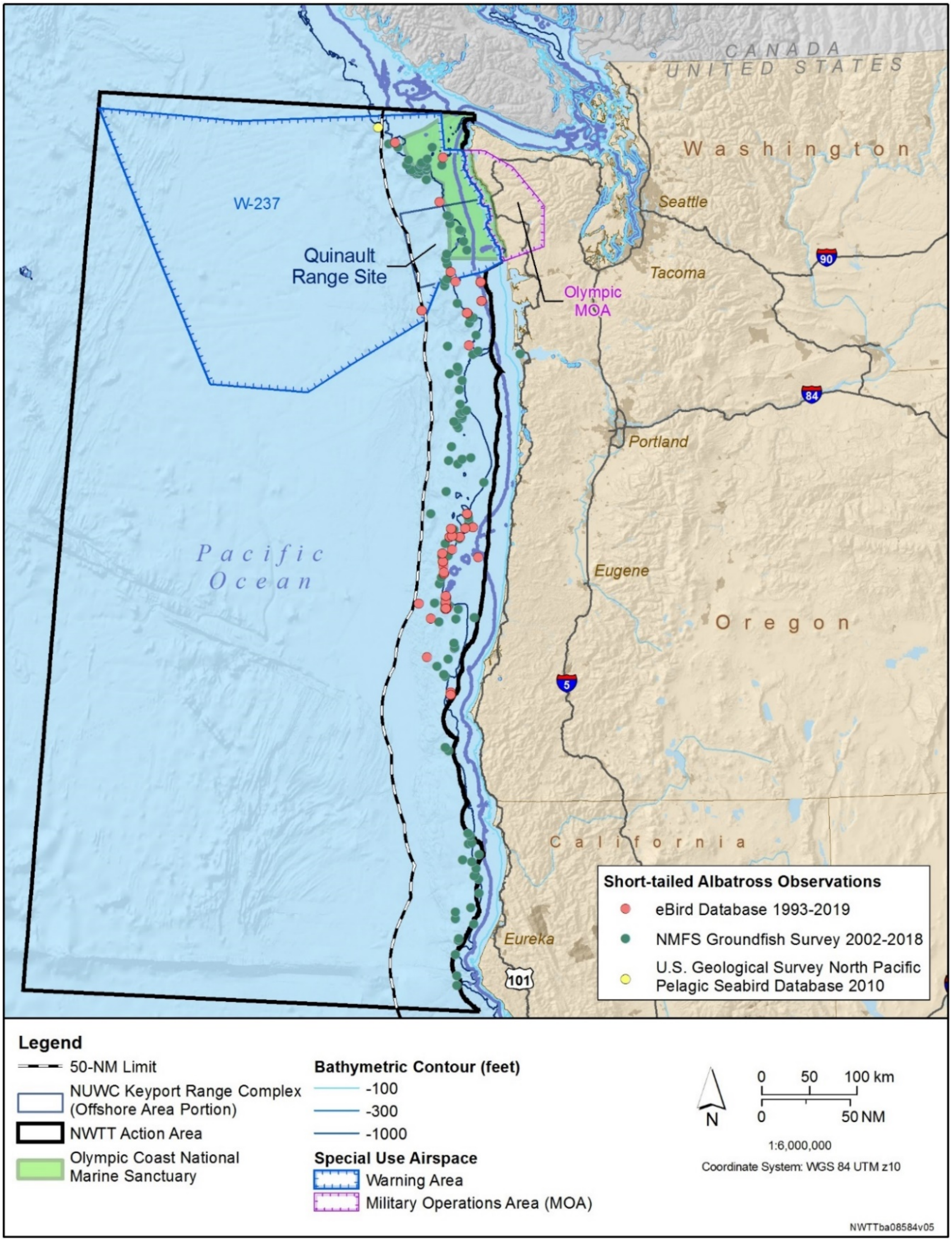

Figure 3.6-5: Occurrences of Short-Tailed Albatross Within the NWTT Offshore Area

3.6.2 Environmental Consequences

In the Proposed Action for this Supplemental, there have been some modifications to the quantity and type of acoustic stressors under the two action alternatives. Because of new activities being proposed, two new stressors would be introduced that are analyzed for their potential effects on marine bird species: high-energy lasers (as an Energy stressor), as detailed in Section 3.0.3.3.2.2 (High-Energy Lasers), and biodegradable polymer (as an Entanglement stressor), as detailed in Section 3.0.3.5.3 (Biodegradable Polymer).

In the 2015 NWTT Final EIS/OEIS, the Navy considered all potential stressors associated with ongoing training and testing activities in the Offshore Area, Inland Waters, and the Western Behm Canal and then analyzed their potential impacts on birds in the Study Area. In this Supplemental, the Navy has reviewed the analysis of impacts from these ongoing activities and additionally analyzed new or changing military readiness activities as projected into the reasonably foreseeable future. The Navy has completed a literature review for information on birds within the Study Area, which included a search for the best available science since the publication of the 2015 NWTT Final EIS/OEIS. Where there has been no substantive or otherwise meaningful change in the action, science, or regulations, the Navy will rely on the previous 2015 NWTT Final EIS/OEIS analysis. Where there has been substantive change in the action, science, or regulations, the information provided in this document will supplement the 2015 NWTT Final EIS/OEIS to support environmental compliance with applicable environmental statutes for birds.

Use of acoustic stressors (sonar and other transducers) and use of explosives have occurred since the 2015 completion of the NWTT Final EIS/OEIS Record of Decision and conclusion of the formal consultation process between the Navy and USFWS in 2016. See Chapter 2 (Description of Proposed Action and Alternatives) for a comparison of all alternatives and a comparison to activities proposed in the 2015 NWTT Final EIS/OEIS. There have been no known additional impacts on bird populations or bird habitats in terrestrial or marine environments that were not accounted for in the 2015 NWTT Final EIS/OEIS (U.S. Department of the Navy, 2015) or the 2016 USFWS BO pursuant to ESA (U.S. Fish and Wildlife Service, 2016). In addition, the Navy will be including a number of measures and adjustments in activities that would reduce potential impacts on the marbled murrelet.

There has been no emergent science that would necessitate changes to conclusions reached by Navy in the 2015 NWTT Final EIS/OEIS regarding those other dismissed stressors as having a negligible and/or discountable impact on bird populations or species. The analysis presented in this section of this Supplemental also considers standard operating procedures that are described in Chapter 2 (Description of Proposed Action and Alternatives), mitigation measures that are described in Chapter 5 (Mitigation), and in Appendix K (Geographic Mitigation Assessment), which defines mitigation areas designed to avoid or reduce potential impacts on birds (e.g., distance from shore restrictions on the use of explosives). The Navy would implement these measures to avoid or reduce potential impacts on birds from stressors associated with the proposed training and testing activities. The Navy coordinated its mitigation development with USFWS through the ESA consultation process.

The potential stressors associated with the training and testing activities in the Study Area include the following, which will be analyzed for potential impacts on birds within the stressor categories below:

- **Acoustic** (sonar and other transducers, vessel noise, aircraft noise, weapons noise)
- **Explosives** (explosive shock wave and sound, explosive fragments)
- **Energy** (in-water electromagnetic devices, and high-energy lasers, radar)

- **Physical disturbance and strike** (vessels and in-water devices, aircraft and aerial targets, and military expended materials)
- **Entanglement** (wires and cables, decelerators/parachutes, biodegradable polymer)
- **Ingestion** (military expended materials other than munitions)
- **Secondary** (impacts on habitat; impacts on prey availability)

This section of this Supplemental evaluates how and to what degree potential impacts on birds from stressors described in Section 3.0.1 (Overall Approach to Analysis) may have changed since the analysis presented in the 2015 NWTT Final EIS/OEIS was completed. Tables 2.5-1, 2.5-2, and 2.5-3 in Chapter 2 (Description of Proposed Action and Alternatives) list the proposed training and testing activities and include the number of times each activity would be conducted annually and the locations within the Study Area where the activity would typically occur under each alternative. The tables also present the same information for activities described in the 2015 NWTT Final EIS/OEIS so that the proposed levels of training and testing under this supplemental can be easily compared.

3.6.2.1 Acoustic Stressors

Section 3.6.3.1 (Acoustic Stressors) in the 2015 NWTT Final EIS/OEIS provides an overview of seabird hearing, including an explanation of how birds can suffer injury, hearing loss, and physiological stress, as well as various behavioral reactions exhibited by birds when a noise event induces a response. Although it was assumed nesting colonial waterbirds would be more likely to flush or exhibit a mob response when disturbed, observations of nesting black skimmers (*Rhynchops niger*) and nesting least terns (*Sternula antillarum*), gull-billed terns (*Gelochelidon nilotica*), and common terns (*Sterna hirundo*) showed they did not modify nesting behavior in response to military fixed-wing aircraft engaged in low-altitude tactical flights and rotary-wing overflights (Hillman et al., 2015). In addition, long-term consequences associated with noise-induced impacts are discussed in the 2015 NWTT Final EIS/OEIS in Section 3.6.3.1 (Acoustic Stressors).

3.6.2.1.1 Background

The sections below include a survey and synthesis of best-available science published in peer-reviewed journals, technical reports, and other scientific sources pertinent to impacts on birds potentially resulting from sound-producing Navy training and testing activities. Impacts on birds depends on the sound source and context of exposure. Possible impacts include auditory or non-auditory trauma; hearing loss resulting in temporary or permanent hearing threshold shift; auditory masking; physiological stress; or changes in behavior, including changing habitat use and activity patterns, increasing stress response, decreasing immune response, reducing reproductive success, increasing predation risk, and degrading communication (Larkin et al., 1996). Numerous studies have documented that birds and other wild animals respond to human-made noise (Bowles et al., 1994; Larkin et al., 1996; National Park Service, 1994). The manner in which birds respond to noise could depend on species' physiology life stage, characteristics of the noise source, loudness, onset rate, distance from the noise source, presence/absence of associated visual stimuli, and previous exposure. Noise may cause physiological or behavioral responses that reduce the animals' fitness or ability to grow, survive, and reproduce successfully.

The types of birds exposed to sound-producing activities depend on where training and testing activities occur. Birds in the study area can be divided into three groups based on breeding and foraging habitat: (1) those species such as albatrosses, petrels, frigatebirds, alcids, jaegers, and some terns that forage over the ocean and nest on coastlines and oceanic islands; (2) species such as pelicans, cormorants, gulls, and some terns that nest along the coast and forage in nearshore areas; and (3) those species such as jaegers, some gull and tern species, grebes, scoters, and ducks and loons that nest and forage along the coast and inland habitats and come to the coastal areas during non-breeding season. In addition, birds that are typically found inland, such as songbirds, may occur in large numbers flying over open ocean areas during annual spring and fall migration periods.

Birds could be exposed to sounds from a variety of sources. While above the water surface, birds may be exposed to airborne sources such as pile driving, weapons noise, vessel noise, and aircraft noise. While foraging and diving, birds may be exposed to underwater sources such as sonar, pile driving, air guns, and vessel noise. While foraging birds will be present near the water surface, migrating birds may fly at various altitudes.

Seabirds use a variety of foraging behaviors that could expose them to underwater sound. Most seabirds plunge-dive from the air into the water or perform aerial dipping (the act of taking food from the water surface in flight); others surface-dip (swimming and then dipping to pick up items below the surface) or jump-plunge (swimming, then jumping upward and diving underwater). Birds that feed at the surface by surface or aerial dipping with limited to no underwater exposure include petrels, jaegers, and phalaropes. Birds that plunge-dive are typically submerged for short durations, and any exposure to underwater sound would be very brief. Birds that plunge-dive include albatrosses, some tern species, boobies, gannets, shearwaters, and tropicbirds. Some birds, such as cormorants, seaducks, alcids, and loons pursue prey under the surface, swimming deeper and staying underwater longer than other plunge-divers. Some of these birds may stay underwater for up to several minutes and reach depths between 50 and 550 ft. (Alderfer, 2003; Durant et al., 2003; Jones, 2001; Lin, 2002; Ronconi, 2001). Birds that forage near the surface would be exposed to underwater sound for shorter periods of time than those that forage below the surface. Exposures of birds that forage below the surface may be reduced by destructive interference of reflected sound waves near the water surface (see Appendix D, Acoustic and Explosive Concepts). Sounds generated underwater during training and testing would be more likely to impact birds that pursue prey under the surface, although as previously stated, little is known about seabird hearing ability underwater.

3.6.2.1.1.1 Injury

Auditory structures can be susceptible to direct mechanical injury due to high levels of impulsive sound. This could include tympanic membrane rupture, disarticulation of the middle ear ossicles, and trauma to the inner ear structures such as hair cells within the organ of Corti. Auditory trauma differs from auditory fatigue in that the latter involves the overstimulation of the auditory system, rather than direct mechanical damage, which may result in hearing loss (see Section 3.6.2.1.1.2, Hearing Loss). There are no data on damage to the middle ear structures of birds due to acoustic exposures. Because birds are known to regenerate auditory hair cells, studies have been conducted to purposely expose birds to very high sound exposure levels (SELs) in order to induce hair cell damage in the inner ear. Because damage can co-occur with fatiguing exposures at high SELs, effects to hair cells are discussed below in Section 3.6.2.1.1.2 (Hearing Loss).

Because there is no data on non-auditory injury to birds from intense non-explosive sound sources, it may be useful to consider information for other similar-sized vertebrates. The rapid large pressure changes near non-explosive impulsive underwater sound sources, such as some large air guns and pile driving, are thought to be potentially injurious to other small animals (fishes and sea turtles). While long-duration exposures (i.e., minutes to hours) to high sound levels of sonars are thought to be injurious to fishes, this has not been experimentally observed (Popper et al., 2014). Potential for injury is generally attributed to compression and expansion of body gas cavities, either due to rapid onset of pressure changes or resonance (enhanced oscillation of a cavity at its natural frequency). Because water is considered incompressible and animal tissue is generally of similar density as water, animals would be more susceptible to injury from a high-amplitude sound source in water than in air since waves would pass directly through the body rather than being reflected. Proximal exposures to high-amplitude non-impulsive sounds underwater could be limited by a bird's surfacing response.

In air, the risk of barotrauma would be associated with high-amplitude impulses, such as from explosives (discussed in Section 3.6.2.2, Explosives Stressors). Unlike in water, most acoustic energy will reflect off the surface of an animal's body in air. Additionally, air is compressible whereas water is not, allowing energy to dissipate more rapidly. For these reasons, in-air non-explosive sound sources in this analysis are considered to pose little risk of non-auditory injury.

3.6.2.1.1.2 Hearing Loss

Exposure to intense sound may result in hearing loss that persists after cessation of the noise exposure. Hearing loss may be temporary or permanent, depending on factors such as the exposure frequency, received sound pressure level (SPL), temporal pattern, and duration. Hearing loss could impair a bird's ability to hear biologically important sounds within the affected frequency range. Biologically important sounds come from social groups, potential mates, offspring, or parents; environmental sounds; prey; or predators.

Because in-air measures of hearing loss and recovery in birds due to an acoustic exposure are limited (e.g., quail, budgerigars [*Melopsittacus undulates*], canaries, and zebra finches [*Taeniopygia guttata*] (Ryals et al., 1999); budgerigar (Hashino et al., 1988); parakeet (Saunders & Dooling, 1974); quail (Niemiec et al., 1994)), and no studies exist of bird hearing loss due to underwater sound exposures, auditory threshold shift in birds is considered to be consistent with general knowledge about noise-induced hearing loss described in the Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities (see Section 3.0.3.7). The frequencies affected by hearing loss would vary depending on the exposure frequency. The limited data on hearing loss in birds shows that the frequency of exposure is the hearing frequency most likely to be affected (Saunders & Dooling, 1974).

Hearing loss can be due to biochemical (fatiguing) processes or tissue damage. Tissue damage can include damage to the auditory hair cells and their underlying support cells. Hair cell damage has been observed in birds exposed to long duration sounds that resulted in initial threshold shifts greater than 40 dB (Niemiec et al., 1994; Ryals et al., 1999). Unlike many other animals, birds have the ability to regenerate hair cells in the ear, usually resulting in considerable anatomical, physiological, and behavioral recovery within several weeks (Rubel et al., 2013; Ryals et al., 1999). Still, intense exposures are not always fully recoverable, even over periods up to a year after exposure, and damage and subsequent recovery vary significantly by species (Ryals et al., 1999). Birds may be able to protect themselves against damage from sustained sound exposures by reducing middle ear pressure, an ability that may protect ears while in flight (Ryals et al., 1999) and from injury due to pressure changes during diving (Dooling & Therrien, 2012).

Hearing loss is typically quantified in terms of threshold shift, which is the amount (in dB) that hearing thresholds at one or more specified frequencies are elevated, compared to their pre-exposure values, at some specific time after the noise exposure. The amount of threshold shift measured usually decreases with increasing recovery time, which is the amount of time that has elapsed since a noise exposure. If the threshold shift eventually returns to zero (i.e., the hearing threshold returns to the pre-exposure value), the threshold shift is called a temporary threshold shift (TTS). If the threshold shift does not completely recover (the threshold remains elevated compared to the pre-exposure value), the remaining threshold shift is called a permanent threshold shift (PTS). Figure 3.0-3 (Chapter 3, Section 3.0.3.7.2 – Hearing Loss) shows two hypothetical threshold shifts: one that completely recovers, a TTS, and one that does not completely recover, leaving some PTS. By definition, TTS is a function of the recovery time; therefore, comparing the severity of noise exposures based on the amount of induced TTS can only be done if the recovery times are also considered. For example, a 20 dB TTS measured 24 hours post-exposure indicates a more hazardous exposure than one producing 20 dB of TTS measured only 2 minutes after exposure. If the TTS is 20 dB after 24 hours, the TTS measured after 2 minutes would be much higher. Conversely, if 20 dB of TTS is measured after 2 minutes, the TTS measured after 24 hours would likely would likely be much smaller. Studies in mammals have revealed that noise exposures resulting in high levels of TTS (greater than 40 dB) may also result in neural injury without any permanent hearing loss (Kujawa & Liberman, 2009; Lin et al., 2011). It is unknown if a similar effect would be observed in birds.

Hearing Loss due to Non-Impulsive Sounds

Behavioral studies of threshold shift in birds within their frequencies of best hearing (between 2 and 4 kHz) due to long duration (30 minutes to 72 hours) continuous, non-impulsive, high-level sound exposures in air have shown that susceptibility to hearing loss varies substantially by species, even in species with similar auditory sensitivities, hearing ranges, and body size (Niemiec et al., 1994; Ryals et al., 1999; Saunders & Dooling, 1974). For example, Ryals et al. (1999) conducted the same exposure experiment on quail and budgerigars, which have very similar audiograms. A 12-hour exposure to a 2.86 kHz tone at 112 dB re 20 µPa SPL (cumulative SEL of 158 dB re 20 µPa2-s) resulted in a 70 dB threshold shift measured after 24 hours of recovery in quail, but a substantially lower 40 dB threshold shift measured after just 12 hours of recovery in budgerigars recovered to within 10 dB of baseline after 3 days and fully recovered by one month (Ryals et al., 1999). Although not directly comparable, this SPL would be perceived as extremely loud but just under the threshold of pain for humans per the American Speech-Language-Hearing Association. Whereas the 158 dB re 20 μPa^2-s SEL tonal exposure to quail discussed above caused 20 dB of PTS (Ryals et al., 1999), a shorter (4-hour) tonal exposure to quail with similar SEL (157 dB re 20 μPa^2-s) caused 65 dB of threshold shift that fully recovered within 2 weeks (Niemiec et al., 1994).

Data on threshold shift in birds due to relatively short-duration sound exposures that could be used to estimate the onset of threshold shift is limited. Saunders and Dooling (1974) provide the only threshold shift growth data measured for birds. Saunders and Dooling (1974) exposed young budgerigars to four levels of continuous 1/3-octave band noise (76, 86, 96, and 106 dB re 20 µPa) centered at 2.0 kHz and measured the threshold shift at various time intervals during the 72-hour exposure. The earliest measurement found 7 dB of threshold shift after approximately 20 minutes of exposure to the 96 dB re 20 µPa SPL noise (127 dB re 20 μPa^2-s SEL). Generally, onset of TTS in other species has been considered 6 dB above measured threshold (Finneran, 2015), which accounts for natural variability in auditory thresholds. The Saunders and Dooling (1974) budgerigar data are the only bird data showing low levels of threshold shift. Because of the observed variability of threshold shift susceptibility among bird species and the relatively long duration of sound exposure in Saunders and Dooling (1974), the observed onset level cannot be assumed to represent the SEL that would cause onset of TTS for other bird species or for shorter duration exposures (i.e., a higher SEL may be required to induce threshold shift for shorter duration exposures).

Since the goal of most bird hearing studies has been to induce hair cell damage to study regeneration and recovery, exposure durations were purposely long. Studies with other non-avian species have shown that long-duration exposures tend to produce more threshold shift than short-duration exposures with the same SEL [e.g., see Finneran (2015)]. The SELs that induced TTS and PTS in these studies likely over-estimate the potential for hearing loss due to any short-duration sound of comparable SEL that a bird could encounter outside of a controlled laboratory setting. In addition, these studies were not designed to determine the exposure levels associated with the onset of any threshold shift or to determine the lowest SEL that may result in PTS.

With insufficient data to determine PTS onset for birds due to a non-impulsive exposure, data from other taxa are considered. Studies of terrestrial mammals suggest that 40 dB of threshold shift is a reasonable estimate of where PTS onset may begin (see (Southall et al., 2007). Similar amounts of threshold shift have been observed in some bird studies with no subsequent PTS. Of the birds studied, the budgerigars showed intermediate susceptibility to threshold shift; they exhibited threshold shifts in the range of 40 dB–50 dB after 12-hour exposures to 112 dB and 118 dB re 20 μPa SPL tones at 2.86 kHz (158–164 dB re 20 μPa^2-s SEL), which recovered to within 10 dB of baseline after 3 days and fully recovered by 1 month (Ryals et al., 1999). These experimental SELs are a conservative estimate of the SEL above which PTS may be considered possible for birds.

All of the above studies were conducted in air. There are no studies of hearing loss to diving birds due to underwater sound exposures.

Hearing Loss due to Impulsive Sounds

The only measure of hearing loss in a bird due to an impulsive noise exposure was conducted by Hashino et al. (1988), in which budgerigars were exposed to the firing of a pistol with a received level of 169 dB re 20 μPa peak SPL (two gunshots per each ear); SELs were not provided. While the gunshot frequency power spectrum had its peak at 2.8 kHz, threshold shift was most extensive below 1 kHz. Threshold shift recovered at frequencies above 1 kHz, while a 24 dB PTS was sustained at frequencies below 1 kHz. Studies of hearing loss in diving birds exposed to impulsive sounds underwater do not exist.

Because there is only one study of hearing loss in birds due to an impulsive exposure, the few studies of hearing loss in birds due to exposures to non-impulsive sound (discussed above) are the only other avian data upon which to assess bird susceptibility to hearing loss from an impulsive sound source. Data from other taxa (U.S. Department of the Navy, 2017) indicate that, for the same SEL, impulsive exposures are more likely to result in hearing loss than non-impulsive exposures. This is due to the high peak pressures and rapid pressure rise times associated with impulsive exposures.

3.6.2.1.1.3 Masking

Masking occurs when one sound, distinguished as the "noise," interferes with the detection or recognition of another sound. The quantitative definition of masking is the amount in decibels an auditory detection or discrimination threshold is raised in the presence of a masker (Erbe et al., 2016). As discussed in the Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities (Section 3.0.3.7), masking can effectively limit the distance over which an animal can communicate and detect biologically relevant sounds. Masking only occurs in the presence of the masking noise and does not persist after the cessation of the noise.

Critical ratios are the lowest ratio of signal-to-noise at which a signal can be detected. When expressed in decibels, critical ratios can easily be calculated by subtracting the noise level (in dB re 1 μPa^2/Hz) from the signal level (in dB re 1 µPa) at detection threshold. A signal must be received above the critical ratio at a given frequency to be detectable by an animal. Critical ratios have been determined for a variety of bird species (e.g., Dooling (1980), Noirot et al. (2011), Dooling and Popper (2000), and Crowell (2016)), and inter-species variability is evident. Some birds exhibit low critical ratios at certain vocal frequencies, perhaps indicating that hearing evolved to detect signals in noisy environments or over long distances (Dooling & Popper, 2000).

The effect of masking is to limit the distance over which a signal can be perceived. An animal may attempt to compensate in several ways, such as by increasing the source level of vocalizations (the Lombard effect), changing the frequency of vocalizations, or changing behavior (e.g., moving to another location, increasing visual display). Birds have been shown to shift song frequencies in the presence of a tone at a similar frequency (Goodwin & Podos, 2013), and in continuously noisy urban habitats, populations have been shown to have altered song duration and shifted to higher frequencies (Slabbekoorn & den Boer-Visser, 2006). Changes in vocalization may incur energetic costs and hinder communication with conspecifics, which, for example, could result in reduced mating opportunities. These effects are of long-term concern in constant noisy urban environments (Patricelli & Blickley, 2006) where masking conditions are prevalent.

3.6.2.1.1.4 Physiological Stress

Animals in the marine environment naturally experience stressors within their environment and as part of their life histories. Contributors to stress include changing weather and ocean conditions, exposure to diseases and naturally occurring toxins, lack of prey availability, social interactions with members of the same species, nesting, and interactions with predators. Anthropogenic sound-producing activities have the potential to provide additional stressors beyond those that naturally occur, as described in the Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities (see Section 3.0.3.7).

Chronic stress due to disturbance may compromise the general health and reproductive success of birds (Kight et al., 2012), but a physiological stress response is not necessarily indicative of negative consequences to individual birds or to populations (Larkin et al., 1996; National Park Service, 1994). The reported behavioral and physiological responses of birds to noise exposure can fall within the range of normal adaptive responses to external stimuli, such as predation, that birds face on a regular basis. These responses can include activation of the neural and endocrine systems, which can cause changes such as increased blood pressure, available glucose, and blood levels of corticosteroids (Manci et al., 1988). It is possible that individuals would return to normal almost immediately after short-term or transient exposure, and the individual's metabolism and energy budget would not be affected in the long term. Studies have also shown that birds can habituate to noise following frequent exposure and cease to respond behaviorally to the noise (Larkin et al., 1996; National Park Service, 1994; Plumpton, 2006). However, the likelihood of habituation is dependent upon a number of factors, including species of bird (Bowles et al., 1991) and frequency of and proximity to exposure. Although Andersen et al. (1990) did not evaluate noise specifically, they found evidence that anthropogenic disturbance is related to changes in home ranges; for example, raptors have been shown to shift their terrestrial home range when concentrated military training activity was introduced to the area. On the other hand, cardinals nesting in areas with high levels of military training activity (including gunfire, artillery, and explosives) were observed to have similar reproductive success and stress hormone levels as cardinals in areas of low activity (Barron et al., 2012).

While physiological responses such as increased heart rate or startle response can be difficult to measure in the field, they often accompany more easily measured reactions like behavioral responses.

A startle is a reflex characterized by rapid increase in heart rate, shutdown of nonessential functions, and mobilization of glucose reserves. Habituation keeps animals from expending energy and attention on harmless stimuli, but the physiological component might not habituate completely (Bowles, 1995).

A strong and consistent behavioral or physiological response is not necessarily indicative of negative consequences to individuals or to populations (Bowles, 1995; Larkin et al., 1996; National Park Service, 1994). For example, many of the reported behavioral and physiological responses to noise are within the range of normal adaptive responses to external stimuli, such as predation, that wild animals face on a regular basis. In many cases, individuals would return to homeostasis or a stable equilibrium almost immediately after exposure. The individual's overall metabolism and energy budgets would not be affected if it had time to recover before being exposed again. If the individual does not recover before being exposed again, physiological responses could be cumulative and lead to reduced fitness. However, it is also possible that an individual would have an avoidance reaction (i.e., move away from the noise source) to repeated exposure or habituate to the noise when repeatedly exposed.

Due to the limited information about acoustically induced stress responses, the Navy conservatively assumes in its effects analysis that any physiological response (e.g., hearing loss or injury) or significant behavioral response is also associated with a stress response.

3.6.2.1.1.5 Behavioral Reactions

Numerous studies have documented that birds and other wild animals respond to human-made noise, including aircraft overflights, weapons firing, and explosions (Larkin et al., 1996; National Park Service, 1994; Plumpton, 2006). The manner in which an animal responds to noise could depend on several factors, including life history characteristics of the species, characteristics of the noise source, sound source intensity, onset rate, distance from the noise source, presence or absence of associated visual stimuli, food and habitat availability, and previous exposure (see Section 3.0.3.7, Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities). Researchers have documented a range of bird behavioral responses to noise, including no response, head turn, alert behavior, startle response, flying or swimming away, diving into the water, and increased vocalizations (Brown et al., 1999; Larkin et al., 1996; National Park Service, 1994; Plumpton, 2006; Pytte et al., 2003; Stalmaster & Kaiser, 1997). Some behavioral responses may be accompanied by physiological responses, such as increased heart rate or short-term changes in stress hormone levels (Partecke et al., 2006).

Behavioral responses may depend on the characteristics of the noise and whether the noise is similar to biologically relevant sounds such as alarm calls by other birds and predator sounds. For example, European starlings (*Sturnus vulgaris*) took significantly longer to habituate to repeated bird distress calls than white noise or pure tones (Johnson et al., 1985). Starlings may have been more likely to continue to respond to the distress because it is a more biologically meaningful sound. Starlings were also more likely to habituate in winter than summer, possibly meaning that food scarcity or seasonal physiological conditions may affect intensity of behavioral response (Johnson et al., 1985).

<u>Behavioral Reactions to Impulsive Sound Sources</u>

Studies regarding behavioral responses by non-nesting birds to impulsive sound sources are limited. Seismic surveys had no noticeable impacts on the movements or diving behavior of long-tailed ducks undergoing wing molt, a period in which flight is limited and food requirements are high (Lacroix et al., 2003). The birds may have tolerated the seismic survey noise to stay in preferred feeding areas.

Responses to aircraft sonic booms are informative of responses to single impulsive sounds. Responses to sonic booms are discussed below in Behavioral Reactions to Aircraft.

Behavioral Reactions to Sonar and Other Active Acoustic Sources

Hansen et al. (2020) exposed two common murres to broadband sound bursts and mid-frequency active sonar playback during an underwater foraging task and found that both birds exhibited behavioral reactions to both stimuli as compared to no reactions in control trials. One subject exhibited stronger behavioral reactions to the noise bursts, and the other to the sonar. The authors found this effect for received levels between 110 and 137 dB re 1 µPa root mean squared and noted that the birds tended to turn or swim away from the sound source. This research suggests that anthropogenic noise within the birds' hearing range may cause behavioral disturbance while foraging underwater.

With respect to the effect of pingers on fishing nets, fewer common murres were entangled in gillnets when the gillnets were outfitted with 1.5 kHz pingers with a source level of 120 dB re 1 µPa; however, there was no significant reduction in rhinoceros auklet bycatch in the same nets (Melvin et al., 2011; Melvin et al., 1999). It was unknown whether the pingers elicited a behavioral response by the birds or decreased prey availability.

Behavioral Reactions to Aircraft

There are multiple possible factors involved in behavioral responses to aircraft overflights, including the noise stimulus as well as the visual stimulus.

Observations of tern colonies responses to balloon overflights suggest that visual stimulus is likely to be an important component of disturbance from overflights (Brown, 1990). Although it was assumed nesting colonial waterbirds would be more likely to flush or exhibit a mob response when disturbed, observations of nesting black skimmers and nesting least, gull-billed, and common terns showed they did not modify nesting behavior in response to military fixed-wing aircraft engaged in low-altitude tactical flights and rotary-wing overflights (Hillman et al., 2015). Maximum behavioral responses by crested tern (*Sterna bergii*) to aircraft noise were observed at sound level exposures greater than 85 A-weighted decibels (dBA) re 20 µPa. However, herring gulls (*Larus argentatus*) significantly increased their aggressive interactions within the colony and their flights over the colony during overflights with received SPLs of 101–116 dBA re 20 µPa (Burger, 1981).

Raptors and wading birds have responded minimally to jet (110 dBA re 20 µPa) and propeller plane (92 dBA re 20 µPa) overflights, respectively. Jet flights greater than 1,640 ft. distance from raptors were observed to elicit no response (Ellis, 1981). The impacts of low-altitude military training flights on wading bird colonies in Florida were estimated using colony distributions and turnover rates. There were no demonstrated impacts of military activity on wading bird colony establishment or size (Black et al., 1984). Fixed-winged jet aircraft disturbance did not seem to adversely affect waterfowl observed during a study in coastal North Carolina (Conomy et al., 1998); however, harlequin ducks (*Histrionicus histrionicus*) were observed to show increased agonistic behavior and reduced courtship behavior up to 1 to 2 hours after low-altitude military jet overflights (Goudie & Jones, 2004).

It is possible that birds could habituate and no longer exhibit behavioral responses to aircraft noise, as has been documented for some impulsive noise sources (Ellis, 1981; Russel et al., 1996) and aircraft noise (Conomy et al., 1998). Ellis (1981), found that raptors would typically exhibit a minor short-term startle response to simulated sonic booms, and there was no long-term effect to productivity.

3.6.2.1.1.6 Long-Term Consequences

Long-term consequences to birds due to acoustic exposures are considered following the Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities (see Section 3.0.3.7).

Long-term consequences due to individual behavioral reactions and short-term instances of physiological stress are especially difficult to predict because individual experience over time can create complex contingencies. It is more likely that any long-term consequences to an individual would be a result of costs accumulated over a season, year, or life stage due to multiple behavioral or stress responses resulting from exposures to multiple stressors over significant periods of time. Conversely, some birds may habituate to or become tolerant of repeated acoustic exposures over time, learning to ignore a stimulus that in the past did not accompany any overt threat. Most research on long-term consequences to birds due to acoustic exposures has focused on breeding colonies or shore habitats, and does not address the brief exposures that may be encountered during migration or foraging at sea. More research is needed to better understand the long-term consequences of human-made noise on birds, although intermittent exposures are assumed to be less likely than prolonged exposures to have lasting consequences.

3.6.2.1.2 Impacts from Sonar and Other Transducers

Sonar and other transducers emit sound waves into the water to detect objects, safely navigate, and communicate. Use of sonar and other transducers would typically be transient and temporary. General categories of sonar systems are described in Section 3.0.3.1 (Acoustic Stressors).

Information regarding the impacts of sonar on birds is limited, and little is known about the ability of birds to hear underwater. The limited information available (Crowell, 2016; Crowell et al., 2015; Crowell et al., 2016; Johansen et al., 2016; Maxwell et al., 2017) suggest the range of best hearing may shift to lower frequencies in water (Dooling & Therrien, 2012; Therrien, 2014) (see Section 3.6.1.5, Hearing and Vocalization). Because few birds can hear above 10 kHz in air, it is likely that the only sonar sources they may be able to detect are low and mid-frequency sources.

Other than pursuit diving species, the exposure to birds by these sounds is likely to be negligible because they spend only a very short time underwater (plunge-diving or surface-dipping) or forage only at the water surface. Pursuit divers may remain underwater for minutes, increasing the chance of underwater sound exposure. Any exposure would be limited to a bird's dive duration, and a bird may reduce its exposure if its dive is disrupted or the bird re-locates to another foraging area. Possible exposure also depends on whether it forages in areas where these sound sources may be used.

In addition to diving behavior, the likelihood of a bird being exposed to underwater sound depends on factors such as source duty cycle (defined as the percentage of the time during which a sound is generated over a total operational period), whether the source is moving or stationary, and other activities that might be occurring in the area. When used, continuously active sonars transmit more frequently (greater than 80 percent duty cycle) than traditional sonars, but at a substantially lower source level. However, it should be noted that active sonar is rarely used continuously throughout the listed activities, and many sources are mobile. For moving sources such as hull-mounted sonar, the likelihood of an individual bird being repeatedly exposed to an intense sound source over a short period of time is low because the training activities are transient and sonar use and bird diving are intermittent. The potential for birds to be exposed to intense sound associated with stationary sonar sources would likely be limited for some training and testing activities because other activities occurring in conjunction may cause them to leave the immediate area. For example, birds would likely react to helicopter noise during dipping sonar exercises by flushing from the immediate area, and would therefore not be exposed to underwater sonar.

Injury due to acoustic resonance of air space in the lungs from sonar and other transducers is unlikely in birds. Unlike mammals, birds have compact, rigid lungs with strong pulmonary capillaries that do not change much in diameter when exposed to extreme pressure changes (Baerwald et al., 2008), leading to resonant frequencies lower than the frequencies used for Navy sources. Furthermore, potential direct injuries (e.g., barotrauma, hemorrhage, or rupture of organs or tissue) from non-impulsive sound sources such as sonar are unlikely because of slow rise times, lack of a strong shock wave such as that associated with an explosive, and relatively low peak pressures.

A physiological impact, such as hearing loss, would likely only occur if a seabird were close to an intense sound source. An underwater sound exposure would have to be intense and of a sufficient duration to cause hearing loss. Avoiding the sound by returning to the surface would limit extended or multiple sound exposures underwater. Additionally, some diving birds may avoid interactions with large moving vessels upon which the most powerful sonars are operated (Schwemmer et al., 2011). In general, birds are less susceptible to both temporary and PTS than mammals (Saunders & Dooling, 1974). Diving birds have adaptations to protect the middle ear and tympanum from pressure changes during diving that may affect hearing (Dooling & Therrien, 2012). While some adaptions may exist to aid in underwater hearing, other adaptations to protect in-air hearing may limit aspects of underwater hearing (Hetherington, 2008). Because of these reasons, the likelihood of a diving bird experiencing an underwater exposure to sonar or other transducer that could result in an impact on hearing is considered low.

Because diving birds may rely more on vision for foraging and there is no evidence that diving birds rely on underwater acoustic communication for foraging (see Section 3.6.1.5, Hearing and Vocalization), the masking of important acoustic signals underwater by sonar or other transducers is unlikely.

There have been very limited studies documenting diving seabirds' reactions to sonar (e.g., Hansen et al. (2020)). However, given the information and adaptations discussed above, diving seabirds are not expected to detect high-frequency sources underwater and are only expected to detect mid- and low-frequency sources when in close proximity. A diving bird may not respond to an underwater source, or it may respond by altering its dive behavior, perhaps by reducing or ceasing a foraging bout. It is expected that any behavioral interruption would be temporary as the source or the bird changes location.

Some birds commonly follow vessels, including certain species of gulls, storm petrels, and albatrosses, as there is increased potential of foraging success as the prop wake brings prey to the surface (Hamilton, 1958; Hyrenbach, 2001, 2006; Melvin et al., 2001). Birds that approach vessels while foraging are the most likely to be exposed to underwater active acoustic sources, but only if the ship is engaged in anti-submarine warfare or mine warfare with active acoustic sources. However, hull-mounted sonar does not project sound aft of ships (behind the ship, opposite the direction of travel), so most birds diving in ship wakes would not be exposed to sonar. In addition, based on what is known about bird hearing capabilities in air, it is expected that diving birds may have limited or no ability to perceive high-frequency sounds, so they would likely not be impacted by high-frequency sources such as those used in mine warfare.

3.6.2.1.2.1 Impacts from Sonar and Other Transducers Under Alternative 1

Impacts from Sonar and Other Transducers Under Alternative 1 for Training Activities

Under Alternative 1 training activities, sonar and other transducers would not be regularly used in nearshore areas that could be used by foraging marine birds, except during maintenance and for navigation in areas around ports. General categories and characteristics of sonar systems and the number of hours these sonars would be operated during training activities under Alternative 1 are described in Section 3.0.3.1.1 (Sonar and Other Transducers). Activities using sonars and other transducers would be conducted as described in Chapter 2 (Description of Proposed Action and Alternatives) and Appendix A (Navy Activities Descriptions).

The possibility of a bird species being exposed to sonar and other transducers depends on whether it submerges during foraging and whether it forages in areas where these sound sources may be used. Most sonar use occurs offshore, so the chance for an exposure would be low. It is assumed that birds, including the marbled murrelet and short-tailed albatross, would not be sensitive to frequencies above 10 kHz when underwater in their natural environment. Because impacts on individual birds, if any, are expected to be minor and limited, no long-term consequences to individuals are expected. In addition, as all designated critical habitat for marbled murrelet, northern spotted owl, steaked horned lark, and western snowy plover occurs in the terrestrial environment, there would be no impacts to designated critical habitat from underwater sound sources. The marbled murrelet and short-tailed albatross are analyzed below for potential impacts associated with the use of sonar and other active acoustic stressors.

Marbled Murrelet. Marbled murrelets regularly foraging in inland areas where sonar and other transducers are used may be exposed to underwater sound. Marbled murrelets may be exposed to underwater sound from training activities; however, for an exposure to occur, a murrelet would have to be submerged at the same time of sonar and other transducer use, and the murrelet would have to be sufficiently close to the sound source. A number of factors reduce the likelihood of exposure, such as the relatively short dive duration and the location where activities occur. Within the Inland Waters, marbled murrelets forage throughout Puget Sound and are known to occur at the Dabob Bay Range Complex (DBRC), Keyport Range site, Naval Station (NS) Everett, Naval Base Kitsap (NBK) Bangor and NBK Bremerton, but only maintenance activities occurring in inland waters have sound sources within the hearing range of birds. The instances of murrelets occurring under water, coinciding at the time and location of maintenance activities, would be infrequent. Most other sonar use occurs farther offshore (e.g., greater than 3 NM from shore), so the chance for an exposure would decrease further from shore. Specifically, anti-submarine warfare activities would typically occur at distances that exceed foraging ranges for murrelets, particularly during the nesting season. Other sonars used for anti-mine warfare, communication, and navigation are outside of the known hearing range for birds. Therefore, exposures would be more likely to occur within winter (when murrelets may forage further offshore); however, instances of murrelets occurring under water, coinciding at the time and location of anti-submarine warfare training, would be infrequent.

The Navy has requested reinitiation of ESA section 7 consultation with the USFWS for activities described in this Supplemental for potential impacts on marbled murrelets from sonar and other transducers. As part of this consultation, the Navy is presenting the most current information to estimate and model potential impacts on the marbled murrelet. This information includes updated range to effects estimates since the previous consultation between the Navy and USFWS for activities described in the 2015 NWTT Final EIS/OEIS. The updated range to effects estimates are based off of a revised modeling methodology using the Navy Acoustic Effects Model and a cumulative SEL threshold to auditory injury of 220 decibels referenced to 1 micropascal squared seconds (dB re 1 μPa^2-s), consistent with the underwater non-impulsive auditory injury threshold applied in the 2016 BO. After reviewing the best available science since 2016, the Navy has re-affirmed this criterion. The ranges to auditory injury for an MF1 hull-mounted sonar would be 5 m for a 30-second exposure and 14 m for a five-minute exposure. Ranges for other less powerful sonars would be substantially less or even zero. Although marbled murrelet foraging bouts last over a period of 27–33 minutes (Nelson, 1997), birds are not submerged during the entire bout, and the average dive time is 16 seconds (Ralph & Miller, 1995). Therefore, the potential for auditory injury is very low.

Short-tailed Albatross. Short-tailed albatrosses are rare vagrant migrants that forage in offshore, open ocean waters (U.S. Fish and Wildlife Service, 2005a). Considering the rarity of this species in general and the infrequent sightings, chances for its potential interactions with training activities within the Study Area would be extremely low. The spatial and temporal variability of both the occurrence of a short-tailed albatross and the training activities conducted within offshore locations near foraging areas presents a negligible chance that a direct or indirect impact would occur to this species because of training and testing activities that use non-impulse sound sources. In USFWS' 2016 BO, the potential for short-tailed albatross exposures were considered unlikely to result in injury because of the (1) mobility of sonar sources (with the exception of sonobuoys); (2) short-tailed albatross are mobile, are transported by currents, and only dive to shallow depths when foraging; and (3) the range to effects for sonobuoys is considered to be 0 m (U.S. Fish and Wildlife Service, 2016).

The Navy has requested reinitiation of ESA section 7 consultation with the USFWS for activities described in this Supplemental for potential impacts on the short-tailed albatross from sonar and other transducers and other acoustic substressors. As part of this consultation, the Navy is presenting the most current information to estimate and model potential impacts on the short-tailed albatross. This information includes abundance estimations for off shore areas that overlap with activities using sonar and other transducers, as well as new range to effects estimates based on revised modeling methods (the range to effects for sonobuoys will continue to be considered 0 m). Although the quantitative estimates of impacts on short-tailed albatrosses may be revised during the reinitiated ESA section 7 consultation, the underlying conclusion reached by the Navy and USFWS during the section 7 consultation for activities described in the Navy's 2015 NWTT Final EIS/OEIS are not expected to change—exposures to sonar and other transducers are unlikely to result in injury.

Pursuant to the ESA, acoustic stressors from the use of sonar and other transducers during training activities, as described under Alternative 1, may affect the marbled murrelet and the short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 Code of Federal Regulations [CFR] Part 21), the impacts from sonar and other transducers during training activities described under Alternative 1 would not result in a significant adverse effect on populations of seabirds, shorebirds, and other birds protected under the MBTA.

Impacts from Sonar and Other Transducers Under Alternative 1 for Testing Activities

Sonar and other transducers used in testing activities would occur in the Offshore Area, including the Quinault Range Site. Most of this range is more than 3 NM from shore (see Figure 2.2-2).

General categories and characteristics of sonar systems and the number of hours these sonars would be operated during testing under Alternative 1 are described in Section 3.0.3.1.1 (Sonar and Other Transducers). Activities using sonars and other transducers would be conducted as described in Chapter 2 (Description of Proposed Action and Alternatives) and Appendix A (Navy Activities Descriptions). Overall use of sonar and other transducers in this Supplemental compared with the totals analyzed in the 2015 NWTT Final EIS/OEIS are described in Tables 2.5-1, 2.5-2, and 2.5-3. Testing activities using sonar and other transducers would occur throughout the Study Area.).

Sonar and other transducers would be used during testing activities in Western Behm Canal, Alaska, under Alternative 1 for communications, range calibration, and position information for units operating submerged on the range (see Table 2.5-2 and Figure 2.2-4). Tactical mid-frequency active sonar would not be used in Western Behm Canal. Low-frequency, mid-frequency, and high-frequency source classes would be used in Western Behm Canal during testing activities conducted under Alternative 1. High-frequency sources are generally outside the audible range of seabird hearing; therefore, the analysis focuses on low-frequency and mid-frequency sources.

The possibility of a bird species being exposed to sonar and other transducers depends on whether the species submerges during foraging and whether it forages in areas where these sound sources may be used. Most sonar use occurs in the Inland Waters, so the chance for an exposure would be low. Because impacts on individual birds, if any, are expected to be minor and limited, no long-term consequences to individuals are expected. In addition, as all designated critical habitat for marbled murrelet, northern spotted owl, steaked horned lark, and western snowy plover occurs in the terrestrial environment, there would be no impacts to designated critical habitat from underwater sound sources. The marbled murrelet and short-tailed albatross are analyzed below for potential impacts associated with the use of sonar and other active acoustic stressors.

Marbled Murrelet. Marbled murrelets regularly forage in areas where sonar and other transducers would be used for testing activities. Marbled murrelets may be exposed to underwater sound from testing activities; however, for an exposure to occur, a murrelet would have to be submerged at the same time of sonar and other transducer use, and the murrelet would have to be sufficiently close to the sound source. As with training activities, a number of factors reduce the likelihood of exposure, such as the relatively short dive duration and the location where activities occur. A large portion of other sonar use occurs farther offshore, so the chance for an exposure would decrease further from shore. Within the Inland Waters, marbled murrelets forage throughout Puget Sound and are known to occur at the DBRC, Keyport Range site, NS Everett, NBK Bangor, and NBK Bremerton.

The Navy has requested reinitiation of ESA section 7 consultation with the USFWS for activities described in this Supplemental for potential impacts on marbled murrelets from sonar and other transducers used during testing activities. As part of this consultation, the Navy is presenting the most current information to estimate and model potential impacts on the marbled murrelet. This new information includes range to effects data, increased understanding of underwater hearing abilities of marbled murrelets, and abundance estimations for off shore areas that overlap with activities using sonar and other transducers used during testing activities. The updated range to effects estimates are based off of a revised modeling methodology using the Navy Acoustic Effects Model and a cumulative SEL threshold to auditory injury of 220 dB re 1 μPa^2-s, consistent with the underwater non-impulsive auditory injury threshold applied in the 2016 BO. After reviewing the best available science since 2016, the Navy has re-affirmed this criterion. The ranges to auditory injury for an MF1 hull-mounted sonar would be 5 m for a 30-second exposure and 14 m for a five-minute exposure. Ranges for other less powerful sonars would be substantially less or even zero. Although marbled murrelet foraging bouts last over a period of 27–33 minutes (Nelson, 1997), birds are not submerged during the entire bout, and the average dive time is 16 seconds (Ralph & Miller, 1995). Therefore, the potential for auditory injury is very low.

Short-tailed Albatross. The spatial and temporal variability of both the occurrence of a short-tailed albatross and the testing activities conducted within offshore locations near foraging areas presents a negligible chance that a direct or indirect impact would occur to this species from sonar or other transducers. In USFWS's 2016 BO, the potential for short-tailed albatross exposures were considered unlikely to result in injury because of the (1) mobility of sonar sources (with the exception of sonobuoys); (2) short-tailed albatross are mobile, are transported by currents, and only dive to shallow depths when foraging; and (3) the range to effects for sonobuoys is considered to be 0 m (U.S. Fish and Wildlife Service, 2016).

The Navy has requested reinitiation of ESA section 7 consultation with the USFWS for activities described in this Supplemental for potential impacts on the short-tailed albatross from sonar and other transducers during testing activities. As part of this consultation, the Navy is presenting the most current information to estimate and model potential impacts on the short-tailed albatross. This new information includes abundance estimations for offshore areas that overlap with testing activities using sonar and other transducers.

Pursuant to the ESA, acoustic stressors from the use of sonar and other transducers during testing activities under Alternative 1 may affect the ESA-listed marbled murrelet and short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from sonar and other transducers during testing activities under Alternative 1 would not result in a significant adverse effect on migratory bird populations.

3.6.2.1.2.2 Impacts from Sonar and Other Transducers Under Alternative 2

Impacts from Sonar and Other Transducers Under Alternative 2 for Training Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Section 3.0.3.1.1 (Sonar and Other Transducers), and Appendix A (Navy Activities Descriptions), training activities under Alternative 2 reflect the maximum number of activities that could occur within a given year. This would result in an overall increase in sonar use compared to Alternative 1.

Marbled Murrelet. Marbled murrelets regularly foraging in inland areas where sonar and other transducers are used may be exposed to underwater sound. Marbled murrelets may be exposed to underwater sound from training activities; however, for an exposure to occur, a murrelet would have to be submerged at the same time of sonar and other transducer use, and the murrelet would have to be sufficiently close to the sound source. A number of factors reduce the likelihood of exposure, such as the relatively short dive duration and the location where activities occur. Within the Inland Waters, marbled murrelets forage throughout Puget Sound and are known to occur at the DBRC, Keyport Range site, NS Everett, NBK Bangor, and NBK Bremerton, but only these maintenance activities occurring in inland waters have sound sources within the hearing range of birds. The instances of murrelets occurring under water, coinciding at the time and location of maintenance activities, would be infrequent. Most other sonar use occurs farther offshore (e.g., greater than 3 NM from shore), so the chance for an exposure would decrease further from shore. Specifically, anti-submarine warfare activities would typically occur at distances that exceed foraging ranges for murrelets, particularly during the nesting season. Other sonars used for anti-mine warfare, communication, and navigation are outside of the known hearing range for birds. Therefore, exposures would be more likely to occur within winter (when murrelets may forage further offshore); however, instances of murrelets occurring under water, coinciding at the time and location of anti-submarine warfare training, would be infrequent. Compared to Alternative 1, exposure to sonar and other transducers substressors would likely increase under Alternative 2.

Short-tailed Albatross. Short-tailed albatrosses are rare vagrant migrants that forage in offshore, open ocean waters (U.S. Fish and Wildlife Service, 2005a). Considering the rarity of this species in general and the infrequent sightings, chances for its potential interactions with training activities within the Study Area would be extremely low, even under Alternative 2 with a relative increase in the overall use of sonar and other transducers. The spatial and temporal variability of both the occurrence of a short-tailed albatross and the training activities conducted within offshore locations near foraging areas presents a negligible chance that a direct or indirect impact would occur to this species because of training and testing activities that use non-impulse sound sources. In USFWS's 2016 BO, the potential for short-tailed albatross exposures were considered unlikely to result in injury because of the (1) mobility of sonar sources (with the exception of sonobuoys); (2) short-tailed albatross are mobile, are transported by currents, and only dive to shallow depths when foraging; and (3) the range to effects for sonobuoys is considered to be 0 m (U.S. Fish and Wildlife Service, 2016).

Pursuant to the ESA, acoustic stressors from the use of sonar and other transducers during training activities, as described under Alternative 2, may affect the ESA-listed marbled murrelet and short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from sonar and other transducers during training activities described under Alternative 2 would not result in a significant adverse effect on populations seabirds, shorebirds, and other birds protected under the MBTA.

<u>Impacts from Sonar and Other Transducers Under Alternative 2 for Testing Activities</u>

As described in Chapter 2 (Description of Proposed Action and Alternatives), Section 3.0.3.1.1 (Sonar and Other Transducers), and Appendix A (Navy Activities Descriptions), testing activities under Alternative 2 reflects the maximum number of activities that could occur within a given year. This would result in an overall increase in sonar use compared to Alternative 1.

Under Alternative 2, testing activities using low-frequency sonar and other transducers will take place throughout the NWTT Study Area; however, these sources would occur more frequently in the NWTT Inland Waters.

Marbled Murrelet. Marbled murrelets regularly forage in areas where sonar and other transducers would be used for testing activities. Marbled murrelets may be exposed to underwater sound from testing activities; however, for an exposure to occur, a murrelet would have to be submerged at the same time of sonar and other transducer use, and the murrelet would have to be sufficiently close to the sound source. As with training activities, a number of factors reduce the likelihood of exposure, such as the relatively short dive duration and the location where activities occur. Most other sonar use occurs farther offshore, so the chance for an exposure would decrease further from shore. Within the Inland Waters, marbled murrelets forage throughout Puget Sound and are known to occur at the DBRC, Keyport Range site, NS Everett, NBK Bangor, and NBK Bremerton. With the increase in the use of sonar and other transducers in inland waters under Alternative 2, more marbled murrelets would likely be exposed to this substressors while foraging in inland waters (particularly during the nesting season) compared to Alternative 1.

Short-tailed Albatross. As with training activities, there is a negligible chance of short-tailed albatross exposure to sonar and other transducers. This conclusion is supported by the spatial and temporal variability of both the occurrence of a short-tailed albatross and the testing activities conducted within offshore locations near foraging areas. In USFWS's 2016 BO, the potential for short-tailed albatross exposures were considered unlikely to result in injury because of the (1) mobility of sonar sources (with the exception of sonobuoys); (2) short-tailed albatross are mobile, are transported by currents, and only dive to shallow depths when foraging; and (3) the range to effects for sonobuoys is considered to be 0 m (U.S. Fish and Wildlife Service, 2016).

Pursuant to the ESA, acoustic stressors from the use of sonar and other transducers during testing activities, as described under Alternative 2, may affect the ESA-listed marbled murrelet and short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from sonar and other transducers during testing activities described under Alternative 2 would not result in a significant adverse effect on populations seabirds, shorebirds, and other birds protected under the MBTA.

3.6.2.1.2.3 Impacts from Sonar and Other Transducers Under the No Action Alternative

Under the No Action Alternative, the Navy would not conduct proposed at-sea training and testing activities in the Study Area. Sonar and other transducers as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer acoustic stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from sonar and other transducers on individual birds, but would not measurably improve the status of bird populations.

3.6.2.1.3 Impacts from Vessel Noise

Section 3.6.3.1.4 (Impacts from Vessel Noise) of the 2015 NWTT Final EIS/OEIS discusses the different types of vessels and the noise they generate, along with a summary of potential responses marine birds may exhibit. Naval combat vessels are designed to be quiet to avoid detection; therefore, any disturbance to birds is expected to be due to visual, rather than acoustic, stressors. Other training and testing support vessels, such as rigid hull inflatable boats, use outboard engines that can produce substantially more noise even though they are much smaller than warships. Noise due to watercraft with outboard engines, or noise produced by larger vessels operating at high speeds, may briefly disturb some birds while foraging or resting at the water surface. However, the responses due to both acoustic and visual exposures are likely related and difficult to distinguish. Although loud, sudden noises can startle and flush birds, Navy vessels are not expected to result in major acoustic disturbance of seabirds in the Study Area. Noise from Navy vessels is similar to or less than those of the general maritime environment. Birds respond to the physical presence of a vessel, regardless of the associated noise. The potential is very low for noise generated by Navy vessels to impact seabirds, and such noise would not result in major impacts on seabird populations. Since the publication of the 2015 NWTT Final EIS/OEIS and 2016 USFWS BO (U.S. Fish and Wildlife Service, 2016), no new information was identified during the Navy's literature review that would substantially alter the assessment of potential impacts on marine birds from vessel noise. Therefore, the information contained in Section 3.6.3.1.4 (Impacts from Vessel Noise) of the 2015 NWTT Final EIS/OEIS remains valid.

Pursuant to the ESA, vessel noise generated during training and testing activities, as described under Alternatives 1 and 2, may affect the marbled murrelet and the short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from sonar and other transducers during training and testing activities described under Alternatives 1 and 2 would not result in a significant adverse effect on populations seabirds, shorebirds, and other land birds protected under the MBTA.

Under the No Action Alternative, the Navy would not conduct proposed at-sea training and testing activities in the NWTT Study Area. Vessel noise from sources as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities. Discontinuing the training and testing activities would result in less vessel noise within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for vessel noise impacts on individual birds and bird populations.

3.6.2.1.4 Impacts from Aircraft Noise

Section 3.6.3.1.5 (Impacts from Aircraft Noise) of the 2015 NWTT Final EIS/OEIS discusses the different types of aircraft and the noise they generate, along with a summary of potential responses birds may exhibit. Since the publication of the 2015 NWTT Final EIS/OEIS and 2016 USFWS BO (U.S. Fish and Wildlife Service, 2016), no new information was identified during the Navy's literature review that would substantially alter the assessment of potential impacts on birds from aircraft noise. Aircraft restrictions (e.g., flight altitude restrictions, supersonic flights only allowed to occur greater than 30 NM from shore) would remain in place as analyzed in the 2015 NWTT Final EIS/OEIS. Therefore, the information contained in Section 3.6.3.1.5 (Impacts from Aircraft Noise) of the 2015 NWTT Final EIS/OEIS remains valid. A summary of noise sources and potential bird responses is provided below for fixed-wing aircraft and helicopters.

- **Fixed-wing aircraft** (manned and unmanned). Common behavioral responses to aircraft noise include no response or stationary alert behavior (Johnson & Reynolds, 2002), startle response, flying away, and increased vocalizations (Bowles, 1995; Larkin et al., 1996; National Park Service, 1994). In some instances, behavioral responses could interfere with foraging, habitat use, and physiological energy budgets, particularly when an animal continues to respond to repeated exposures. The potential for masking of calls in air is possible if a bird remains in the area; however, due to the transitory nature of aircraft overflights, the duration of masking would be limited. Supersonic flights are only authorized when the aircraft is at least 30 NM from shore and clear of islands and vessels. In such circumstances, some air combat maneuver training would involve high-altitude, supersonic flight which would produce sonic booms, but such airspeeds would be infrequent and are typically conducted at high altitudes and far from shore, limiting the areas where birds could be exposed. When sonic booms do occur, boom duration is generally less than 300 milliseconds. Sonic booms would cause seabirds to startle, but the exposure would be brief, and any reactions are expected to be short-term. Startle impacts range from altering behavior (e.g., stop feeding or preening), minor behavioral changes (e.g., head turning), or at worst, a flight response. Because most fixed-wing flights are not supersonic and both birds and aircraft are transient in any area, exposure of birds in the open ocean to sonic booms would be infrequent. It is unlikely that individual birds would be repeatedly exposed to sonic booms in the open ocean.

- **Helicopters**. Exposure from helicopter noise may be as brief as fixed-wing aircraft, but lower altitude and hovering or slow-moving helicopters could prolong the exposure, eliciting different responses and resulting in more severe impacts. Helicopter activities at lower altitudes increase the likelihood that birds would respond to noise from overflights with reactions such as flushing (Stalmaster & Kaiser, 1997), although a large portion of birds may exhibit no reaction to nearby helicopters (Grubb et al., 2010). Helicopter flights are generally limited to the inland water areas, unless deployed onboard ships. Helicopter flights, therefore, are more likely to impact the greater numbers of birds that forage in coastal areas than those that forage in open ocean areas. Nearshore areas of the coast are the primary foraging habitat for many bird species. The presence of dense aggregations of sea ducks, other seabirds, and migrating land birds is a potential concern during low-altitude helicopter activities. Although birds may be more likely to react to helicopters than to fixed-wing aircraft, Navy helicopter pilots avoid large flocks of birds to protect aircrews and equipment, thereby reducing disturbance to birds as well. Noise from low-altitude helicopter overflights would only be expected to elicit short-term behavioral or physiological responses in exposed birds.

Birds in areas that may experience repeated exposure often habituate and do not respond behaviorally (Larkin et al., 1996; National Park Service, 1994; Plumpton, 2006). Throughout the Study Area, repeated exposure of individual birds or groups of birds is unlikely based on the dispersed nature of the overflights and the capability of birds to avoid or rapidly vacate an area of disturbance. Therefore, the general health of individual birds would not be compromised. Occasional startle or alert reactions to aircraft noise are not likely to disrupt major behavior patterns (such as migrating, breeding, feeding, and sheltering) or to result in serious injury to any birds.

3.6.2.1.4.1 Impacts from Aircraft Noise Under Alternative 1

Impacts from Aircraft Noise Under Alternative 1 for Training Activities

Under Alternative 1, the number of proposed training activities involving aircraft is shown in Table 3.0-11 of this Supplemental EIS/OEIS. Airborne noise levels for aircraft used during training activities, along with airborne noise levels at various stages of flight (e.g., takeoff, under afterburner for aircraft) are provided by Bousman and Kufeld (2005) for helicopters (e.g., H-60), U.S. Naval Research Advisory Committee (2009) for F/A-18C/D and F-35A, U.S. Department of the Air Force (2016) for F-35A at takeoff, U.S. Department of the Navy (2012) for EA-18G aircraft (see Table 3.0-4 of this Supplemental). The activities would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts on birds would be the same.

Aircraft training activities conducted under Alternative 1 over Inland Waters would be limited to low altitude helicopter overflights, primarily at Crescent Harbor and Restricted Area 6701, and fixed-wing overflights within the Olympic MOA and transit flight paths between Whidbey Island to the MOA, which would occur no lower than 6,000 ft. above mean sea level (including cruising altitude once an aircraft departs from Whidbey Island). Unlike fixed-wing aircraft, helicopters typically operate below 1,000 ft. altitude and often occur as low as 75–100 ft. altitude. This low altitude increases the likelihood that birds would respond to noise from helicopter overflights. Helicopters travel at slower speeds (less than 100 knots), which increases durations of noise exposure compared to fixed-wing aircraft. In addition, some studies have suggested that birds respond more to noise from helicopters than from fixed-wing aircraft (Larkin et al., 1996; National Park Service, 1994). The noise level from a hovering SH-60 helicopter at 50 ft. is approximately 90 A-weighted decibels (dBA). Noise from low-altitude helicopter overflights would be expected to elicit short-term behavioral or physiological responses in exposed birds. Birds foraging or loafing on the water's surface or nesting in adjacent areas could flush in response to the noise, vibration, downwash, or visual cues associated with a helicopter. This could result in energetic costs to individuals from lost foraging time. However, birds are also likely to habituate to disturbance from helicopters (Black et al., 1984; Conomy et al., 1998; Nedelec et al., 2016). Habituation is a simple form of learning, in which an animal, after a period of exposure to a stimulus, stops responding. Navy jets flying over land areas within the Olympic MOA would potentially expose land bird species to various levels of aircraft noise, ranging from low-intensity, ambient-level sounds from distant overflights to high amplitude sounds associated with low altitude flights.

Both ESA-listed bird species within the Study Area (marbled murrelet and short-tailed albatross) are analyzed for potential impacts resulting from aircraft noise. Aircraft noise will impact these bird species differently based on where these species occur and the flight altitude restrictions that overlie their habitats.

Marbled Murrelet. Foraging or loafing murrelets could exhibit short-term behavioral and physiological responses to helicopter overflights but would be expected to resume normal behavior shortly after the helicopter leaves the area. In their 2016 BO, the USFWS concluded that murrelets are likely to habituate to in-air sound fields. Some murrelets may have no previous exposure to these sound fields and may have a stronger behavioral response initially, but they are not likely to abort foraging as a result of encountering a sound field (U.S. Fish and Wildlife Service, 2016). Habituation has likely already occurred in many murrelets because helicopters have been used in Navy training exercises within Puget Sound for decades. Marbled murrelet nesting habitats surrounding Puget Sound and foraging habitats within Puget Sound underlie extensive commercial air traffic routes (see Section 3.12, Socioeconomic Resources and Environmental Justice), which also likely contributes to habituation to aircraft noise by murrelets. Potential marbled murrelet responses to disturbance can range from minor behavioral responses, such as scanning or head-turning, or increased vigilance for short periods, to more severe responses such as flushing. In the 2016 USFWS BO, the criteria used to assess potential risk was aircraft noise exceeding 92 dBA SEL at an active nest site, or aircraft approach within a distance of 110 yards (U.S. Fish and Wildlife Service, 2016). This criteria was based Delaney et al. (1999) that found Mexican spotted owls (*Strix occidentalis lucida*) exposed to helicopter noise did not flush from their roosts until the noise from helicopters exceeded 92 dBA SEL and the helicopters were within a distance of 105 m. It should be noted that no jet aircraft would be within 110 yards of a murrelet, even in flight. In addition, no helicopter training activities occur within the MOA; therefore, there is no chance for an aircraft to occur within the distance (110 yards) where behavioral responses were noted by the Delaney et al. (1999) study.

Most studies of avian responses to aircraft have been limited to raptors and waterfowl. Even within these groups, responses have differed widely, depending on reproductive state, activity, age, exposure frequency, and species. Given the range of responses observed in various bird species, the USFWS expected the combined auditory and visual stimuli of low altitude jet flights to pose a risk of disturbance to marbled murrelets. Navy aircraft (including Navy jet aircraft and helicopters) would fly over the Olympic MOA at altitudes not less than 6,000 ft. above mean sea level. Because marbled murrelet nesting, roosting, and foraging habitat in the Study Area ranges in elevation from 0 to 4,000 ft., the closest approach of an aircraft over marbled murrelet habitat would be 2,000 ft. above ground level.
In summary, the proposed aircraft overflights are likely to affect marbled murrelets through intermittent exposures to aircraft noise throughout the year, including during the nesting season. However, because Navy aircraft would maintain minimum flight altitudes well above the distances at which any significant behavioral responses by affected marbled murrelets are likely to occur, the effects to marbled murrelets by these aircraft overflights should be considered insignificant.

Critical habitat for the marbled murrelet occurs below the MOA; however, none of the primary constituent elements of the critical habitat designation would be impacted by aircraft overflights. Therefore, there would be no effect on designated marbled murrelet critical habitat from proposed training activities.

Short-tailed Albatross. Given the proposed timing, location, and frequency of training in the Offshore Area and the small number of short-tailed albatross that are likely to occur in the Offshore Area at any given time, it is extremely unlikely that individual albatross would co-occur with aircraft noise. Therefore, any adverse effects of aircraft noise on short-tailed albatross would be discountable.

Pursuant to the ESA, acoustic stressors from aircraft noise during training activities, as described under Alternative 1, may affect the marbled murrelet and short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from aircraft noise during training activities described under Alternative 1 would not result in a significant adverse effect on populations seabirds, shorebirds, and other birds protected under the MBTA.

Impacts from Aircraft Noise Under Alternative 1 for Testing Activities

Under Alternative 1, the number of proposed testing activities involving aircraft is shown in Table 3.0-11 of this Supplemental EIS/OEIS. Compared to ongoing activities, the number of aircraft overflights would increase in the Offshore Area, remain the same in the Western Behm Canal portions of the Study Area, but decrease in Inland Waters. Although the additional number of aircraft flights would increase the frequencies of overflights on land and at sea, impacts on birds are likely minimal because (1) flight restrictions minimizing exposures to birds on land and at sea (discussed above), and (2) the brief duration of exposure.

Marbled Murrelet. Foraging or loafing murrelets could exhibit short-term behavioral and physiological responses to aircraft overflights but would be expected to resume normal behavior shortly after the aircraft leaves the area. In their 2016 BO, the USFWS concluded that murrelets are likely to habituate to in-air sound fields (U.S. Fish and Wildlife Service, 2016). Some murrelets may have no previous exposure to these sound fields and may have a stronger behavioral response initially, but they are not likely to abort foraging as a result of encountering a sound field. Within the Quinault Range, aircraft overflights that test mine countermeasures using UAS may occur from 0 to 3 NM from the shore, with a nominal altitude of 3,000 ft. These flights could occur over foraging habitats of murrelets. In the 2016 USFWS BO, the criteria used to assess potential risk was aircraft noise exceeding 92 dB SEL at an active nest site, or aircraft approach within a distance of 110 yards. Navy aircraft would fly over the Olympic MOA at altitudes not less than 6,000 ft. above mean sea level. Because marbled murrelet nesting, roosting, and foraging habitat in the Study Area ranges in elevation from 0 to 4,000 ft., the closest approach of an aircraft over marbled murrelet habitat would be 2,000 ft. above ground level. In summary, the proposed aircraft overflights are likely to affect marbled murrelets through intermittent exposures to aircraft noise throughout the year, including during the nesting season. However, because Navy aircraft would maintain minimum flight altitudes well above the distances at which any significant behavioral responses by affected marbled murrelets are likely to occur, the effects to marbled murrelets by these aircraft overflights during testing activities should be considered insignificant. Critical habitat for the marbled murrelet occurs below the MOA; however, none of the primary constituent elements of the critical habitat designation would be impacted by aircraft overflights. Therefore, there would be no effect on designated marbled murrelet critical habitat from proposed testing activities.

Short-tailed Albatross. Given the proposed timing, location, and frequency of testing activities in the Offshore Area and the small number of short-tailed albatross that are likely to occur in the Offshore Area at any given time, it is extremely unlikely that individual albatross would co-occur with aircraft noise. Therefore, the effects of aircraft noise on short-tailed albatross would be discountable.

Pursuant to the ESA, acoustic stressors from aircraft noise during testing activities, as described under Alternative 1, may affect the marbled murrelet and short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from aircraft noise during testing activities described under Alternative 1 would not result in a significant adverse effect on populations seabirds, shorebirds, and other birds protected under the MBTA.

3.6.2.1.4.2 Impacts from Aircraft Noise Under Alternative 2

<u>**Impacts from Aircraft Noise Under Alternative 2 for Training Activities**</u>

Under Alternative 2, the number of proposed training activities would increase, decrease, or stay the same compared to the number of activities proposed in the 2015 NWTT Final EIS/OEIS (see Table 2.5-1). Increases and decreases shown in Table 2.5-1 for activities proposed under Alternative 2 do not appreciably change the impact conclusions presented in the 2015 NWTT Final EIS/OEIS. As with Alternative 1, exposures under Alternative 2 to most seabirds and landbirds would be infrequent, based on the brief duration and dispersed nature of the aircraft activities. Impacts from aircraft noise training activities would be the same as those discussed under Alternative 1.

Pursuant to the ESA, acoustic stressors from aircraft noise during training activities, as described under Alternative 2, may affect the marbled murrelet and short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from aircraft noise during training activities described under Alternative 2 would not result in a significant adverse effect on populations seabirds, shorebirds, and other birds protected under the MBTA.

Impacts from Aircraft Noise Under Alternative 2 for Testing Activities

Under Alternative 2, the number of proposed testing activities involving aircraft is shown in Table 3.0-11. Compared to Alternative 1, the number of aircraft overflights would increase in the Offshore portions of the Study Area, but stay the same in the Inland Waters and Western Behm Canal portions. Increases and decreases shown in Tables 2.5-2 and 2.5-3 for activities proposed under Alternative 2 do not appreciably change the impact conclusions presented in the 2015 NWTT Final EIS/OEIS. As with Alternative 1, exposures under Alternative 2 to most seabirds would be infrequent, based on the brief duration and dispersed nature of the aircraft activities. Impacts from aircraft noise testing activities would be the same as those discussed under Alternative 1.

Pursuant to the ESA, acoustic stressors from aircraft noise during testing activities, as described under Alternative 2, may affect the marbled murrelet and short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from aircraft noise during testing activities described under Alternative 2 would not result in a significant adverse effect on populations seabirds, shorebirds, and other birds protected under the MBTA.

3.6.2.1.4.3 Impacts from Aircraft Noise Under the No Action Alternative

Under the No Action Alternative, the Navy would not conduct proposed at-sea training and testing activities in the Study Area. Aircraft noise from sources as listed above would not be introduced into the marine environment or areas over land. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer acoustic stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from aircraft noise on individual birds, but would not measurably improve the status of bird populations.

3.6.2.1.5 Impacts from Weapons Noise

Sounds produced by weapons firing (muzzle blast), launch boosters, and projectile travel are potential stressors to birds and are discussed as impulsive noise under Section 3.6.3.1.3 (Impacts from Weapons Firing, Launch, and Water-Surface Impact Noise) in the 2015 NWTT Final EIS/OEIS.

Birds might experience auditory injury from weapon noise exposure during the proposed activities. Very little data exists that can be used to predict the effect of impulsive noise on bird hearing, yet some studies have demonstrated auditory injury from loud sound exposure. The only study to measure hearing loss as a function of impulsive noise sources in birds found PTS, which is auditory injury, after exposing budgerigars to four gunshots that were each 169 dB re 1 µPa peak SPL (Hashino et al., 1988). Based on the hearing loss found by Hashino et al. (1988) over a portion of the hearing range (lower frequencies), exposure to peak pressure of 169 dB re 1 µPa peak SPL could exceed the onset of auditory injury. However, for that study, the SEL, which is another metric for determining auditory injury, was not reported and could not be reliably approximated.

Based on the best available scientific information, the multi-disciplinary science panel convened by USFWS and the Navy to establish pile driving injury criteria, also known as the Hydroacoustic Science

Panel (Science Applications International Corporation, 2011), determined that an impulsive exposure that results in 20 dB of initial threshold shift should be considered injurious (note that this is different from the 40 dB of threshold shift required to produce auditory injury from tonal, non-impulsive sources). The Hydroacoustic Panel relied on results of exposures of budgerigars to broadband sound (Dooling, 1980) in air to estimate the onset of auditory injury for impulsive exposures. Based on those results, the panel set a sound exposure threshold (unweighted) of 135 dB re 20 µPa^2-s cumulative SEL as an approximate threshold for onset of auditory injury in birds due to impulsive sources in air, plus a spectral correction factor of 15 dB to account for low-frequency energy in an impulsive exposure versus the broadband sound in Dooling (1980).

A more relevant metric for injurious exposure to impulsive sounds, especially in close proximity where the fast rise, high pressure of the shock front dominates the impulse, is peak pressure. Consideration of peak pressure is always unweighted. In order to approximate the peak pressure from an impulsive source that would result in auditory injury to birds, the Navy relied on the established relationship between cumulative exposures and impulsive exposures that produced threshold shift in amphibious marine mammals (U.S. Department of the Navy, 2017). After correcting for auditory weighting by subtracting 15 dB from weighted thresholds to estimate unweighted cumulative SEL (National Marine Fisheries Service, 2016b), the offset between SEL and peak SPL that produced threshold shift was 30–38 dB for pinnipeds, depending on the species group (National Marine Fisheries Service, 2016b; Schlundt et al., 2000; Southall et al., 2007). To obtain an approximate onset of auditory injury for impulsive sources in air, the more conservative value of 30 dB was added to the unweighted 135 dB re 20 µPa^2-s cumulative SEL threshold discussed above to obtain an injury threshold of 165 dB re 20 µPa peak SPL. This is less than the peak pressure associated with PTS observed over a portion of the hearing range due to exposure to gunshots (Hashino et al., 1988). This estimated threshold for PTS is consistent with the observations of Hashino et al. described above.

3.6.2.1.5.1 Impact Ranges for Weapon Noise

Impact ranges for auditory injury due to weapon noise exposures were calculated using the methods described below.

Large-Caliber Blast Noise Range to Injury

Blast noise exposure levels are based on extrapolations from actual measurements of blast noise from the MK-45 5 inch large-caliber gun (U.S. Department of the Navy, 1981). The range to onset of auditory injury is approximately 39 m for large-caliber gunnery.

Bow Shock Range to Injury

Bow shock waves produced by supersonic projectiles were analyzed for area of effect using the methods described in "Appendix E: Projectile Bow Shock Analysis" from U.S. Department of the Navy (1981). This method was used to assess the area of effect in the USFWS 2016 BO. The assumptions for the analysis (Mach number, projectile dimensions, and projectile path length) are based on Navy fact files (see https://www.navy.mil/navydata/fact.asp) and weapons manufacturer specifications. These ranges represent the typical maximum range of the system and actual ranges used in training and testing would vary. Mach number at firing likely overestimates the range of effect along the length of the trajectory, as it does not account for deceleration of gun shells. The area of effect over which a bird might be exposed to bow shock waves was calculated assuming that birds are not likely to be present above 20 m, which is consistent with assumptions in the 2016 BO. The auditory injury footprints for each type of supersonic projectile are shown in Table 3.6-3.

Table 3.6-3: Projectile Bow Shock Wave Trajectory and Area of Effect Analysis

Projectile Type[1]	Range to Auditory Injury[2] (m)	Portion of Trajectory Below 20 m Altitude[2] (m)	Effective Area of Impact per Event[3] (km^2)
Training			
Gunnery Exercise Surface-to-Air Large Caliber[4] {> 20 NM (NEPM), > 50 NM (HE)]			
MK45 Mod 4 5 in. round (conventional)	12	58	0.0012
Gunnery Exercise Surface-to-Surface Ship Large Caliber {> 20 NM (NEPM), > 50 NM (HE)]			
MK45 Mod 4 5 in. round (conventional)	12	115	0.0025
Gunnery Exercise Surface-to-Air Medium Caliber[4] [> 12 NM]			
MK15 Phalanx CIWS 20-mm APDS	2	58	0.0001
MK38 25mm Machine Gun APDS	3	58	0.0001
Gunnery Exercise Surface-to-Surface Ship Medium Caliber [> 12 NM]			
MK15 Phalanx CIWS 20-mm APDS	2	115	0.0001
MK38 25mm Machine Gun APDS	3	115	0.0002
Missile Exercise Surface-to-Air[4] [> 50 NM]			
RIM-116 Rolling Airframe Missile (RAM)*	9	58	0.0007
RIM-7 Sea Sparrow missile	15	58	0.0020
Testing			
Kinetic Energy Weapon Testing [> 50 NM]			
Kinetic Energy weapon[5]	17	115	0.0053

[1] Only supersonic projectiles shown. The projectiles shown are typical of those that would be used during testing and training, and are considered representative of the types of projectiles that could be used during Phase III.

[2] Assumptions:

- Birds are unlikely to be present above 20 m altitude.
- Low firing angle of 10 degrees.
- Firing point at 10 m above the water surface.
- Target at water surface for Surface-to-Surface Gunnery Exercises and Kinetic Energy Weapon Testing.
- Deceleration of gun shells is not considered (i.e., range to injury is over-estimated for end of trajectory).

[3] The effective area is the two-dimensional area of effect based on the portion of airspace affected above the trajectory footprint.

[4] Target is at altitudes above bird flight altitude.

[5] Kinetic energy weapons are in the early stages of development.

Notes: HE = high-explosive, km^2= square kilometers, m = meters, NEPM = non-explosive practice munitions, NM = nautical miles.

Chapter 5 (Mitigation) of this Supplemental includes procedural mitigation to avoid or reduce potential impacts on birds from weapon noise during large-caliber gunnery activities (see Table 5.3-3 for a description of the mitigation requirements).

3.6.2.1.5.2 Impacts from Weapon Noise Under Alternative 1

Impacts from Weapons Noise Under Alternative 1 for Training Activities

Under Alternative 1, the number of proposed training activities would increase, decrease, or stay the same compared to the number of activities proposed in the 2015 NWTT Final EIS/OEIS (see Table 2.5-1). These activities would only occur offshore (not in inshore waters). Most activities involving large-caliber naval gunfire or the launching of targets, missiles, bombs, or other munitions are conducted more than 12 NM from shore. Most sounds 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. Most incidents of impulsive sounds produced by weapons firing, launch, or inert object impacts would be single events, with the exception of gunfire activities. Variants of the Long Range Acoustic Device are used both on vessels and on piers. These devices communicate voice, tones, or prerecorded tracks within the range of human hearing and may reach birds within 3,000 m of the device. Birds have the potential to be briefly startled or temporarily displaced during training with this device.

Increases and decreases shown in Table 2.5-1 for activities proposed under Alternative 1 do not appreciably change the impact conclusions presented in the 2015 NWTT Final EIS/OEIS. A bird in the open ocean could be exposed to weapons noise if not already displaced by the visual or noise disturbance of a vessel supporting weapons firing exercises. Birds foraging or migrating through a training area in the open ocean may respond by avoiding areas where weapons firing exercises occur. Exposures to most seabirds would be infrequent, based on the brief duration and dispersed nature of the vessels, and the brief duration of the weapons firing noise. If a bird responds to weapons noise, only short-term behavioral responses such as startle responses, head turning, or avoidance responses would be expected.

Marbled Murrelet. As discussed above, murrelets in nesting seasons tend to be greatest in nearshore waters to reduce flight times between foraging locations and nests; however, in winter, marbled murrelets may range further out to sea. Within the NWTT Study Area, marbled murrelets were reasonably certain to occur within 12 NM of the coastline in the summer and within 50 NM in the winter. Large-caliber weapons and other large platform systems use occurs more than 12 NM from shore. Inland waters and some nearshore coastal areas may use small- and medium-caliber weapons, which produce less noise (per firing event) but would happen more frequently. In general, it is reasonable to assume that although some murrelets may be exposed to large-caliber weapons noise during at-sea activities, most murrelets would likely be exposed to small- and medium-caliber weapons noise. Anticipated reactions, if any, would be behavioral, eliciting short-term responses (cessation of foraging activities, flushing while loafing on water, or diverting flight direction away from the sound source).

The Navy has requested reinitiation of ESA section 7 consultation with the USFWS for activities described in this Supplemental for potential impacts on marbled murrelets from weapons firing noise during training activities. As part of this consultation, the Navy is presenting the most current information to estimate and model potential impacts on the marbled murrelet. This new information includes range to effects data and abundance estimations for offshore areas that overlap with weapons firing activities.

Short-tailed Albatross. Given the proposed timing, location, and frequency of training in the Offshore Area and the small number of short-tailed albatross that are likely to occur in Offshore Area at any given time, it is extremely unlikely that individual albatross would co-occur with weapons firing, launch, and non-explosive impact noise. Therefore, the effects of weapons firing, launch, and non-explosive impact noise on short-tailed albatross would be discountable.

The Navy has requested reinitiation of ESA section 7 consultation with the USFWS for activities described in this Supplemental for potential impacts on the short-tailed albatross from weapons firing noise during testing activities. As part of this consultation, the Navy is presenting the most current information to estimate and model potential impacts on the short-tailed albatross. This new information includes abundance estimations for offshore areas that overlap with weapons firing activities.

Pursuant to the ESA, acoustic stressors from weapons noise during training activities, as described under Alternative 1 may affect the marbled murrelet and the short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from weapons noise during training activities described under Alternative 1 would not result in a significant adverse effect on populations seabirds, shorebirds, and other land birds protected under the MBTA.

Impacts from Weapons Noise Under Alternative 1 for Testing Activities

Under Alternative 1 testing activities, additional testing activities not previously analyzed would occur in the Offshore Area. This section considers the kinetic energy weapons testing that would occur in the Offshore Area greater than 50 NM from the shore. At this distance, it is reasonable to expect decreased marine bird densities, and therefore fewer exposures than activities generating weapons firing noise closer to shore. General characteristics of kinetic energy weapons testing are provided in Section 3.0.3.1.4 (Weapons Noise) and summarized here to consider potential impacts of noise generated from these systems on marine birds.

Supersonic projectiles, which would be similar in size to shells fired from 5 in./54 guns, would travel at approximately 2,600 ft./second, creating a bow shock wave. Pater et al. (2009) measured the characteristics of a bow shock wave from a 5 in. projectile and found that the shock wave ranged from 40 to 147 dB re 20 µPa SPL peak taken at the ground surface at 1,100 m from the firing location and 190 m perpendicular from the trajectory (for safety reasons). Shells fired from a kinetic energy weapon are considered hypersonic, and would travel at about 6,500 ft./second, and peak pressures would be expected to be several dB higher than for shell velocities described by Pater et al. (2009). By definition, bow shock waves, regardless of shell velocity, would travel at the speed of sound in air. Marine birds would be exposed to this type of noise for a very brief period of time (a few seconds), and would likely cause brief and temporary behavioral reactions described previously for other in-air noise disturbances.

As shown in Table 3.0-14, testing activities under Alternative 1 would include 80 hypersonic firing testing events. Because of the distance from shore (greater than 50 NM), lower densities of marine birds, the temporary nature of the impact, the chances of adverse impacts on individual marine birds is remote and no population level impacts are expected to occur.

Marbled Murrelet. As discussed above, murrelets may occur, albeit at lower densities, in areas where kinetic energy weapons are tested. While the summer distribution of murrelets is well documented as occurring primarily in the nearshore waters, the winter distribution of murrelets is poorly documented but does include a few observations of murrelets in offshore areas. Exposure of marbled murrelets to bow shock wave noise from hypersonic shells traveling through the air would not be expected to occur because of the wide dispersal of activities, the low number of murrelets that could be in the area where they would be exposed to noise, and the infrequent number of kinetic energy weapons testing activities. If any marbled murrelets were exposed to bow shock waves, the exposure would be very brief, and with normal activities quickly resuming after behavioral reactions. Anticipated reactions, if any, would be behavioral, eliciting short-term responses (cessation of foraging activities, flushing while loafing on water, or diverting flight direction away from the sound source).

The Navy has requested reinitiation of ESA section 7 consultation with the USFWS for activities described in this Supplemental for potential impacts on marbled murrelets from new testing activities involving bow shock wave generation from kinetic energy weapons testing. As part of this consultation, the Navy is presenting the most current information to estimate and model potential impacts on the marbled murrelet. This new information includes range to effects data and abundance estimations for offshore areas that overlap with weapons firing activities.

Short-tailed Albatross. Given the proposed timing, location, and frequency of training in the Offshore Area and the small number of short-tailed albatross that are likely to occur in Offshore Area at any given time, it is extremely unlikely that individual albatross would co-occur with kinetic energy weapons testing. If any short-tailed albatrosses were exposed to bow shock waves, the exposure would be very brief, and with normal activities quickly resuming after behavioral reactions. Anticipated reactions, if any, would be behavioral, eliciting short-term responses (cessation of foraging activities or diverting flight direction away from the sound source).

The Navy has requested reinitiation of ESA section 7 consultation with the USFWS for activities described in this Supplemental for potential impacts on short-tailed albatross from new testing activities involving bow shock wave generation from kinetic energy weapons testing. As part of this consultation, the Navy is presenting the most current information to estimate and model potential impacts on the short-tailed albatross. This new information includes range to effects data and abundance estimations for offshore areas that overlap with weapons firing activities.

Pursuant to the ESA, acoustic stressors from weapons noise during testing activities, as described under Alternative 1, may affect the marbled murrelet and the short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from weapons noise during testing activities described under Alternative 1 would not result in a significant adverse effect on populations seabirds, shorebirds, and other birds protected under the MBTA.

3.6.2.1.5.3 Impacts from Weapons Noise Under Alternative 2

Impacts from Weapons Noise Under Alternative 2 for Training Activities

Under Alternative 2, the number of proposed training activities would increase, decrease, or stay the same compared to the number of activities proposed in the 2015 NWTT Final EIS/OEIS (see Table 2.5-1). Increases and decreases shown in Table 2.5-1 for activities proposed under Alternative 2 do not appreciably change the impact conclusions presented in the 2015 NWTT Final EIS/OEIS. The analysis of stressors discussed under Alternative 1, would be the same for Alternative 2. Therefore, conclusions would be the same.

Pursuant to the ESA, acoustic stressors from weapons noise during training activities, as described under Alternative 2, may affect the marbled murrelet and the short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from weapons noise during training and testing activities described under Alternative 2 would not result in a significant adverse effect on populations seabirds, shorebirds, and other birds protected under the MBTA.

Impacts from Weapons Noise Under Alternative 2 for Testing Activities

Under Alternative 2, the number and type of testing activities generating weapons noise are the same as discussed under Alternative 1. Therefore, the analysis of stressors discussed under Alternative 1, would be the same for Alternative 2. Therefore, conclusions would be the same.

Pursuant to the ESA, acoustic stressors from weapons noise during testing activities, as described under Alternative 2, may affect the marbled murrelet and the short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from weapons noise during testing activities described under Alternative 2 would not result in a significant adverse effect on populations seabirds, shorebirds, and other birds protected under the MBTA.

3.6.2.1.5.4 Impacts from Weapons Noise Under the No Action Alternative

Under the No Action Alternative, the Navy would not conduct proposed at-sea training and testing activities in the Study Area. Weapons noise from sources as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer acoustic stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from weapons noise on individual birds, but would not measurably improve the status of bird populations.

3.6.2.2 Explosives Stressors

Section 3.6.3.1.2 (Impacts from Explosives) in the 2015 NWTT Final EIS/OEIS discusses the sources and potential impacts of in-water and in-air explosives noise on marine birds (e.g., injury, hearing loss, physiological stress, masking, and long-term consequences of exposures). This Supplemental includes new explosive testing activities not previously analyzed in the 2015 NWTT Final EIS/OEIS. These new activities using explosives would occur only in the Offshore Area. Explosive training and testing activities in inland waters would either decrease or not change compared to levels analyzed in the 2015 NWTT Final EIS/OEIS (see Table 3.0-7 in this Supplemental for comparisons between the number and types of events proposed in this Supplemental to the 2015 NWTT Final EIS/OEIS).

Explosions in the water, near the water surface, and in the air can introduce loud, impulsive, broadband sounds into the marine environment. But, unlike other acoustic stressors, explosives release energy at a high rate producing a shock wave that can be injurious and even deadly. Therefore, explosive impacts on birds are discussed separately from other acoustic stressors, even though the analysis of explosive impacts will rely on data for bird impacts due to impulsive sound exposure where appropriate.

Explosives are usually described by their net explosive weight, which accounts for the weight and type of explosive material. Additional explanation of the acoustic and explosive terms and sound energy concepts used in this section is found in Appendix D (Acoustic and Explosive Concepts).

This section begins with a summary of relevant data regarding explosive impacts on birds in Section 3.6.2.1.1 (Background). Studies of the effects of sound and energy from explosives on birds are limited, therefore, where necessary, knowledge of impacts on other species from explosives is used to assess impacts on birds.

The sections below include a survey and synthesis of best-available-science published in peer-reviewed journals, technical reports, and other scientific sources pertinent to impacts on birds potentially resulting from Navy training and testing activities. A range of impacts could occur to a bird depending on the explosive source and context of the exposure. In addition to acoustic impacts including temporary or permanent hearing loss, auditory masking, physiological stress, or changes in behavior; potential impacts from an explosive exposure can include non-lethal injury and mortality.

3.6.2.2.1 Background

3.6.2.2.1.1 Injury

If a bird is close to an explosive detonation, the exposure to high pressure levels and sound impulse can cause barotrauma. Barotrauma is physical injury due to a difference in pressure between an air space inside the body and the surrounding air or water. Sudden very high pressures can also cause damage at tissue interfaces due to the way pressure waves travel differently through tissues with different material properties. Damage could also occur to the structure of the ear, considered to be the body part most susceptible to pressure damage.

Detonations that occur underwater could injure, kill, or disturb diving birds, particularly pursuit divers that spend more time underwater than other foraging birds (Danil & St Leger, 2011). Studies show that birds are more susceptible to underwater explosions when they are submerged versus partially submerged on the surface. Two species of duck were exposed to explosive blasts while submerged 0.61 m and while sitting on the water surface. Onset of mortality (LD_1) was predicted to occur at an impulse exposure of 248 pascal seconds (Pa-s) (36 pounds per square inch per millisecond [psi-ms]) for birds underwater and 690 Pa-s (100 psi-ms) for birds at the water surface. No injuries would be expected for birds underwater at blast pressures below 41 Pa-s (6 psi-ms) and for birds on the surface at blast pressures below 207 Pa-s (30 psi-ms). Tests of underwater explosive exposures to other taxa (fish, mammals) have shown that susceptibility to injury is related to animal mass, with smaller animals being more susceptible to injury (Yelverton & Richmond, 1981). It is reasonable to assume that this relationship would apply to birds as well. The range to these thresholds would be based on several factors including charge size, depth of the detonation, and how far the bird is beneath the water surface.

Detonations in air or at the water surface could also injure birds while either in flight or at the water surface. Experiments that exposed small, medium, and large birds to blast waves in air were conducted to determine the exposure levels that would be injurious (Damon et al., 1974). Birds were assessed for internal injuries to air sacs, organs, and vasculature, as well as injury to the auditory tympanum, but internal auditory damage was not assessed. Results indicated that peak pressure exposure of 5 psi would be expected to produce no blast injuries, 10 psi would produce slight to extensive injuries, and 20 psi would produce 50 percent mortality. These results also suggested that birds with higher mass may be less susceptible to injury. In addition to the risk of direct blast injury, exposure to an explosion in air may cause physical displacement of a bird that could be injurious if the animal impacts a surface. The same study examined displacement injuries to birds (Damon et al., 1974). Results indicated that impulse exposures below 5 psi-ms would not be expected to result in injuries.

One experiment was conducted with birds in flight, showing how birds can withstand relatively close exposures to in-air explosions (Damon et al., 1974). Flying rock pigeons (*Columba livia*) were exposed to a 64-pound (lb.) net explosive weight explosion. Birds at 44 to 126 ft. from the blast exhibited no signs of injury, while serious injuries were sustained at ranges less than 40 ft. The no injury zone in this experiment was also for exposures less than 5 psi-ms impulse, similar to the results of the displacement injury study. Ranges to the no injury threshold for a range of in-air explosives are shown in Table 3.6-4.

Table 3.6-4: **Range to the No Injury Threshold for Birds Exposed to In-Air Explosives**

Net Explosive Weight	*Range to 5 psi*
5 lb.	21 ft.
10 lb.	26 ft.
100 lb.	57 ft.

Note: Ranges calculated using the methods in (Swisdak, 1978; Swisdak & Montanaro, 1992).

Another risk of explosions in air is exposure to explosive fragmentation, in which pieces of the casing of a cased explosive are ejected at supersonic speeds from the explosion. The risk of direct strike by fragmentation would decrease exponentially with distance from the explosion, as the worst case for strike at any distance is the surface area of the casing fragments, which ultimately would decrease their outward velocity under the influence of drag. It is reasonable to assume that a direct strike in air or at the water surface would be lethal. Once in water, the drag on any fragments would quickly reduce their velocity to non-hazardous levels (Swisdak & Montanaro, 1992).

The initial detonation in a series of detonations may deter birds from subsequent exposures via an avoidance response, however, birds have been observed taking interest in surface objects related to detonation events and subsequently being killed following detonation (R. Stemp in Greene et al. (1985)).

3.6.2.2.1.2 Hearing Loss

Exposure to intense sound may result in hearing loss which persists after cessation of the noise exposure. There are no data on hearing loss in birds specifically due to explosives; therefore, the limited data on hearing loss due to impulsive sounds, described for acoustic stressors in Section 3.6.2.1.1.2 (Hearing Loss), apply to explosive exposures.

3.6.2.2.1.3 Physiological Stress

Animals naturally experience stressors within their environment and as part of their life histories. Changing weather conditions, changes in habitat, exposure to diseases and naturally occurring toxins, lack of prey availability, social interactions with members of the same species, nesting, and interactions with predators all contribute to stress. Exposures to explosives have the potential to provide additional stressors beyond those that naturally occur, as described in the Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities (see Section 3.0.3.7).

There are no data on physiological stress in birds specifically due to explosives; therefore, the limited data on physiological stress due to impulsive sounds, described for acoustic stressors in Section 3.6.2.1.1.4 (Physiological Stress), apply to explosive exposures.

3.6.2.2.1.4 Masking

Masking occurs when one sound, distinguished as the "noise," interferes with the detection or recognition of another sound. Exposure to explosives may result in masking. There are no data on masking in birds specifically due to explosives; therefore, the limited data on masking due to impulsive sounds, described for acoustic stressors in Section 3.6.2.1.1.3 (Masking), apply to explosive exposures. Due to the very brief duration of an explosive sound, any masking would be brief during an explosive activity.

3.6.2.2.1.5 Behavioral Reactions

Numerous studies have documented that birds and other wild animals respond to human-made noise, including aircraft overflights, weapons firing, and explosions (Larkin et al., 1996; National Park Service, 1994; Plumpton, 2006). The limited data on behavioral reactions due to impulsive sounds, described for acoustic stressors in Section 3.6.2.1.1.5 (Behavioral Reactions), apply to explosive exposures.

Because data on behavioral responses by birds to explosions is limited, information on bird responses to other impulsive sounds may be informative. Seismic surveys had no noticeable impacts on the movements or diving behavior of long-tailed ducks undergoing wing molt, a period in which flight is limited and food requirements are high (Lacroix et al., 2003). The birds may have tolerated the seismic survey noise to stay in preferred feeding areas. The sensitivity of birds to disturbance may also vary during different stages of the nesting cycle. Similar noise levels may be more likely to cause nest abandonment during incubation of eggs than during brooding of chicks because birds have invested less time and energy and have a greater chance of re-nesting (Knight & Temple, 1986).

3.6.2.2.1.6 Long-Term Consequences

Long-term consequences to birds due to explosive exposures are considered following the Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities (see Section 3.0.3.7).

Long-term consequences to a population are determined by examining changes in the population growth rate. Physical effects that could lead to a reduction in the population growth rate include mortality or injury, which could remove animals from the reproductive pool, and permanent hearing impairment, which could impact foraging and communication. The long-term consequences due to individual behavioral reactions and short-term instances of physiological stress are especially difficult to predict because individual experience over time can create complex contingencies. It is more likely that any long-term consequences to an individual would be a result of costs accumulated over a season, year, or life stage due to multiple behavioral or stress responses resulting from exposures to multiple stressors over significant periods of time. Conversely, some birds may habituate to or become tolerant of repeated acoustic exposures over time, learning to ignore a stimulus that in the past did not accompany any overt threat. More research is needed to better understand the long-term consequences of anthropogenic stressors, although intermittent exposures to explosive noise are assumed to be less likely to have lasting consequences.

3.6.2.2.2 Impacts from Explosives

3.6.2.2.2.1 Methods for Analyzing Impacts from Explosives

Criteria to assess impacts to birds were developed in support of the 2016 BO. The Navy applied those same thresholds to assess effects in the reinitiation of ESA section 7 consultation with the USFWS for activities described in this Supplemental, except where noted below.

The injury and mortality thresholds for in-air exposures to explosions were established using the data for multiple species of birds exposed to explosions in Damon et al. (1974). The data available from that study enabled establishment of dual metric thresholds for injury and mortality using peak pressure (dB peak) and impulse (Pa-s). There was insufficient data to correct for the mass of the bird using the data in Damon et al. (1974); therefore, the lowest values associated with injury and mortality were applied. These values were used in the analysis conducted in the 2016 BO.

The injury and mortality thresholds for underwater exposures to explosions were established using the data for ducks exposed to explosions in Yelverton et al. (1973). The authors of that study correlated the impulse metric (Pa-s) to injuries observed in birds. The thresholds for injury and mortality developed using the data in Yelverton et al. (1973) were adjusted to account for the relatively smaller mass of the marbled murrelet (200 grams) and the relatively larger mass of the short-tailed albatross (4,000 grams) compared to the ducks in the study. This adjustment was based on the data in Yelverton and Richmond (1981). These values were used in the analysis conducted in the 2016 BO.

The in-air threshold for onset of auditory injury for impulsive noise exposure is 165 dB re 20 µPa peak. Based on the hearing loss found by Hashino et al. (1988), exposure to peak pressure of 169 dB re 1 µPa peak SPL could exceed the onset of auditory injury. However, for that study, the SEL, which is another metric for determining auditory injury, was not reported and could not be reliably approximated. This value differs from the threshold applied in the 2016 BO, as described in Section 3.6.2.1.5 (Impacts from Weapon Noise).

The underwater threshold for auditory injury is extrapolated from the available data on bird hearing loss from in-air exposures. The multi-disciplinary science panel convened by USFWS and the U.S. Navy to establish pile driving injury criteria, also known as the Hydroacoustic Science Panel (Science Applications International Corporation, 2011), set a sound exposure threshold (unweighted) of 135 dB re 20 μPa^2-s cumulative SEL plus a spectral correction factor of 15 dB to account for low-frequency energy in an impulsive exposure as an approximate threshold for onset of auditory injury in birds due to impulsive sources in air. To convert this threshold to an underwater auditory injury threshold, the reference pressure is changed from 20 µPa in air to 1 µPa in water (add 26 dB) and the hearing ability of birds, and correspondingly their sensitivity to auditory impacts, is estimated using the limited data on bird hearing underwater and data from other amphibious species, specifically otariids (see U.S. Department of the Navy (2017)). That data suggests a 36 dB impedance value for birds underwater. The resulting in-water auditory injury threshold is 212 dB re 1 μPa^2-s SEL. This value was used in the analysis conducted in the 2016 BO.

Table 3.6-5 presents the auditory and non-auditory injury thresholds from underwater and in-air explosions for the two ESA-listed diving bird species found in the NWTT Study Area.

Table 3.6-5: Explosive Effects Thresholds for ESA-listed Bird Species

<table>
<tr><th rowspan="2">Bird Species</th><th colspan="3">Underwater</th><th colspan="3">In Air</th></tr>
<tr><th>Auditory Injury[1] (dB re 1 μPa^2 s)</th><th>Injury[2] (Pa-s)</th><th>Mortality[2] (Pa-s)</th><th>Auditory Injury (dB re 20 μPa peak)</th><th>Injury[3] Dual Metric (dB re 20 μPa peak) (Pa-s)</th><th>Mortality[3] Dual Metric (dB re 20 μPa peak) (Pa-s)</th></tr>
<tr><td>Marbled Murrelet</td><td rowspan="2">212</td><td>36</td><td>138</td><td rowspan="2">165</td><td rowspan="2">185 dB re 20 μPa peak
34.5 Pa-s</td><td rowspan="2">191 dB re 20 μPa peak
69 Pa-s</td></tr>
<tr><td>Short-Tailed Albatross</td><td>94</td><td>361</td></tr>
</table>

[1]Threshold based on methods of the Hydroacoustic Science Panel, consistent with the analysis in the 2016 BO.
[2]Underwater injury and mortality thresholds are adjusted to consider typical mass of each bird species, based on the relationships between injury and mass for fish, consistent with the analysis in the 2016 BO.
[3]Dual metrics from observations of in-air explosive injuries to birds in Damon et al. (1974), consistent with the analysis in the 2016 BO. Data similar to that for underwater explosive injuries is not available to conduct mass-scaling of in-air injury thresholds; however, the data in Damon et al. (1974) is specific to birds and included birds of similar size as considered in this analysis.
Notes: Underwater sound exposure level = dB re 1 μPa^2 s, In-air peak pressure = dB re 20 μPa peak, Impulse = Pa-s (pascal seconds).

3.6.2.2.2.2 Impact Ranges for Explosives

Underwater Explosives

Ranges to effect for explosives were calculated for underwater explosions using the criteria listed in Table 3.6-5 above and the Navy Acoustic Effects Model. Smaller animals are more susceptible to injury from underwater explosions (Yelverton & Richmond, 1981), so the underwater mortality and injury criteria in Table 3.6-5 were scaled to the mass of each species based on the relationships observed for fish. Ranges to auditory injury, non-auditory injury, and mortality for underwater explosives are reported in Table 3.6-6 for the marbled murrelet and Table 3.6-7 for the short-tailed albatross.

Marbled murrelet

For the sources analyzed in Table 3.6-6, a portion of explosive bins occur greater than 50 NM from shore, where there is very little evidence of marbled murrelet presence in the Study Area.

Table 3.6-6: Underwater Explosives Range to Effects (in meters) for the Marbled Murrelet in the Inland Waters and Offshore Area

Range to Effects for Explosives: Marbled Murrelet[1]				
Source Bin[2]	***Source Depth (meters)***	***Range to Auditory Injury (meters)***	***Range to Non-Auditory Injury (meters)***	***Range to Mortality (meters)***
E1	0.1	9 (3–12)	22 (21–23)	6 (6–7)
	18.25	8 (2–11)	25 (24–25)	7 (7–7)
E2	0.1	6 (4–8)	27 (25–30)	8 (8–9)
E3	10 (Inland Waters)	31 (8–75)	103 (75–220)	22 (22–22)
	18.25 (Offshore Area)	23 (8–35)	70 (70–75)	27 (22–35)
E4	10	14 (11–17)	100 (100–100)	30 (30–30)
	30	13 (10–15)	105 (100–140)	30 (30–30)
	70	0 (0–0)	100 (100–100)	19 (19–19)
	90	0 (0–0)	90 (90–95)	0 (0–5)
E5	0.1	25 (10–40)	78 (75–80)	25 (23–25)
E7	10	40 (40–40)	363 (330–400)	110 (110–110)
	30	32 (30–35)	435 (380–550)	123 (110–200)
	70	20 (19–20)	514 (360–775)	110 (110–110)
	90	0 (0–5)	424 (360–775)	100 (100–100)
E8	47.75	40 (40–40)	524 (420–825)	155 (150–230)
E10	0.1	47 (35–55)	245 (200–850)	102 (85–350)
E11	91.4	86 (85–100)	1086 (975–2025)	455 (390–775)
	200	0 (0–10)	1431 (1275–1775)	390 (390–390)

[1]Average distance (in meters) is shown with the minimum and maximum distances due to varying propagation environments in parentheses.
[2]Shaded bins occur greater than 50 NM from the shore, where marbled murrelet presence is unlikely.

Short-Tailed Albatross

For the explosive bin E3 (Inland Waters) listed in Table 3.6-6 above, no geographic overlap with short-tailed albatross is expected because the species does not occur in Inland Waters. There is also limited spatial overlap of short-tailed albatross dive depths and underwater detonations for the bins identified in Table 3.6-7.

Table 3.6-7: Underwater Explosives Range to Effects (in meters) for the Short-Tailed Albatross in the Offshore Area

Range to effects for explosives: Short-tailed Albatross[1]				
Bin[2]	***Source depth***	***Range to Auditory Injury (m)***	***Range to Non-Auditory Injury (m)***	***Range to Mortality (m)***
E1	0.1	2 (0–10)	2 (0–8)	1 (0–3)
	18.25	0 (0–0)	0 (0–0)	2 (2–3)
E2	0.1	6 (4–7)	9 (9–10)	3 (3–3)
E3	18.25	20 (0–45)	25 (25–25)	0 (0–0)
E4	10	14 (10–17)	40 (40–40)	11 (11–11)
	30	0 (0–0)	33 (30–35)	0 (0–0)
	70	0 (0–0)	0 (0–0)	0 (0–0)
	90	0 (0–0)	0 (0–0)	0 (0–0)
E5	0.1	14 (8–20)	17 (17–17)	8 (8–8)
E7	10	40 (40–40)	139 (130–160)	45 (45–45)
	30	30 (30–30)	130 (130–130)	40 (40–40)
	70	0 (0–0)	144 (140–150)	0 (0–0)
	90	0 (0–0)	133 (130–140)	0 (0–0)
E8	45.75	25 (25–30)	200 (190–210)	45 (45–45)
E10	0.1	21 (18 -23)	59 (35–420)	26 (18–140)
E11	91.4	77 (75–100)	491 (470–500)	150 (150–150)
	200	0 (0–0)	547 (525–575)	0 (0–0)

[1]Average distance (in meters) is shown with the minimum and maximum distances due to varying propagation environments in parentheses.
[2]Shaded ranges to effect have no overlap with expected short-tailed albatross dive depth.

In-Air Explosives

Ranges to effect for in-air explosions for both species are reported in Table 3.6-8.

The Navy's proposed training activities involving in-air explosives would all occur greater than 50 NM from shore. Explosions that occur at aerial targets would occur at altitudes far above marbled murrelet and short-tailed albatross presence. Table 3.6-8 presents ranges to effect for explosions that would occur at or near the water surface, releasing explosive energy into the air, which are applicable to both the marbled murrelet and the short-tailed albatross. Ranges to effect were calculated using methods based on Swisdak (1975).

Table 3.6-8: Predicted Range to Effects for In-Air Explosions

Bin	Range to effect (meters)				
	Auditory Injury	Injury		Mortality	
	range (m)	impulse[1]	peak pressure	impulse[1]	peak pressure
E1	9.3	0.6	1.7	0.1	1.2
E2	16.0	2.1	2.9	0.8	2.0
E5	43.4	16.4	7.9	7.9	5.4
E10	159.7	193.6	29.0	121.0	19.8

[1]Thresholds for impulse RTE calculations are dependent on NEW of the explosive, so they are scaled appropriately using the lookup table and figure 3a found in U.S. Department of the Navy (1975).

3.6.2.2.3 Impacts from Explosives Under Alternative 1

Impacts from Explosives Under Alternative 1 for Training Activities

As shown in Table 3.0-7, the number of explosions would increase for E1, E2, and E5 explosives but decrease for E12 explosives. E3 and E10 explosives would remain the same as what was analyzed previously under the 2015 NWTT Final EIS/OEIS. Sound and energy generated by most small underwater explosions are unlikely to disturb birds above the water surface. If a detonation is sufficiently large or is near the water surface, however, pressure will be released at the air-water interface. Birds above this pressure release could be injured or killed. Explosives detonated at or just above the water surface, such as those used in anti-surface warfare, would create blast waves that would propagate through both the water and air. Detonations in air could also injure birds while either in flight or at the water surface. Detonations in air during anti-air warfare training would typically occur at much higher altitudes (greater than 3,000 ft. above mean sea level) where seabirds and migrating birds are less likely to be present, although some events target incoming threats at lower altitudes. Detonations of bombs with larger net explosive weights, any event employing static targets, or multiple detonations could be more likely to cause seabird mortalities or injuries. If prey species, such as fish, are killed or injured as a result of detonations, some birds may continue to forage close to the area, or may be attracted to the area, and be exposed to subsequent detonations in the same area within a single event, such as gunnery exercises, which involves firing multiple high-explosive 5 in. rounds at a target area; bombing exercises, which could involve multiple bomb drops separated by several minutes; or underwater detonations, such as multiple explosive munitions disposal charges. However, a fleeing response to an initial explosion may reduce seabird exposure to any additional explosions that occur within a short timeframe. Detonations either in air or underwater have the potential to cause a permanent or temporary threshold shift, which could affect the ability of a bird to communicate with conspecifics or detect biologically relevant sounds.

An explosive detonation would likely cause a startle reaction, as the exposure would be brief and any reactions are expected to be short-term. Startle impacts range from altering behavior (e.g., stop feeding or preening), minor behavioral changes (e.g., head turning), or a flight response. The range of impacts could depend on the charge size, distance from the charge, and the animal's behavior at the time of the exposure. Any impacts related to startle reactions, displacement from a preferred area, or reduced foraging success in offshore waters would likely be short-term and infrequent.

Nearshore waters are the primary foraging habitat for many seabird species. Any small detonations close to shore could have a short-term adverse impact on nesting and nearshore foraging species. Larger detonations would typically occur near areas with the potential for relatively high concentrations of seabirds (upwelling areas associated with the Pacific Current; productive live/hard bottom habitats; and large algal mats); therefore, any impacts on seabirds are likely to be greater in these areas.

Offshore training activities involving explosions would typically be conducted in existing training areas, with detonations and explosive munitions typically occurring 50 NM or more from shore. Explosions would occur in Inland Waters within the Crescent Harbor EOD Training Range and Hood Canal EOD Training Range. Unlike offshore training areas where explosives are used, detonations in Crescent Harbor would occur in the same general location that measures approximately 1,200 m wide and 2,400 m long (2.88 km^2). As shown in Table 3.0-7 of this Supplemental, the number of E3 detonations would remain at six per year and the number of charges smaller than 0.1 lb. would remain the same; therefore, birds in Inland Waters would be exposed to the same number of detonations as was analyzed in the 2015 NWTT Final EIS/OEIS.

The Navy will implement mitigation to avoid or minimize potential impacts on seabirds during applicable explosive medium-caliber gunnery activities in the NWTT Offshore Area, and during explosive mine neutralization activities involving Navy divers in NWTT Inland Waters, as discussed in Section 5.3.3 (Explosive Stressors). In addition, the Navy will not use explosives during training activities within 50 NM from shore in the Marine Species Coastal Mitigation Area, which will reduce the likelihood of exposure to birds that migrate or forage in the nearshore portions of the Offshore Area, particularly for marbled murrelets during breeding periods when they are known to forage in waters in close proximity to nest sites.

Marbled Murrelet. As discussed previously, marbled murrelet ranges in breeding periods are closer to breeding habitats, which suggests that no murrelets would be exposed to high explosives (as these activities occur greater than 50 NM from shore). All research, to date, indicates that marbled murrelet occurrence beyond 12 km offshore is extremely unlikely, even during the winter months (Adams et al., 2014; Falxa & Raphael, 2016; Lorenz et al., 2016; Raphael et al., 2007; U.S. Fish and Wildlife Service, 2016). Therefore, exposures to explosive training activities are not likely to occur. In Inland Waters, marbled murrelets have an increased likelihood of exposure. Marbled murrelets exposed to underwater explosions may be subject to lethal or non-lethal injuries. Non-lethal injuries may include scarred or ruptured eardrums, or gastrointestinal tract lesions. Marbled murrelets may survive their exposure to in-air and in-water explosions and associated stressors; however, these individuals would have reduced levels of fitness and reproductive success, and higher risk of predation by reducing their ability to detect and/or evade predators. Lethal injuries may include direct mortality, lung hemorrhaging, ruptured liver, hemorrhaged kidney, ruptured air sacs, and/or coronary air embolisms. For individual marbled murrelets that are exposed to in-air and in-water explosions but not injured or killed, responses would likely include startle responses, flushing, or avoidance behaviors (i.e., diving, or leaving the area). In uninjured individuals, these responses would be short term with no significant disruptions to their normal behavior that would create a likelihood of injury. For in-water explosions, the Navy no longer uses detonation techniques where the detonation is delayed between the time of pre-detonation survey and the detonation in inland waters. This allows the Navy to detonate on command once the pre-detonation surveys have been completed. This may reduce the window of opportunity for birds to enter into the area where injury may occur after the surveys have been completed (U.S. Fish and Wildlife Service, 2016).

The Navy has requested reinitiation of ESA section 7 consultation with the USFWS for training activities described in this Supplemental for potential impacts on marbled murrelets from explosive stressors. As part of this consultation, the Navy is presenting the most current information to estimate and model potential impacts on the marbled murrelet. This information includes new range to effects estimates not included in the previous consultation between the Navy and USFWS for activities described in the 2015 NWTT Final EIS/OEIS. The new range to effects estimates are based off of a revised modeling methodology and in-air explosives criteria, as well as an increased understanding of underwater hearing abilities of marbled murrelets and abundance estimations for areas that overlap with activities using explosives of different types and sizes.

Short-tailed Albatross. Short-tailed albatross pelagic range overlaps with areas that include detonations as part of training activities in the Offshore Area portion of the NWTT Study Area. If a short-tailed albatross were within the range to effects for a particular detonation, mortality and injury may occur, or various behavioral responses. Due to the small range to effects distance and widely dispersed activities within the Offshore Area of the Study Area, and the expected low numbers of short-tailed albatrosses at sea where training activities would occur, short-tailed albatrosses would have a low potential for any exposures from explosives use during training activities. Mitigation measures for explosive medium-caliber gunnery activities will help the Navy avoid or reduce potential impacts on short-tailed albatrosses during those events, as described in Chapter 5 (Mitigation).

The Navy has requested reinitiation of ESA section 7 consultation with the USFWS for training activities described in this Supplemental for potential impacts on short-tailed albatrosses from explosive stressors. As part of this consultation, the Navy is presenting the most current information to estimate and model potential impacts on the short-tailed albatross. This information includes new range to effects estimates not included in the previous consultation between the Navy and USFWS for activities described in the 2015 NWTT Final EIS/OEIS, as well as revised in-air explosive criteria.

Pursuant to the ESA, explosives used during training activities as described under Alternative 1 may affect the marbled murrelet and the short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from explosives stressors during training activities using explosives described under Alternative 1 would not result in a significant adverse effect on populations seabirds, shorebirds, and other birds protected under the MBTA.

Impacts from Explosives Under Alternative 1 for Testing Activities

For a summary of general impacts on marine birds from explosive testing activities, see the discussion above under training activities. As shown in Table 3.0-7, the number of explosions in the Offshore Area would increase for E1, E7, E8, and E11 explosives, but decreases for E4 explosives compared to activities previously analyzed in the 2015 NWTT Final EIS/OEIS. Only one testing activity, explosive Mine Countermeasure and Neutralization Testing, would occur within 50 NM from shore in the Marine

Species Coastal Mitigation Area. This event involves the use of explosives in bins E4 and E7. Based on operational parameters, explosive Mine Countermeasure and Neutralization Testing would occur in waters 3 NM or greater from shore at the Quinault Range Site or 12 NM or greater from shore elsewhere in the NWTT Offshore Area. This activity would not occur south of the Oregon/California border. During the ESA consultation and permitting processes, the Navy developed mitigation to prohibit the use of explosives in bin E7 closer than 6 NM from shore at the Quinault Range Site. The Navy also developed mitigation from October 1 through June 30 within 20 NM from shore to not exceed the use of 20 explosives from bin E4 and 3 explosives from bin E7 annually and no more than 60 explosives from bin E4 and 9 explosives from bin E7 over 7 years. The Navy will not conduct explosive events year-round within the Olympic Coast National Marine Sanctuary Mitigation Area and Juan de Fuca Eddy Marine Species Mitigation Area. There would be no testing activities using explosives in Inland Waters under Alternative 1.

Marbled Murrelet. Marbled murrelets may be exposed to explosives during mine countermeasure and neutralization testing proposed in the Offshore Area. Exposures to explosions during other testing activities, if any, would likely occur when murrelets extend their pelagic ranges in winter (non-breeding) periods. Within the NWTT Study Area, marbled murrelets were reasonably certain to occur within 12 NM of the coastline in the summer and within 50 NM in the winter (Adams et al., 2014; Falxa & Raphael, 2016; Lorenz et al., 2016; Raphael et al., 2007; U.S. Fish and Wildlife Service, 2016). Marbled murrelets exposed to underwater explosions may be subject to lethal or non-lethal injuries. Non-lethal injuries may include scarred or ruptured eardrums, or gastrointestinal tract lesions. Marbled murrelets may survive their exposure to in-air and in-water explosions and associated stressors; however, these individuals have reduced levels of fitness and reproductive success, and higher risk of predation by reducing their ability to detect and/or evade predators. Lethal injuries may include direct mortality, lung hemorrhaging, ruptured liver, hemorrhaged kidney, ruptured air sacs, and/or coronary air embolisms. For individual marbled murrelets that are exposed to in-air and in-water explosions but not injured or killed, responses would likely include a startle response, flushing, or avoidance (i.e., diving, or leaving the area). In uninjured individuals, these responses would be short term with no significant disruptions to their normal behavior that would create a likelihood of injury.

Mitigation measures described above and detailed in Chapter 5 (Mitigation) and Appendix K (Geographic Mitigation Assessment) would reduce the areas of potential overlap and limit potential exposure of marbled murrelets to explosive activities. For example, limitations on the use of explosives over a 7-year period would result in explosive events being conducted every other year, instead of annually. Requirements to use explosives in bin E7 6 NM or further from shore will significantly reduce potential overlap with marbled murrelet habitat. Additional mitigation area restrictions will result in explosive events not occurring within or north of the Olympic Coast National Marine Sanctuary. Considering the mitigation areas, explosive events would only occur beyond 12 NM from shore off the coast of Oregon (where murrelets are unlikely to occur) or within the portion of the Quinault Range Site located outside of the sanctuary.

The Navy has requested reinitiation of ESA section 7 consultation with the USFWS for testing activities under Alternative 1 for potential impacts on marbled murrelets from explosive stressors. As part of this consultation, the Navy is presenting the most current information to estimate and model potential impacts on the marbled murrelet. This information includes new range to effects estimates not included in the previous consultation between the Navy and USFWS for activities described in the 2015 NWTT Final EIS/OEIS. The new range to effects estimates are based off of a revised modeling methodology and in-air explosives criteria, as well as an increased understanding of underwater hearing abilities of marbled murrelets and abundance estimations for areas that overlap with activities using explosives of different types and sizes.

Short-tailed Albatross. Short-tailed albatross pelagic range overlaps with areas that include detonations as part of testing activities in the Offshore Area portion of the NWTT Study Area. If a short-tailed albatross were within the range to effects for a particular detonation, mortality and injury may occur, or various behavioral responses. Due to the small range to effects distance and widely dispersed activities within the Offshore Area of the Study Area, and the expected low numbers of short-tailed albatrosses at sea where testing activities would occur, short-tailed albatrosses would have a low potential for any exposures from explosives use during testing activities.

The Navy has requested reinitiation of ESA section 7 consultation with the USFWS for testing activities under Alternative 1 for potential impacts on short-tailed albatrosses from explosive stressors. As part of this consultation, the Navy is presenting the most current information to estimate and model potential impacts on the short-tailed albatross. This information includes new range to effects estimates not included in the previous consultation between the Navy and USFWS for activities described in the 2015 NWTT Final EIS/OEIS, as well as revised in-air explosive criteria.

Pursuant to the ESA, explosives used during testing activities as described under Alternative may affect the marbled murrelet and the short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from explosives stressors during testing activities using explosives described under Alternative 1 would not result in a significant adverse effect on populations seabirds, shorebirds, and other birds protected under the MBTA.

3.6.2.2.3.1 Impacts from Explosives Under Alternative 2

Impacts from Explosives Under Alternative 2 for Training Activities

For a summary of general impacts on marine birds from explosive training activities, see the discussion above under Alternative 1 training activities. As shown in Table 3.0-7, the number of explosions in the Offshore Area would increase for E1, E2, E5, E10, and E11 explosives (in locations greater than 50 NM from shore). In Inland Waters, the number of E3 explosives and explosives smaller than 0.1 lb. would remain the same.

Marbled Murrelet. As discussed under Alternative 1, marbled murrelet ranges in breeding periods are closer to breeding habitats, which suggests that no murrelets would be exposed to high explosives (as these activities occur greater than 50 NM from shore). Exposures, if any, would likely occur when murrelets extend their pelagic ranges in winter (non-breeding) periods. All research to date indicates that such pelagic environments are rarely or never used by marbled murrelets (Adams et al., 2014; Falxa & Raphael, 2016; Lorenz et al., 2016; Raphael et al., 2007; U.S. Fish and Wildlife Service, 2016). The potential impacts on marbled murrelets from explosive stressors under Alternative 2 training activities are the same as discussed previously under Alternative 1 training activities. For in-water explosions, the Navy no longer uses detonation techniques where the detonation is delayed between the time of pre-detonation survey and the detonation in inland waters. This allows the Navy to detonate on command once the pre-detonation surveys have been completed. This may reduce the window of opportunity for birds to enter into the area where injury may occur after the surveys have been completed (U.S. Fish and Wildlife Service, 2016).

Short-tailed Albatross. Short-tailed albatross pelagic range overlaps with areas that include detonations as part of training activities in the Offshore Area portion of the NWTT Study Area. If a short-tailed albatross were within the range to effects for a particular detonation, mortality and injury may occur, or various behavioral responses. Due to the small range to effects distance and widely dispersed activities within the Offshore Area of the Study Area, and the expected low numbers of short-tailed albatrosses at sea where training activities would occur, short-tailed albatrosses would have a low potential for any exposures from explosives use during training activities.

Pursuant to the ESA, explosives used during training activities as described under Alternative 2 may affect the marbled murrelet and the short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from explosives stressors during training activities using explosives described under Alternative 2 would not result in a significant adverse effect on populations seabirds, shorebirds, and other birds protected under the MBTA.

Impacts from Explosives Under Alternative 2 for Testing Activities

For a summary of general impacts on marine birds from explosive testing activities, see the discussion above under Alternative 1 training activities. As shown in Table 3.0-7, the number of explosions in the Offshore Area would increase for E1, E7, E8, and E11 explosives, but decreases for E4 explosives compared to activities previously analyzed in the 2015 NWTT Final EIS/OEIS. There would be no activities using explosives in Inland Waters under Alternative 2.

Marbled Murrelet. Marbled murrelets may be exposed to explosives during mine countermeasure and neutralization testing proposed in the Offshore Area. Exposures to explosions during other testing activities, if any, would likely occur when murrelets extend their pelagic ranges in winter (non-breeding) periods. All research to date indicates that such pelagic environments are rarely or never used by marbled murrelets (Adams et al., 2014; Falxa & Raphael, 2016; Lorenz et al., 2016; Raphael et al., 2007; U.S. Fish and Wildlife Service, 2016). The potential impacts on marbled murrelets from explosive stressors under Alternative 2 testing activities are the same as discussed previously under Alternative 1 testing activities.

Short-tailed Albatross. Short-tailed albatross pelagic range overlaps with areas that include detonations as part of testing activities in the Offshore Area portion of the NWTT Study Area. If a short-tailed albatross were to be within an area considered to be within the range to effects for a particular detonation, mortality and injury may occur, or various behavioral responses. Due to the small range to effects distance and widely dispersed activities within the Offshore Area of the Study Area, and the expected low numbers of short-tailed albatrosses at sea where testing activities would occur, short-tailed albatrosses would have a low potential for any exposures from explosives use during testing activities.

Pursuant to the ESA, explosives used during testing activities as described under Alternative 2 may affect the marbled murrelet and the short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from explosives stressors during testing activities using explosives described under Alternative 2 would not result in a significant adverse effect on populations seabirds, shorebirds, and other birds protected under the MBTA.

3.6.2.2.4 No Action Alternative

Under the No Action Alternative, the Navy would not conduct proposed at-sea training and testing activities in the Study Area. Explosives stressors from sources as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer explosive stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from explosives on individual birds, but would not measurably improve the status of bird populations.

3.6.2.3 Energy Stressors

The energy stressors that may impact marine birds include in-water electromagnetic devices and high-energy lasers. Only one new energy stressor (high-energy lasers) used in testing activities differs from the energy stressors that were previously analyzed in the 2015 NWTT Final EIS/OEIS. Use of low-energy lasers was analyzed and dismissed as an energy stressor in the 2015 NWTT Final EIS/OEIS in Section 3.0.5.3.2.2 (Lasers). However, at that time high-energy laser weapons were not part of the Proposed Action for the Study Area.

3.6.2.3.1 Impacts from In-Water Electromagnetic Devices

In-water electromagnetic devices were described in Section 3.0.5.3.2.1 (Electromagnetic) of the 2015 NWTT Final EIS/OEIS; however, they were not analyzed for potential impacts on birds. This Supplemental provides an update to the 2015 NWTT Final EIS/OEIS with an analysis of potential impacts on birds from the use of in-water electromagnetic devices. For a description of in-water electromagnetic devices, see Section 3.0.3.3.1.2 (In-Water Electromagnetic Devices) and Table 3.0-9 in this Supplemental EIS/OEIS.

3.6.2.3.1.1 Impacts from In-Water Electromagnetic Devices Under Alternative 1

Impacts from In-Water Electromagnetic Devices Under Alternative 1 Training Activities

Under Alternative 1 training activities, the number of proposed training activities involving the use of in-water electromagnetic devices would remain the same as those proposed in the 2015 NWTT Final EIS/OEIS (Table 3.0-9).

Exposure of birds would be limited to those foraging at or below the surface (e.g., cormorants, loons, alcids, petrels, grebes) because that is where the devices are used. Birds that forage inshore could be exposed to these in-water electromagnetic stressors because their habitat overlaps with some of the activities that occur in the nearshore portions within the Study Area. However, the in-water electromagnetic fields generated would be distributed over time and location near mine warfare ranges and harbors, and any influence on the surrounding environment would be temporary and localized. More importantly, the in-water electromagnetic devices used are typically towed by a helicopter, surface ship, or unmanned vehicle. It is likely that any birds in the vicinity approaching a vehicle towing an in-water electromagnetic device would be dispersed by the noise and disturbance generated by the vehicles (Section 3.6.2.1.4, Impacts from Aircraft Noise) and therefore move away from the vehicle and device before any exposure could occur.

Impacts on birds from potential exposure to in-water electromagnetic devices would be temporary and inconsequential based on the (1) relatively low intensity of the magnetic fields generated (0.2 microtesla at 200 m from the source), (2) very localized potential impact area, (3) temporary duration of the activities (hours), (4) occurrence only underwater, and (5) the likelihood that any birds in the vicinity of the approaching vehicles towing an in-water electromagnetic devices would move away from the vehicle and device before any exposure could occur. No long-term or population-level impacts are expected.

Impacts on prey availability (fishes) would also likely be negligible. For an analysis of in-water electromagnetic devices on prey species for marine birds, see Section 3.6.2.3.1 (Impacts from In-Water Electromagnetic Devices). Some fishes could have a detectable response to electromagnetic exposure, but any impacts would be temporary and would not impact the animal's fitness, which refers to changes in an individual's growth, survival, annual reproductive success, or lifetime reproductive success. Electromagnetic exposure of eggs and larvae of sensitive bony fishes would be low relative to their total ichthyoplankton biomass (Able & Fahay, 1998). Therefore, potential impacts on marine bird prey species recruitment are not be expected.

Pursuant to the ESA, use of in-water electromagnetic devices used during training activities as described under Alternative 1 would have no effect on the short-tailed albatross. The use of in-water electromagnetic devices may affect, but are not likely to adversely affect, the marbled murrelet. The Navy is consulting with the USFWS on the marbled murrelet, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from in-water electromagnetic devices during training activities described under Alternatives 1 would not result in a significant adverse effect on populations seabirds, shorebirds, and other birds protected under the MBTA.

Impacts from In-Water Electromagnetic Devices Under Alternative 1 Testing Activities

No in-water electromagnetic devices are proposed for testing activities under Alternative 1.

3.6.2.3.1.2 Impacts from In-Water Electromagnetic Devices Under Alternative 2

Impacts from In-Water Electromagnetic Devices Under Alternative 2 for Training Activities

Under Alternative 2, the number of proposed training activities involving the use of in-water electromagnetic devices would remain the same as those proposed in the 2015 NWTT Final EIS/OEIS (Table 3.0-9). The activities would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts on birds would be the same. As described above for Alternative 1, some birds may be exposed to in-water electromagnetic devices during training activities. The impact of these stressors on marine birds under Alternative 2 would be inconsequential because (1) the area exposed to the stressor is extremely small relative to most birds' ranges; (2) birds would only be exposed to electromagnetic energy when submerged; (3) the number of activities involving the stressor is low; (4) exposures would be localized, temporary, and would cease with the conclusion of the activity; and (5) even for susceptible birds (e.g., diving birds), the consequences of exposure are limited to temporary disruptions to navigation and orientation under Alternative 2.

Pursuant to the ESA, use of in-water electromagnetic devices used during training activities as described under Alternative 2 may affect the marbled murrelet and the short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from in-water electromagnetic devices during training activities described under Alternatives 1 would not result in a significant adverse effect on populations seabirds, shorebirds, and other birds protected under the MBTA.

Impacts from In-Water Electromagnetic Devices Under Alternative 2 for Testing Activities

No in-water electromagnetic devices are proposed for testing activities under Alternative 2.

3.6.2.3.1.3 Impacts from In-Water Electromagnetic Devices Under the No Action Alternative

Under the No Action Alternative, the Navy would not conduct proposed at-sea training and testing activities in the Study Area. In-water electromagnetic devices as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer energy stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from in-water electromagnetic devices on individual marine birds and their prey items, but would not measurably improve the status of bird populations or subpopulations.

3.6.2.3.2 Impacts from In-Air Electromagnetic Devices

In-air electromagnetic devices were described as Airborne Electromagnetic Energy in Section 3.0.5.3.2.1 (Electromagnetic) of the 2015 NWTT Final EIS/OEIS; however, they were not analyzed for potential impacts on birds. Sources of electromagnetic energy in the air include communications transmitters, radars, and electronic countermeasures transmitters. Electromagnetic devices on Navy platforms operate across a wide range of frequencies and power. On a single ship the source frequencies may range from 2 megahertz (MHz) to 14,500 MHz, and transmitter maximum average power may range from 0.25 watts to 1,280,00 watts. It is assumed that most Navy platforms associated with the training and testing activities will be transmitting from a variety of in-air electromagnetic devices at all times that they are underway, with very limited exceptions. Most of these transmissions (e.g., for routine surveillance, communications, and navigation) will be at low power. High-power settings are used for a small number of activities including ballistic missile defense training, missile and rocket testing, radar and other system testing, and signature analysis operations. The number of Navy vessels or aircraft in the Study Area at any given time varies and is dependent on local training or testing requirements. Therefore, in-air electromagnetic energy as part of training and testing activities would be widely dispersed throughout the Study Area, but more concentrated in portions of the Study Area near ports, naval installations, and range complexes.

This Supplemental provides an update to the 2015 NWTT Final EIS/OEIS with an analysis of potential impacts on birds from the use of in-water electromagnetic devices. For a description of in-water electromagnetic devices, see Section 3.0.3.3.1.2 (In-Air Electromagnetic Devices) and Table 3.0-9 in this Supplemental EIS/OEIS.

3.6.2.3.2.1 Impacts from In-Air Electromagnetic Devices Under Alternative 1 and Alternative 2

Impacts from In-Air Electromagnetic Devices Under Alternative 1 and 2 for Training and Testing Activities

Studies conducted on in-air electromagnetic sensitivity in birds have typically been associated with land, and little information exists specifically on seabird response to in-air electromagnetic changes at sea. Based on these studies, in-air electromagnetic effects can be categorized as thermal (i.e., capable of causing damage by heating tissue) or non-thermal. Thermal effects are most likely to occur when near high-power systems. Should such effects occur, they would likely cause birds to temporarily avoid the area receiving the electromagnetic radiation until the stressor ceases (Manville, 2016). Currently, questions exist about far-field, non-thermal effects from low-power, in-air electromagnetic devices. Although findings are not always consistent, in a literature review of the topic, Manville (2016) reported that several peer-reviewed studies have shown non-thermal effects can include (1) affecting behavior by preventing birds from using their magnetic compass, which may in turn affect migration; (2) fragmenting the DNA of reproductive cells, decreasing the reproductive capacity of living organisms; (3) increasing the permeability of the blood-brain barrier; (4) other behavioral effects; (5) other molecular, cellular, and metabolic changes; and (6) increasing cancer risk.

Many bird species return to the same stopover, wintering, and breeding areas every year and often follow the exact same or very similar migration routes (Akesson & Hedenstrom, 2007). However, ample evidence exists that displaced birds can successfully reorient and find their way when one or more cues are removed. For example, Haftorn et al. (1988) found that after removal from their nests and release into a different area, snow petrels (*Pagodrama nivea*) were able to successfully navigate back to their nests even when their ability to smell was removed. Furthermore, Wiltschko et al. (2011) and Wiltschko and Wiltschko (2005) report that electromagnetic pulses administered to birds during an experimental study on orientation do not deactivate the magnetite-based receptor mechanism in the upper beak altogether but instead cause the receptors to provide altered information, which in turn causes birds to orient in different directions. However, these impacts were temporary, and the ability of the birds to correctly orient themselves eventually returned.

Given the dispersed nature of Navy testing and training activities at sea and the relatively low-level and dispersed use of these systems at sea, the following conclusions are reached:

- The chance that in-air electromagnetic devices would cause thermal damage to an individual bird is extremely low;
- It is possible, although unlikely, that some birds would be exposed to levels of electromagnetic radiation that would cause discomfort, in which case they would likely avoid the immediate vicinity of testing and training activities;
- The strength of any avoidance response would decrease with increasing distance from the in-air electromagnetic device; and
- No long-term or population-level impacts would occur.

It is unlikely that the marbled murrelet and short-tailed albatross would be exposed to in-air electromagnetic radiation because these species would not be close to vessel or aircraft-based radar systems to receive any measurable amount of electromagnetic field. In their 2016 BO, the USFWS determined that there were several aspects of the electronic warfare training that limit exposures of wildlife to EMR. These factors include antenna configurations of mobile emitters that limit exposure to birds. For example, emitter antennas extend 14 ft. above the mobile emitter vehicles and the directional beams produced by the emitters are aimed to allow unobstructed signal transmission (taking advantage of clear lines of sight) so that there is little or no potential for wildlife on the ground or in the tree canopy to be exposed to the signal (U.S. Fish and Wildlife Service, 2016). Therefore, only birds in flight over the forest canopy have the potential to intersect beams and become exposed to electromagnetic energy from training and testing activities.

Marbled Murrelet. A marbled murrelet would be exposed to electromagnetic energy when their flight paths intersect with a radar beam. The radar emitters are energized intermittently and produce EMR with frequencies between 4 and 8 GHz. The best-available commercial and scientific information indicates that the effects of brief, intermittent exposures to radar frequencies in the range of 4–8 GHz are likely to be insignificant to birds in flight, including the marbled murrelet (Manville, 2016). Physical effects, such as tissue heating or burns, are considered to be discountable, because an exposure lasting a few seconds (as is the case with a bird in flight) would be too brief to manifest these effects.

Pursuant to the ESA, use of in-air electromagnetic devices used during training and testing activities as described under Alternatives 1 and 2 would have no effect on the short-tailed albatross. Activities that use In-air electromagnetic devices may affect the marbled murrelet. The Navy is consulting with the USFWS on the marbled murrelet, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from in-air electromagnetic devices during training and testing activities described under Alternatives 1 and 2 would not result in a significant adverse effect on populations seabirds, shorebirds, and other birds protected under the MBTA.

3.6.2.3.2.2 Impacts from In-Air Electromagnetic Devices Under the No Action Alternative

Under the No Action Alternative, the Navy would not conduct proposed at-sea training and testing activities in the Study Area. In-air electromagnetic devices as listed above would not be introduced into the marine environment or areas over land. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer energy stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from in-air electromagnetic devices on individual birds, but would not measurably improve the status of bird populations or subpopulations.

3.6.2.3.3 Impacts from High-Energy Lasers

Use of low-energy lasers were covered in the 2015 NWTT Final EIS/OEIS in Section 3.0.5.3.2.2 (Lasers), but high-energy laser weapons were not part of the proposed action in the 2015 NWTT Final EIS/OEIS. The use of high-energy lasers represents a new substressor used in an existing activity in this Supplemental EIS/OEIS. As discussed in this Supplemental, Section 3.0.3.3.2.2 (High-Energy Lasers), high-energy laser weapons are designed to disable surface targets, rendering them immobile. High-energy laser weapons testing activities involve evaluating the effectiveness of a high-energy laser deployed from a surface ship or helicopter to create small but critical failures in potential targets from short ranges. The primary concern is the potential for a marine bird to be struck with the laser beam at or near the water's surface, where extended exposure could result in injury or death due to traumatic burns from the beam.

Marine birds could be exposed to a laser only if the beam missed the target or flew between the source and the target. Should the laser strike the sea surface, individual birds at or near the surface could be exposed. Because laser platforms are typically helicopters and ships, marine birds at sea would likely transit away or submerge in response to other stressors, such as ship or aircraft noise, although some marine birds may not exhibit a response to an oncoming vessel or aircraft, increasing the risk of contact with the laser beam. High-energy laser weapons activities would only occur in open ocean locations (not close to land areas).

3.6.2.3.3.1 Impacts from High-Energy Lasers Under Alternative 1

Impacts from High-Energy Lasers Under Alternative 1 Training Activities

No high-energy lasers are proposed for training activities under Alternative 1.

Impacts from High-Energy Lasers Under Alternative 1 Testing Activities

As discussed in Section 3.0.3.3.2.2 (High-Energy Lasers) and shown in Table 3.0-10, under Alternative 1 there would be up to 55 testing activities per year involving the use of high-energy lasers. One of those 55 activities is a test of a laser-based optical communication system, which was discussed in Section 3.0.3.3.2.2 and dismissed from further evaluation. The remaining 54 annual testing activities would involve the use of high-energy laser weapons in the Offshore portion of the Study Area. Birds in the open ocean are unlikely to be exposed to high-energy lasers based on (1) the relatively low number of events (54 per year throughout the entire Offshore portion of the Study Area), (2) the very localized potential impact area of the laser beam, (3) the temporary duration of potential impact (seconds), (4) the low probability of a bird at or near the surface at the exact time and place a laser misses its target, (5) the low probability of a bird transiting the area between the source and target and travel through the beam's path, and (6) the low probability of a laser missing its target. A direct strike of a marine bird at the water's surface or within the beam path is extremely unlikely, and potential impacts on the marbled murrelet and short-tailed albatross are discountable (adverse effects are unlikely to occur).

Pursuant to the ESA, use of high-energy lasers during testing activities as described under Alternative 1 may affect the marbled murrelet and short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from high-energy lasers during testing activities described under Alternative 1 would not result in a significant adverse effect on populations seabirds, shorebirds, and other birds protected under the MBTA.

3.6.2.3.3.2 Impacts from High-Energy Lasers Under Alternatives 2

Impacts from High-Energy Lasers Under Alternative 2 Training Activities

No high-energy lasers are proposed for training activities under Alternative 2.

Impacts from High-Energy Lasers Under Alternative 2 Testing Activities

As shown in Table 3.0-10, 54 high-energy laser weapons testing activities involving the use of high-energy lasers are proposed to be conducted in the Offshore Area under Alternative 2, the same as under Alternative 1. Therefore, the impacts would be the same as described under Alternative 1.

Pursuant to the ESA, use of high-energy lasers during testing activities as described under Alternative 2 may affect the marbled murrelet and short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from high-energy lasers during testing activities described under Alternative 2 would not result in a significant adverse effect on populations seabirds, shorebirds, and other birds protected under the MBTA.

3.6.2.3.3.3 Impacts from High-Energy Lasers Under the No Action Alternative

Under the No Action Alternative, the Navy would not conduct proposed at-sea training and testing activities in the Study Area. High-energy lasers as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer energy stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would remove the potential for impacts from high-energy lasers on individual marine birds, but would not measurably improve the status of bird populations.

3.6.2.4 Physical Disturbance and Strike Stressors

The physical disturbance and strike stressors that may impact birds include (1) aircraft and aerial targets, (2) vessels and in-water devices, and (3) military expended materials. The annual number of activities including aircraft and aerial targets, vessels and in-water devices, and the annual number of military expended materials are shown in Tables 3.0-11 through 3.0-17. Section 3.6.3.2 (Impacts from Physical Disturbance and Strike Stressors) of the 2015 NWTT Final EIS/OEIS discusses the potential impacts on birds by aircraft and aerial target strikes, vessels and in-water devices (disturbance and strike), and military expended material strike. For the purposes of this Supplemental, only activities that have changed since the publication of the 2015 NWTT Final EIS/OEIS are discussed in this section.

Physical disturbances may elicit short-term behavioral or physiological responses such as alert response, startle response, cessation of feeding, fleeing the immediate area, and a temporary increase in heart rate. Birds are unlikely to be struck by aircraft and aerial target strikes, vessels and in-water devices, or military expended material strike. Activities that use these platforms or expend materials typically generate other stressors (e.g., noise) or birds can avoid collision, particularly with vessels and in-water devices, by avoiding the approach of a vessel or in-water device. When strikes do occur, they often result in bird mortality or severe injury, particularly with aircraft strikes.

The Navy will implement procedural mitigation measures to avoid or reduce potential impacts on seabirds from non-explosive small- and medium-caliber gunnery activities, as discussed in Section 5.3.4 (Physical Disturbance and Strike Stressors). The Navy will also implement mitigation to restrict applicable activities within certain distances from shore to avoid or reduce potential impacts of non-explosive practice munitions on seabirds that migrate or forage in the nearshore portions of the NWTT Offshore Area, as described in Appendix K (Geographic Mitigation Assessment). For example, the Navy will not conduct non-explosive large-caliber gunnery activities within 20 NM from shore in the Marine Species Coastal Mitigation Area.

3.6.2.4.1 Impacts from Aircraft and Aerial Target Strikes

Aircraft and aerial targets were described in Section 3.0.5.3.3.5 (Aircraft Strikes) in the 2015 NWTT Final EIS/OEIS. Table 3.0-11 shows the number of ongoing activities (from the 2015 NWTT Final EIS/OEIS) and the number of activities proposed in this Supplemental that include the use of aircraft for both training and testing activities. Bird-aircraft strikes are a grave concern for the Navy because they can harm aircrews. Bird-aircraft strikes can also damage equipment and injure or kill birds (Bies et al., 2006). In the FAA's analysis of aircraft bird strikes from 1990 to 2015, waterfowl, gulls, and raptors are the species groups of birds with the most damaging strikes on aircraft, with most strikes occurring at or after takeoff or landing (Federal Aviation Administration, 2015). Pfeiffer et al. (2018) further analyzed strike risk for specific species and military aircraft using Navy and Air Force strike data. The Navy data covered 27 years (1990–2017) and contained 21,661 wildlife strike records. The Air Force dataset spanned 23 years (1994–2017) and contained 104,129 wildlife strike records. The most hazardous species to military aircraft was the snow goose (*Anser caerulescens*), followed by the common loon (*Gavia immer*), Canada goose (*Branta canadensis*), and black vulture (*Coragyps atratus*) (Pfeiffer et al., 2018). A general overview of flight height characteristics for birds is provided in this Supplemental in Section 3.6.1.3 (Flight Altitudes).

3.6.2.4.1.1 Impacts from Aircraft and Aerial Target Strikes Under Alternative 1

Impacts from Aircraft and Aerial Target Strikes Under Alternative 1 for Training Activities

As shown in Table 3.0-11, the number of activities including aircraft movements under Alternative 1 would increase slightly in the Offshore Area. Within the Offshore Area, birds are least likely to be struck because of the flight altitudes of birds (generally lower for seabirds over open water), and flight altitudes of aircraft. Within inland waters, the number of training activities involving aircraft under Alternative 1 would also increase. As with the 2015 NWTT Final EIS/OEIS, there would be no aircraft activity as part of training activities under Alternative 1 within the Western Behm Canal.

In general, bird populations consist of hundreds or thousands, ranging across a large geographical area. In this context, the loss of several or even dozens of birds due to physical strikes may not constitute a population-level effect, although some species gather in large flocks. Bird exposure to strike potential would be relatively brief, as an aircraft quickly passes overhead. Seabirds actively avoid interaction with aircraft; however, disturbances of various seabird species may occur from aviation operations on a site-specific basis. As a standard operating procedure, aircraft avoid large flocks of birds to minimize the safety risk involved with a potential bird strike.

Air combat maneuver (in W-237 and the Olympic MOA), and electronic warfare training (W-237 and the Olympic MOA) activities were analyzed in the 2015 NWTT Final EIS/OEIS and the USFWS 2016 BO.

The USFWS concluded in their 2016 BO that aircraft strikes of marbled murrelets by aircraft over land to be discountable (adverse effects are unlikely to occur) for the following reasons: (1) all aircraft flights occur at altitudes that exceed 6,000 ft. above mean sea level; (2) because murrelets use forests to 4,000 ft. elevation contours, the closest approach to nesting habitat would be 2,000 ft.; (3) murrelets typically fly at 1,000 ft. above ground level; (4) most aircraft flights would occur higher than 10,000 ft. above mean sea level; and (5) the low densities of murrelets and spotted owls that occur throughout the

Olympic MOA (U.S. Fish and Wildlife Service, 2016). Similarly, the USFWS discounted aircraft strikes of marbled murrelets and short-tailed albatrosses for the following reasons: (1) short-tailed albatrosses and marbled murrelets typically fly over the ocean within a few meters of the water surface; (2) both species will be in very low densities and spending the majority of their time on or near the surface of the water; and (3) although aircraft may fly at low altitudes (no less than 3,000 ft.) over the water surface, birds are expected to exhibit behaviors that will separate the birds from the altitudes used by the great majority of the aircraft.

Pursuant to the ESA, activities involving aircraft flights and aerial targets during training activities as described under Alternative 1 may affect the marbled murrelet and short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts of aircraft and aerial targets during training activities described under Alternative 1 would not result in a significant adverse effect on populations seabirds, shorebirds, and other birds protected under the MBTA.

Impacts from Aircraft and Aerial Target Strikes Under Alternative 1 for Testing Activities

As shown in Table 3.0-11, the number of testing activities including aircraft movements under Alternative 1 would increase in the Offshore Area. Alternative 1 includes new testing activities not previously analyzed in the 2015 NWTT Final EIS/OEIS. These activities include Mine Countermeasure and Neutralization Testing, Kinetic Energy Weapons testing (when using aerial targets), radar and other systems testing, and simulant testing (when using fixed-wing and rotary-wing aircraft). Within the Offshore Area, birds are least likely to be struck because of the flight altitudes of birds (generally lower for seabirds over open water), and flight altitudes of aircraft. Despite increases in the number of testing activities involving aircraft and aerial targets in the Offshore Area under Alternative 1, birds are at low risk for aircraft or aerial target strike for the same reasons as described above under training activities. Under Alternative 1, the number of aircraft activities in the Western Behm Canal would not change from what was previously analyzed in the 2015 NWTT Final EIS/OEIS. Within inland waters, the number of activities involving aircraft under Alternative 1 testing activities would decrease. These flights generally occur at lower altitudes, which may elevate the risk of strike for birds; however, these aircraft are primarily helicopters and birds are expected to respond to other stimulus and avoid the helicopter, reducing the potential for strike. Therefore, the potential for strike of marbled murrelets within inshore waters is discountable, a conclusion supported in the 2016 USFWS BO (U.S. Fish and Wildlife Service, 2016).

Mine Countermeasures and Neutralization Testing may occur in the nearshore and coastal portion of the Quinault Range. Typically, shorebirds when in flight in coastal areas fly within a few meters of the water or land surface and are not susceptible to strike.

Pursuant to the ESA, activities involving aircraft flights and aerial targets during testing activities as described under Alternative 1 may affect the marbled murrelet and short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts of aircraft and aerial targets during testing activities described under Alternative 1 would not result in a significant adverse effect on populations seabirds, shorebirds, and other birds protected under the MBTA.

3.6.2.4.1.2 Impacts from Aircraft and Aerial Targets Under Alternative 2

Impacts from Aircraft and Aerial Targets Under Alternative 2 for Training Activities

As shown in Table 3.0-11, the number of training activities including aircraft movements under Alternative 2 would increase in the Offshore Area compared to what was analyzed previously in the 2015 NWTT Final EIS/OEIS and to what is proposed under Alternative 1. Activities proposed under Alternative 2 in Inland Waters would increase from what was previously analyzed in the 2015 NWTT Final EIS/OEIS and what is proposed under Alternative 1. As with the 2015 NWTT Final EIS/OEIS and Alternative 1, there would be no aircraft activity as part of training activities under Alternative 2 within the Western Behm Canal.

In general, bird populations consist of hundreds or thousands, ranging across a large geographical area. In this context, the loss of several or even dozens of birds due to physical strikes may not constitute a population-level effect. Bird exposure to strike potential would be relatively brief, as an aircraft quickly passes overhead. Seabirds actively avoid interaction with aircraft; however, disturbances of various seabird species may occur from aviation operations on a site-specific basis. As a standard operating procedure, aircraft avoid large flocks of birds to minimize the safety risk involved with a potential bird strike. As stated previously, birds are least at risk from aircraft or aerial target strike in the Offshore Area, primarily because of the different altitudes birds and aircraft typically occupy over the open ocean, the dispersed number of activities, and the relatively lower abundance of birds in the Offshore Area. Within inland waters, aircraft movements would generally occur at lower altitudes, which may elevate the risk of strike for birds. These aircraft, however, are primarily rotor-wing aircraft. Birds are expected to respond to other stimulus and avoid the helicopter, thus reducing the potential for strike. Therefore, the potential for strike of marbled murrelets within inshore waters is discountable, a conclusion supported in the USFWS 2016 BO (U.S. Fish and Wildlife Service, 2016). The conclusions for aircraft strike under Alternative 2 training activities is the same as for Alternative 1.

Pursuant to the ESA, activities involving aircraft flights and aerial targets during training activities as described under Alternative 2 may affect the marbled murrelet and short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts of aircraft and aerial targets during training activities described under Alternative 2 would not result in a significant adverse effect on populations seabirds, shorebirds, and other birds protected under the MBTA.

Impacts from Aircraft and Aerial Targets Under Alternative 2 for Testing Activities

As shown in Table 3.0-11, the number of testing activities including aircraft movements under Alternative 2 would increase in the Offshore Area compared to what was analyzed previously in the 2015 NWTT Final EIS/OEIS and slightly increase compared to what is analyzed under Alternative 1. These increases would occur in the Offshore Area, with decreases in the Inland Waters portion of the Study Area; there would be no change within Western Behm Canal.

In general, bird populations consist of hundreds or thousands, ranging across a large geographical area. In this context, the loss of several or even dozens of birds due to physical strikes may not constitute a population-level effect. Bird exposure to strike potential would be relatively brief, as an aircraft quickly passes overhead. Seabirds actively avoid interaction with aircraft; however, disturbances of various seabird species may occur from aviation operations on a site-specific basis. As a standard operating procedure, aircraft avoid large flocks of birds to minimize the safety risk involved with a potential bird strike. As stated previously, birds are least at risk from aircraft or aerial target strike in the Offshore Area, primarily because of the different altitudes birds and aircraft typically occupy over the open ocean, the dispersed number of activities, and the relatively lower abundance of birds in the Offshore Area. Within inland waters, aircraft movements would generally occur at lower altitudes, which may elevate the risk of strike for birds. These aircraft, however, are primarily rotor-wing aircraft. Birds are expected to respond to other stimulus and avoid the helicopter, thus reducing the potential for strike. Therefore, the potential for strike of marbled murrelets within inshore waters is discountable, a conclusion supported in the 2016 USFWS BO (U.S. Fish and Wildlife Service, 2016). The conclusions for aircraft strike under Alternative 2 testing activities is the same as for Alternative 1.

Pursuant to the ESA, activities involving aircraft flights and aerial targets during testing activities as described under Alternative 2 may affect the marbled murrelet and short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts of aircraft and aerial targets during testing activities described under Alternative 2 would not result in a significant adverse effect on populations seabirds, shorebirds, and other birds protected under the MBTA.

3.6.2.4.1.3 Impacts from Aircraft and Aerial Targets Under the No Action Alternative

Under the No Action Alternative, the Navy would not conduct proposed at-sea training and testing activities in the Study Area. Aircraft and aerial targets as listed above would not be introduced into the affected marine environment or areas over land. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer physical disturbance and strike stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from aircraft and aerial targets on individual birds, but would not measurably improve the status of bird populations.

3.6.2.4.2 Impacts from Vessels and In-Water Devices

Appendix A (Navy Activities Descriptions) describes the number of vessels used during the various types of Navy's proposed activities. Activities involving Navy vessel movement would be widely dispersed throughout the Study Area. Since the release of the 2015 NWTT Final EIS/OEIS, updated information is available regarding vessel traffic in and around major port facilities within the NWTT Study Area. Data from the ports of Vancouver, Seattle, and Tacoma indicated there were in excess of 10,300 commercial vessel transits in 2017 associated with visits to just those ports (The Northwest Seaport Alliance, 2018; Vancouver Fraser Port Authority, 2017). This information is summarized in Chapter 4 (Cumulative Impacts) of this Supplemental EIS/OEIS.

3.6.2.4.2.1 Impacts from Vessels and In-Water Devices Under Alternative 1

Impacts from Vessels and In-Water Devices Under Alternative 1 for Training Activities

Under Alternative 1, the number of proposed training activities involving the movement of vessels or the use of in-water devices would remain generally consistent with those proposed in the 2015 NWTT Final EIS/OEIS (these comparisons are shown in Table 3.0-12 and Table 3.0-13 of this Supplemental). Vessel movement would decrease in the Offshore Area and decrease in Inland Waters, resulting in a small net decrease in activities in the Study Area. No vessel movements would occur as part of training activities within the Western Behm Canal. The activities would occur in the same locations and in a similar manner as were analyzed previously. The increases under Alternative 1 would occur in the Offshore Area and Inland Waters portions of the Study Area, with no use of in-water devices proposed under Alternative 1 occurring in the Western Behm Canal.

In the 2016 BO, the USFWS stated, "The likelihood of either a marbled murrelet or a short-tailed albatross striking a Navy vessel [*sic*] is considered extremely unlikely and is therefore discountable" (U.S. Fish and Wildlife Service, 2016). Activities including vessel movement in the Inland Waters are proposed to decrease. Although activities including vessel movement in the Offshore Area are proposed to increase, the increase in activities does not result in increased risk to marbled murrelets or short-tailed albatross. As stated by the USFWS in the 2016 BO, "marbled murrelets and short-tailed albatross are capable of avoiding vessels" (U.S. Fish and Wildlife Service, 2016).

Similarly, the USFWS stated in the 2016 BO that, "Effects from exposure to in-water devices are considered extremely unlikely and are therefore discountable" (U.S. Fish and Wildlife Service, 2016). There is an overall increase in the use of in-water devices (Table 3.0-13), all of which are associated with small, slow-moving unmanned underwater vehicles.

Marbled Murrelet. Marbled murrelets could encounter vessels or in-water devices during training and testing activities, but strikes are extremely unlikely. Responses of murrelets to vessel operation could include diving, swimming away from a vessel, or abandoning a foraging area. However, the potential for behavioral effects from Navy vessel movements are low because the training and testing events are transitory in time, with few vessels moving over large areas. In addition, if behavioral disruptions result from the vessel operation, they are expected to be temporary. Murrelets are expected to resume their resting, breeding, and foraging bouts with minimal disruption. Therefore, effects are expected to be insignificant.

Short-tailed Albatross. Given the proposed timing, location, and frequency of training in the Offshore Area, and the small number of short-tailed albatross that are likely to occur in the Offshore Area at any given time, it is extremely unlikely that individual albatross would co-occur with Navy vessels or in-water devices. Therefore, the effects of vessel and in-water device strikes on short-tailed albatross would be discountable.

Pursuant to the ESA, training activities that use vessels and in-water devices, as described under Alternative 1, may affect the ESA-listed marbled murrelet or short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from vessels and in-water devices during training activities described under Alternative 1 would not result in a significant adverse effect on migratory bird populations.

Impacts from Vessels and In-Water Devices Under Alternative 1 for Testing Activities

Under Alternative 1, the number of proposed testing activities involving the movement of vessels or the use of in-water devices would increase compared to those proposed in the 2015 NWTT Final EIS/OEIS (see Table 3.0-12 and Table 3.0-13 for a comparison of what was analyzed in the 2015 NWTT Final EIS/OEIS to what is proposed in this Supplemental). While vessel movement would increase significantly in the Offshore Area (from 181 to 283 annual activities), it would increase in both Inland Waters (from 916 to 918) and Western Behm Canal (63 to 77), resulting in a net increase in the Study Area. There is also an overall increase in the use of in-water devices (Table 3.0-13). The activities would occur in the same locations and in a similar manner as were analyzed previously. There is an overall increase in the use of in-water devices (Table 3.0-13). This small increase in testing activity numbers would not appreciably change the analysis included in the 2015 NWTT Final EIS/OEIS, with the impact descriptions the same as described previously under Alternative 1 training activities.

Pursuant to the ESA, testing activities that use vessels and in-water devices, as described under Alternative 1, may affect the ESA-listed marbled murrelet or short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from vessels and in-water devices during testing activities described under Alternative 1 would not result in a significant adverse effect on migratory bird populations.

3.6.2.4.2.2 Impacts from Vessels and In-Water Devices Under Alternative 2

Impacts from Vessels and In-Water Devices Under Alternative 2 for Training Activities

Under Alternative 2, the number of proposed training activities involving the movement of vessels or the use of in-water devices would remain generally consistent with those proposed in the 2015 NWTT Final EIS/OEIS (see Table 3.0-12 and Table 3.0-13 for a comparison of what was analyzed in the 2015 NWTT Final EIS/OEIS to what is proposed in this Supplemental). Vessel movement would decrease slightly in the Study Area (Table 3.0-12), and there is an overall increase in the use of in-water devices (Table 3.0-13). Compared to Alternative 1, Alternative 2 would slightly increase vessel and in-water device use.

As with Alternative 1, the activities described under Alternative 2 in this Supplemental would not be sufficient to modify the vessel and in-water device strike conclusions for seabird species provided in the 2015 NWTT Final EIS/OEIS. Therefore, the conclusions for ESA-listed seabird species and other seabird species protected by the MBTA that were included in the 2015 NWTT Final EIS/OEIS remain valid. During

ESA section 7 consultation between the Navy and USFWS, the Navy determined that the activities described in the 2015 NWTT Final EIS/OEIS may affect, but are not likely to adversely affect the marbled murrelet or short-tailed albatross.

Pursuant to the ESA, training activities that use vessels and in-water devices, as described under Alternative 2, may affect the ESA-listed marbled murrelet or short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from vessels and in-water devices during training activities described under Alternative 2 would not result in a significant adverse effect on migratory bird populations.

Impacts from Vessels and In-Water Devices Under Alternative 2 Testing Activities

Under Alternative 2, the number of proposed testing activities involving the movement of vessels or the use of in-water devices would increase compared to those proposed in the 2015 NWTT Final EIS/OEIS (see Table 3.0-12 and Table 3.0-13 for a comparison of what was analyzed in the 2015 NWTT Final EIS/OEIS to what is proposed in this Supplemental). Compared to the previous 2015 analysis, vessel movement under Alternative 2 would increase in the Offshore Area (from 181 to 285 annual activities), increase in the Inland Waters (from 916 to 1,028), and increase in the Western Behm Canal (from 60 to 77), resulting in an increase in the Study Area. There is also an overall increase in the use of in-water devices (Table 3.0-13). Compared to Alternative 1, Alternative 2 would slightly increase vessel and in-water device use.

As with Alternative 1, the testing activities described under Alternative 2 in this Supplemental would not be sufficient to modify the vessel and in-water device strike conclusions for bird species provided in the 2015 NWTT Final EIS/OEIS. Therefore, the conclusions for ESA-listed seabird species and other seabird species protected by the MBTA that were included in the 2015 NWTT Final EIS/OEIS remain valid.

Pursuant to the ESA, testing activities that use vessels and in-water devices, as described under Alternative 2, may affect the ESA-listed marbled murrelet or short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from vessels and in-water devices during testing activities described under Alternative 2 would not result in a significant adverse effect on migratory bird populations.

3.6.2.4.2.3 Impacts from Vessels and In-Water Devices Under the No Action Alternative

Under the No Action Alternative, the Navy would not conduct proposed at-sea training and testing activities in the Study Area. Vessels and in-water devices as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer physical disturbance and strike stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from vessels and in-water devices on individual birds, but would not measurably improve the status of bird populations.

3.6.2.4.3 Impacts from Military Expended Materials

For the analysis of impacts from military expended material as physical disturbance stressors, see Section 3.6.3.2.3 (Impacts from Military Expended Materials) in the 2015 NWTT Final EIS/OEIS. Since the 2015 NWTT Final EIS/OEIS, there has been no new or emergent science that would change in any way the rationale for the dismissal of impacts from military expended material as presented in the 2015 analyses. There have been no known instances of physical disturbance or strike to any marine bird as a result of training and testing activities involving the use of military expended materials prior to or since the 2015 NWTT Final EIS/OEIS.

3.6.2.4.3.1 Impacts from Military Expended Materials Under Alternative 1

Impacts from Military Expended Materials Under Alternative 1 for Training Activities

Under Alternative 1, the number of military materials that would be expended during training activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from (Tables 3.0-14 through 3.0-16) are combined, the number of items proposed to be expended under Alternative 1 decreases compared to ongoing activities (from a total of 187,016 to 170,754 items). The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. The Navy will implement mitigation within a 200-yard mitigation zone to avoid or reduce potential impacts from non-explosive small- and medium-caliber gunnery activities on seabirds, as detailed in Section 5.3.4 (Physical Disturbance and Strike Stressors). While the number of training activities using military expended material would change under this Supplemental, the analysis presented in the 2015 NWTT Final EIS/OEIS and the 2016 USFWS BO (U.S. Fish and Wildlife Service, 2016) remain valid; physical disturbance and strike impacts on birds resulting from military expended materials are not anticipated.

Pursuant to the ESA, training activities that release military expended materials, as described under Alternative 1, may affect the ESA-listed marbled murrelet or short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from military expended materials during training activities described under Alternative 1 would not result in a significant adverse effect on migratory bird populations.

Impacts from Military Expended Materials Under Alternative 1 for Testing Activities

Under Alternative 1, the number of military materials that would be expended during testing activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from Table 3.0-14 through Table 3.0-16 in this Supplemental are combined, the number of items proposed to be expended under Alternative 1 increases compared to ongoing activities (from a total of 8,130 to 10,710 items). The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. While the number of testing activities using military expended material would change under this Supplemental, the analysis presented in the 2015 NWTT Final EIS/OEIS and the 2016 USFWS BO (U.S. Fish and Wildlife Service, 2016) remain valid; physical disturbance and strike impacts on marine birds resulting from military expended materials are not expected.

Pursuant to the ESA, testing activities that release military expended materials, as described under Alternative 1, may affect the ESA-listed marbled murrelet or short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from military expended materials during testing activities described under Alternative 1 would not result in a significant adverse effect on migratory bird populations.

3.6.2.4.3.2 Impacts from Military Expended Materials Under Alternative 2

Impacts from Military Expended Materials Under Alternative 2 for Training Activities

Under Alternative 2, the number of military materials that would be expended during training activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from Table 3.0-14 through Table 3.0-16 of this Supplemental are combined, the number of items proposed to be expended under Alternative 2 increases compared to ongoing activities (from a total of 187,016 to 196,629 items). Compared to Alternative 1, there would be an overall increase in the number of items expended under Alternative 2. While the number of testing activities using military expended material would change under this Supplemental, the analysis presented in the 2015 NWTT Final EIS/OEIS and the 2016 USFWS BO (U.S. Fish and Wildlife Service, 2016) remain valid; physical disturbance and strike impacts on birds resulting from military expended materials are not expected.

Pursuant to the ESA, training activities that release military expended materials, as described under Alternative 2, may affect the ESA-listed marbled murrelet or short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from military expended materials during training activities described under Alternative 2 would not result in a significant adverse effect on migratory bird populations.

Impacts from Military Expended Materials Under Alternative 2 for Testing Activities

Under Alternative 2, the number of military materials that would be expended during testing activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from Table 3.0-14 through Table 3.0-16 are combined, the number of items proposed to be expended under Alternative 2 increases compared to ongoing activities and would increase compared to what is proposed under Alternative 1 (by approximately 3,000 total items).

While the number of testing activities using military expended material would change under this Supplemental, the analysis presented in the 2015 NWTT Final EIS/OEIS and the 2016 USFWS BO (U.S. Fish and Wildlife Service, 2016) remain valid; physical disturbance and strike impacts on birds resulting from military expended materials are not expected.

Pursuant to the ESA, testing activities that release military expended materials, as described under Alternative 2, may affect the ESA-listed marbled murrelet or short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from military expended materials during testing activities described under Alternative 2 would not result in a significant adverse effect on migratory bird populations.

3.6.2.4.3.3 Impacts from Military Expended Materials Under the No Action Alternative

Under the No Action Alternative, the Navy would not conduct proposed at-sea training and testing activities in the Study Area. Military expended materials as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer physical disturbance and strike stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from military expended materials on individual birds, but would not measurably improve the status of bird populations.

3.6.2.5 Entanglement Stressors

In the 2015 NWTT Final EIS/OEIS, the Navy did not analyze potential impacts on birds from entanglement stressors. The USFWS, however, decided the analysis of entanglement stressors was warranted and included this analysis in the 2016 USFWS BO (U.S. Fish and Wildlife Service, 2016). Entanglement stressors were not analyzed in the 2015 NWTT EIS/OEIS because wires and cables and decelerators/parachutes (the types materials analyzed for potential entanglement of other marine animals) were determined to be an extremely low risk for marine birds. Certain activities and their associated stressors take place in specific locations or depth zones within the Study Area outside the range or foraging abilities of most birds. The USFWS analyzed the potential for entanglement of expended materials during training and testing activities and determined that the risk was discountable for marbled murrelets and short-tailed albatross for the following reasons: (1) guidance wires and fiber optic cables would rapidly sink in the water column; (2) decelerators and parachutes have weights and metal clips attached to them that facilitate their descent to the seafloor and minimize the time when entanglement could occur; and (3) items at risk for entanglement of murrelets and albatrosses are expended from moving objects (e.g., torpedoes, unmanned underwater vehicles), which are likely avoided by birds).

Since the publication of the 2015 NWTT Final EIS/OEIS, a new type of expended material is used during the existing countermeasure testing activity that involves the use of biodegradable polymers. The biodegradable polymers that the Navy uses are designed to temporarily interact with the propeller(s) of a target craft, rendering it ineffective. Based on the constituents of the biodegradable polymer the Navy proposes to use, it is anticipated that the material will breakdown into small pieces within a few days to weeks. This will breakdown further and dissolve into the water column within weeks to a few months. The final products which are all environmentally benign will be dispersed quickly to undetectable concentrations. Unlike other entanglement stressors, biodegradable polymers only retain their strength for a relatively short period of time, therefore the potential for entanglement by a marine bird would be limited. Furthermore, the longer the biodegradable polymer remains in the water, the weaker it becomes making it more brittle and likely to break. A marine bird would have to encounter the biodegradable polymer immediately after it was expended for it to be a potential entanglement risk. If an animal were to encounter the polymer a few hours after it was expended, it is very likely that it would break easily and would no longer be an entanglement stressor. The use of biodegradable polymers is included as a new testing activity in this Supplemental and is analyzed in the following sections.

3.6.2.5.1 Impacts from Biodegradable Polymers Under Alternative 1

Impacts from Military Expended Materials Under Alternative 1 for Training Activities

There are no training activities under Alternative 1 that use biodegradable polymers.

Impacts from Military Expended Materials Under Alternative 1 for Testing Activities

As shown in Table 3.0-21, four testing activities involving the use of biodegradable polymers are proposed to be conducted in the Inland Waters under Alternative 1 in the DBRC and the Keyport Range. The impact of biodegradable polymers on marine birds would be inconsequential because biodegradable polymers only retain their strength for a relatively short period of time, and a marine bird would have to encounter the biodegradable polymer immediately after it was expended for it to be a potential entanglement risk. It is possible for any marine bird species inhabiting the Inland Waters portion of the Study Area to be at either of those two locations.

The number of proposed testing activities involving biodegradable polymers in the Inland Waters is relatively low. Based on this limited number of annual activities, the concentration of biodegradable polymers within the two Inland Waters locations of the Study Area would likewise be low, and the Navy does not anticipate that any marine birds would become entangled by biodegradable polymers.

Pursuant to the ESA, testing activities that release biodegradable polymers, as described under Alternative 1, would have no effect on the short-tailed albatross and may affect the ESA-listed marbled murrelet. The Navy is consulting with the USFWS on the marbled murrelet, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from biodegradable polymers released during testing activities described under Alternative 1 would not result in a significant adverse effect on migratory bird populations.

3.6.2.5.2 Impacts from Biodegradable Polymers Under Alternative 2

Impacts from Military Expended Materials Under Alternative 2 for Training Activities

There are no training activities under Alternative 2 that use biodegradable polymers.

Impacts from Military Expended Materials Under Alternative 2 for Testing Activities

Biodegradable polymers were not part of the proposed action analyzed in the 2015 NWTT Final EIS/OEIS. The proposed use of biodegradable polymers under Alternative 2 in this Supplemental is the same as under Alternative 1 (see Table 3.0-21 for a comparison of what was analyzed in the 2015 NWTT Final EIS/OEIS to what is proposed in this Supplemental). As a result, the expected impacts are the same between the two alternatives and as described in detail above under Alternative 1; Navy does not anticipate that any marine birds would become entangled by biodegradable polymers.

Pursuant to the ESA, testing activities that release biodegradable polymers, as described under Alternative 2, may affect the ESA-listed marbled murrelet. The Navy is consulting with the USFWS on this species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from biodegradable polymers released during testing activities described under Alternative 2 would not result in a significant adverse effect on migratory bird populations.

3.6.2.5.3 Impacts from Biodegradable Polymers Under the No Action Alternative for Training and Testing Activities

Under the No Action Alternative, proposed training and testing activities would not occur. Biodegradable polymers as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer entanglement stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for entanglement on individual marine birds, but would not measurably improve the status of bird populations.

3.6.2.6 Ingestion Stressors

As discussed in Section 3.6.3.3 (Ingestion Stressors) of the 2015 NWTT Final EIS/OEIS, a variety of ingestible materials may be released into the marine environment by Navy training and testing activities. Unrecovered materials from the Navy's training and testing activities that that could float at or below the surface include chaff fibers, plastic end caps and pistons from flares, plastic end caps and pistons from chaff cartridges, fragments of missiles (rubber, carbon, or Kevlar fibers), and fragments of targets. Plastic end caps and pistons from flares and chaff cartridges may float for some period of time. The ingestions stressor that may impact marine birds is a broad category of military expended materials other than munitions, that includes fragments from targets, chaff and flare components, and biodegradable polymers) as detailed in Section 3.0.3.6 (Ingestion Stressors) in this Supplemental EIS/OEIS.

The 2015 NWTT Final EIS/OEIS discounted the potential of military expended materials from munitions (non-explosive practice munitions and fragments from high-explosives) as a potential ingestion stressor because military expended material from munitions is not expected to occur because the solid metal and heavy plastic objects from these ordnances sink rapidly to the seafloor, beyond the foraging depth range of most birds. The analysis for potential ingestion stressors in the 2015 NWTT Final EIS/OEIS also discounted decelerator/parachutes as an ingestion stressor because these items likely remain on the surface, but sink rapidly because of metal components attached to the decelerator/parachute. In the 2016 USFWS BO, the USFWS agreed with the Navy in discounting military expended materials from munitions and decelerator/parachutes and determined that potential impacts on marbled murrelets would be discountable (unlikely to occur) from ingestion stressors. The USFWS, however, determined that short-tailed albatrosses would likely experience adverse effects from potentially ingestible military expended materials other than munitions (U.S. Fish and Wildlife Service, 2016).

3.6.2.6.1 Impacts from Ingestion Stressors (Military Expended Materials Other than Munitions) Under Alternative 1

<u>**Impacts from Military Expended Materials – Other Than Munitions Under Alternative 1 for Training Activities**</u>

Under Alternative 1, the number of military expended materials other than munitions that would be used during training activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS (see Table 3.0-15, 3.0-17, Table 3.0-20, Table 3.0-21, and Table 3.0-22 for a comparison of what was analyzed in the 2015 NWTT Final EIS/OEIS to what is proposed in this Supplemental). When the amount of military expended materials other than munitions (fragments from targets, chaff and flare components, and biodegradable polymers) are combined, the number of items proposed to be expended under Alternative 1 increases slightly from ongoing activities. While training use of military expended material would change under this Supplemental, the analysis presented in Section 3.6.3.3 (Ingestion Stressors) in the 2015 NWTT Final EIS/OEIS and the 2016 USFWS BO (U.S. Fish and Wildlife Service, 2016) would not change. The USFWS determined that potential impacts on marbled murrelets from ingestion stressors would be discountable (unlikely to occur), and that the short-tailed albatross would likely experience adverse effects through the introduction of plastic debris in the Study Area.

Pursuant to the ESA, training activities that release military expended materials – other than munitions, as described under Alternative 1, may affect the ESA-listed marbled murrelet and short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from military expended materials – other than munitions released during training activities described under Alternative 1 would not result in a significant adverse effect on migratory bird populations.

<u>**Impacts from Military Expended Materials, Other Than Munitions, Under Alternative 1 for Testing Activities**</u>

Under Alternative 1 and as presented in Section 3.0 (Introduction, see Table 3.0-15, Table 3.0-17, Table 3.0-20, Table 3.0-21, and Table 3.0-22 for a comparison of what was analyzed in the 2015 NWTT Final EIS/OEIS to what is proposed in this Supplemental), testing use of military expended materials – other than munitions will increase in comparison to ongoing activities and as discussed in the 2015 NWTT Final EIS/OEIS. This includes testing activities that use biodegradable polymers, which are proposed to be conducted in the DBRC, Keyport Range, and Hood Canal. The number of proposed testing activities involving biodegradable polymers is relatively low (a maximum of four times annually), as shown in Section 3.0.3.5.3 (Biodegradable Polymer), Table 3.0-21. As stated previously, biodegradable polymers would be used in some testing activities and were not analyzed in the 2015 document. Biodegradable polymers could theoretically be ingested by birds; however, the likelihood is low because testing activities that use biodegradable polymers would only occur in Hood Canal, Keyport Range, and Dabob Bay (only birds foraging in these waters would potentially ingest biodegradable polymers), the material would persist only until the polymer degrades, generally within days to weeks of deployment. Because the final products of the breakdown are all environmentally benign, the Navy does not expect the use biodegradable polymer to have any negative impacts for marine birds.

While testing use of military expended material would change under this Supplemental, the analysis presented in Section 3.6.3.3 (Ingestion Stressors) in the 2015 NWTT Final EIS/OEIS and the 2016 USFWS BO (U.S. Fish and Wildlife Service, 2016) would not change. The USFWS determined that potential impacts on marbled murrelets from ingestion stressors would be discountable (unlikely to occur), and that the short-tailed albatross would likely experience adverse effects through the introduction of plastic debris in the Study Area. Because biodegradable polymers would only be expended in Inland Waters, only the marbled murrelet would be potentially exposed to biodegradable polymers as an ingestion stressor.

Pursuant to the ESA, testing activities that release military expended materials (other than munitions), as described under Alternative 1, would have no effect on the short-tailed albatross and may affect the ESA-listed marbled murrelet and short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from military expended materials – other than munitions released during testing activities described under Alternative 1 would not result in a significant adverse effect on migratory bird populations.

3.6.2.6.2 Impacts from Military Expended Materials – Other than Munitions Under Alternative 2

Impacts from Military Expended Materials – Other Than Munitions Under Alternative 2 for Training Activities

Under Alternative 2 and as presented in Section 3.0 (Introduction, see Table 3.0-15, Table 3.0-17, Table 3.0-20, Table 3.0-21, and Table 3.0-22 for a comparison of what was analyzed in the 2015 NWTT Final EIS/OEIS to what is proposed in this Supplemental), training use of military expended materials – other than munitions increases in comparison to ongoing activities and Alternative 1. The new biodegradable polymers ingestion sub stressor would not be used during training activities under Alternative 2. While training use of military expended material would change under this Supplemental, the analysis presented in Section 3.6.3.3 (Ingestion Stressors) in the 2015 NWTT Final EIS/OEIS and the 2016 USFWS BO (U.S. Fish and Wildlife Service, 2016) would not change. The USFWS determined that potential impacts on marbled murrelets from ingestion stressors would be discountable (unlikely to occur), and that the short-tailed albatross would likely experience adverse effects through the introduction of plastic debris in the Study Area.

Pursuant to the ESA, training activities that release military expended materials – other than munitions, as described under Alternative 2, may affect the ESA-listed marbled murrelet and short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from military expended materials – other than munitions released during training activities described under Alternative 2 would not result in a significant adverse effect on migratory bird populations.

Impacts from Military Expended Materials – Other Than Munitions Under Alternative 2 for Testing Activities

Under Alternative 2 and as presented in Section 3.0 (Introduction, see Table 3.0-15, Table 3.0-17, Table 3.0-20, Table 3.0-21, and Table 3.0-22 for a comparison of what was analyzed in the 2015 NWTT Final EIS/OEIS to what is proposed in this Supplemental), testing use of military expended materials – other than munitions will increase in comparison to ongoing activities and are the same as proposed under Alternative 1 in this Supplemental EIS/OEIS. Given the alternatives are the same and as presented above for Alternative 1 for testing, the conclusions are the same. Impacts from ingestion stressors from the use of military expended materials – other than munitions are not expected.

Pursuant to the ESA, testing activities that release military expended materials – other than munitions, as described under Alternative 2, may affect the ESA-listed marbled murrelet and short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from military expended materials – other than munitions released during testing activities described under Alternative 2 would not result in a significant adverse effect on migratory bird populations.

3.6.2.6.3 Impacts from Military Expended Materials – Other Than Munitions Under the No Action Alternative

Under the No Action Alternative, the Navy would not conduct proposed at-sea training and testing activities in the Study Area. Military expended materials –other than munitions as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer ingestion stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from military expended materials on individual birds, but would not measurably improve the status of bird populations.

3.6.2.7 Secondary Stressors (Impacts on Habitat or Prey Availability)

Stressors from training and testing activities could pose secondary or indirect impacts on birds via habitat, sediment, and water quality. These include (1) impacts on habitats for birds, and (2) impacts on prey availability.

While the number of training and testing activities would change under this supplement, the analysis presented in the 2015 NWTT Final EIS/OEIS, Section 3.6.3.4 (Secondary Stressors) remains valid. The changes in training and testing activities are not substantial and would not result in an overall change to existing environmental conditions or an increase in the level or intensity of secondary stressors within the Study Area.

As stated in the 2015 NWTT Final EIS/OEIS, indirect impacts of explosives and unexploded ordnance on birds via water could not only cause physical impacts, but prey items (e.g., fishes) might also have behavioral reactions to underwater sound. For example, the sound from underwater explosions might induce startle reactions and temporary dispersal of schooling fishes if they are within close proximity. The abundances of fish and invertebrate prey species near the detonation point could be diminished for a short period of time before being repopulated by animals from adjacent waters. Secondary impacts from underwater explosions would be temporary, and no lasting impact on prey availability or the pelagic food web would be expected. Indirect impacts of underwater detonations and explosive ordnance use under the Proposed Action would not result in a decrease in the quantity or quality of bird populations or habitats, or prey species and habitats, in the Study Area.

Certain metals are harmful to prey items at concentrations above background levels (e.g., cadmium, chromium, lead, mercury, zinc, copper, manganese, and many others) (Wang & Rainbow, 2008). Metals are introduced into seawater and sediments as a result of Navy training and testing activities involving vessel hulks, targets, ordnance, munitions, and other military expended materials. Indirect impacts of metals on birds consuming prey items through the food chain involve concentrations that are several orders of magnitude lower than concentrations achieved via bioaccumulation. Fishes may be exposed by contact with the metal, contact with contaminants in the sediment or water, and ingestion of contaminated sediments. Concentrations of metals in sea water are orders of magnitude lower than concentrations in marine sediments. It is extremely unlikely that birds would be indirectly impacted by toxic metals via the water.

Any effects to birds are not anticipated to be harmful or severe because of (1) the temporary nature of impacts on water or air quality, (2) the distribution of temporary water or air quality impacts, (3) the wide distribution of birds in the Study Area, and (4) the dispersed spatial and temporal nature of the training and testing activities that may have temporary water or air quality impacts. No long-term or population-level impacts are expected.

Pursuant to the ESA, secondary impacts on prey availability during training or testing activities as described under Alternative 1 and Alternative 2 may affect the marbled murrelet and short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA for secondary stressors under Alternative 1.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from secondary stressors would not result in a significant adverse effect on migratory bird populations.

3.6.2.8 Critical Habitat Determinations

The 2015 NWTT Final EIS/OEIS contained critical habitat determinations. Critical habitat has not changed for any of the species considered, and as stated in the analysis above, no activities have increased, decreased, or changed significantly enough to alter the conclusions from the 2015 NWTT Final EIS/OEIS or 2016 USFWS BO (U.S. Fish and Wildlife Service, 2016); therefore, those conclusions remain valid for this Supplemental EIS/OEIS. The Navy has determined that the Alternatives 1 and 2 would have no effect on designated critical habitat for the marbled murrelet, northern spotted owl, streaked horned lark, or the western snowy plover. Critical habitat has not been designated or proposed for the short-tailed albatross.

3.6.2.9 Migratory Bird Treaty Act Determinations

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from stressors introduced during training and testing activities would not result in a significant adverse effect on migratory bird populations.

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3.7 Marine Vegetation

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3.7 Marine Vegetation

3.7.1 Affected Environment

For purposes of this Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) (Supplemental), the region of influence for marine vegetation remains the same as that identified in the 2015 Northwest Training and Testing (NWTT) Final EIS/OEIS.

3.7.1.1 General Threats

Following a review of recent literature, the existing conditions of marine habitats in the Study Area as listed in the 2015 NWTT Final EIS/OEIS have not appreciably changed. As such, the information presented in the 2015 NWTT Final EIS/OEIS remains valid.

3.7.1.2 Marine Vegetation Groups and Distribution

A literature review found that the information on marine vegetation groups in the Study Area have not substantially changed from what is shown in the 2015 NWTT Final EIS/OEIS. As such, the information presented in the 2015 NWTT Final EIS/OEIS remains valid for the following marine vegetation groups: phylum Dinophyta [dinoflagellates], phylum Cyanobacteria [blue-green algae], phylum Chlorophyta [green algae], phylum Heterokontophyta [brown algae], phylum Rhodophyta [red algae], diatoms, and phylum Spermatophyta [seagrasses and cordgrasses]).

Some of the vegetated habitats, such as eelgrass beds, are Essential Fish Habitat (EFH) and protected under the Magnuson-Stevens Fishery Conservation and Management Act, which was reauthorized and amended by the Sustainable Fisheries Act in 1996.

3.7.2 Environmental Consequences

In the Proposed Action for this Supplemental, some modifications have been made to the quantity and type of explosive stressors under the two action alternatives. New activities being proposed; high-energy lasers (Energy stressor), as described in Section 3.0.3.3.2.2 (High-Energy Lasers); and biodegradable polymer (Entanglement stressor), as described in Section 3.0.3.5.3 (Biodegradable Polymer) would not impact marine vegetation and therefore do not change the stressors analyzed or the results of the analyses presented in the 2015 NWTT Final EIS/OEIS.

The 2015 NWTT Final EIS/OEIS considered training and testing activities proposed to occur in the Study Area that may have the potential to impact marine vegetation. The stressors applicable to marine vegetation in the Study Area include the same stressors considered in the 2015 NWTT Final EIS/OEIS:

- **Explosive** (in-air explosions, in-water explosions)
- **Physical disturbance and strike** (vessels and in-water devices, military expended materials, seafloor devices)
- **Secondary** (impacts associated with sediments and water quality)

This section evaluates how and to what degree potential impacts on marine vegetation from stressors described in Section 3.0 (Introduction) may have changed since the analysis presented in the 2015 NWTT Final EIS/OEIS was completed. Proposed training and testing activities, the number of times each activity would be conducted annually, and the locations within the Study Area where the activity would typically occur under each alternative are presented in Tables 2.5-1, 2.5-2, and 2.5-3 in Chapter 2 (Description of Proposed Action and Alternatives). The tables also present the same information for activities described in the 2015 NWTT Final EIS/OEIS so that the proposed levels of training and testing under this Supplemental can be easily compared.

The analysis presented in this section also considers standard operating procedures described in Section 2.3.3 (Standard Operating Procedures) and mitigation measures that are described in Chapter 5 (Mitigation) and analyzed in Appendix K (Geographic Mitigation Assessment). These procedures and measures include the use of lookouts or observers to observe for additional biological resources, such as floating vegetation. The term "floating vegetation" refers specifically to floating concentrations of detached kelp paddies and *Sargassum*. The Navy observes for these additional biological resources to protect Endangered Species Act-listed species or to offer an additional layer of protection for marine mammals and sea turtles. The Navy would implement these measures to avoid potential impacts on marine vegetation from stressors associated with the proposed training and testing activities.

3.7.2.1 Explosive Stressors

3.7.2.1.1 Impacts from Explosives

As stated in the 2015 NWTT Final EIS/OEIS, the potential for an explosion to injure or destroy marine vegetation would depend on the amount of vegetation present, the number of munitions used, and their net explosive weight. In areas where marine vegetation and locations for explosions overlap, marine vegetation on the surface of the water, in the water column, or rooted in the seafloor may be impacted. Seafloor macroalgae and single-celled algae may overlap with underwater and sea surface explosion locations. If these vegetation types are near an explosion, only a small number of them are likely to be impacted relative to their total population level. Also, some seafloor macroalgae are resilient to high levels of wave action (Mach et al., 2007), which may aid in their ability to withstand underwater explosions that occur near them. Underwater explosions also may temporarily increase the turbidity (sediment suspended in the water) in nearby waters, incrementally reducing the amount of light available to marine vegetation. Reducing light availability temporarily decreases the photosynthetic ability of marine vegetation.

3.7.2.1.1.1 Impacts from Explosives Under Alternative 1

<u>**Impacts from Explosives Under Alternative 1 for Training Activities**</u>

As shown in Table 3.0-7, the number of explosions would increase for E1, E2, and E5 explosives, but decreases for E12 explosives compared to levels presented in the 2015 NWTT Final EIS/OEIS. The activities would occur in the same locations and in a similar manner as were analyzed previously, with underwater detonations typically occurring in waters greater than 200 ft. in depth and greater than 50 nautical miles (NM) from shore, with the exception of mine countermeasure and neutralization testing proposed in the Offshore Area, and existing mine warfare areas in Inland Waters (e.g., Crescent Harbor and Hood Canal Explosive Ordnance Disposal Training Ranges).Therefore, the impacts to marine vegetation would be the same. As stated in the 2015 NWTT Final EIS/OEIS, underwater and surface explosions conducted for training activities are not expected to cause population-level impacts on seagrasses because (1) the impact area of underwater explosions is very small (localized) relative to seagrass distribution; (2) the training would occur in previously disturbed areas; (3) the low number of charges reduces the potential for impacts; and (4) disturbance would be temporary and dependent upon the level of sediment redistributed, the amount of time it takes the sediment to settle, and the amount of light that reaches the disturbed area. Based on these factors, potential impacts on marine algae and vegetation from underwater and surface explosions are not expected to result in detectable changes to growth, survival, or propagation that would result in population-level impacts.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of explosives during training activities under Alternative 1 may have an adverse effect on EFH by reducing the quality and quantity of marine vegetation that constitutes EFH or Habitat Areas of Particular Concern (HAPC). Impacts on attached macroalgae is determined to be minimal and temporary to long term throughout the Study Area and minimal and long term (stressor duration or recovery in more than 3 years but less than 20 years) on submerged rooted vegetation beds.

Impacts from Explosives Under Alternative 1 for Testing Activities

As shown in Table 3.0-7, the number of explosions would increase for E1, E7, E8, and E11 explosives, but decreases for E4 explosives compared to levels presented in the 2015 NWTT Final EIS/OEIS. The activities that use explosive munitions would occur in the same general locations and in a similar manner as previously analyzed in the 2015 NWTT Final EIS/OEIS, with one exception. A new mine countermeasure and neutralization testing activity would occur in the Offshore Area approximately two times per year and would use explosives within the water column (see Chapter 2, Description of Proposed Action and Alternatives). This activity would occur closer to shore than other activities analyzed in the 2015 NWTT Final EIS/OEIS that involved the use of in-water explosives in the Offshore Area. Although this activity would occur closer to shore, it would typically occur in water depths greater than 100 feet (beyond the maximum extent of kelp beds). Therefore, the impacts would remain the same as stated in the 2015 NWTT Final EIS/OEIS. Underwater and surface explosions conducted for testing activities are not expected to cause population-level impacts on seagrasses because (1) the impact area of underwater explosions is very small (localized) relative to seagrass distribution; (2) the low number of charges reduces the potential for impacts; and (3) disturbance would be temporary and dependent upon the level of sediment redistributed, the amount of time it takes the sediment to settle, and the amount of light that reaches the disturbed area. Based on these factors, potential impacts on marine algae and vegetation from underwater and surface explosions are not expected to result in detectable changes to growth, survival, or propagation that would result in population-level impacts.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of explosives during testing activities under Alternative 1 may have an adverse effect on EFH by reducing the quality and quantity of marine vegetation that constitutes EFH or HAPC. Impacts on attached macroalgae is determined to be minimal and temporary to long term throughout the Study Area and minimal and long term (stressor duration or recovery in more than 3 years but less than 20 years) on submerged rooted vegetation beds.

3.7.2.1.1.2 Impacts from Explosives Under Alternative 2

Impacts from Explosives Under Alternative 2 for Training Activities

The quantity of explosives used during training activities under Alternative 2 would increase compared to levels presented above for Alternative 1 (Table 3.0-7) and levels presented in the 2015 NWTT Final EIS/OEIS. The activities would occur in the same locations and in a similar manner as were analyzed previously, with underwater detonations typically occurring in waters greater than 200 ft. in depth and greater than 50 NM from shore, with the exception of mine countermeasure and neutralization testing proposed in the Offshore Area, and existing mine warfare areas in Inland Waters (e.g., Crescent Harbor and Hood Canal Explosive Ordnance Disposal Training Ranges). Therefore, the impacts to marine vegetation would be the same as described above under Alternative 1 and in the 2015 NWTT Final EIS/OEIS. Impacts of explosions that exceed natural disturbance intensities may uproot plants and damage substrates, which would delay recovery; however, the Navy reduces impacts on overall vegetation communities by using previously disturbed areas for training. Therefore, potential impacts on marine algae and vegetation from underwater and surface explosions are not expected to result in detectable changes to growth, survival, or propagation that would result in population-level impacts.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of explosives during training activities under Alternative 2 may have an adverse effect on EFH by reducing the quality and quantity of marine vegetation that constitutes EFH or HAPC. Impacts on attached macroalgae is determined to be minimal and temporary to long term throughout the Study Area and minimal and long term (stressor duration or recovery in more than 3 years but less than 20 years) on submerged rooted vegetation beds.

Impacts from Explosives Under Alternative 2 for Testing Activities

The quantity of explosives used during testing activities under Alternative 2 would be the same as Alternative 1 (Table 3.0-7), but would decrease from 148 to 129 explosives compared to levels presented in the 2015 NWTT Final EIS/OEIS. The activities that use explosive munitions would occur in the same general locations and in a similar manner as previously analyzed in the 2015 NWTT Final EIS/OEIS, with one exception. A new mine countermeasure and neutralization testing activity would occur in the Offshore Area approximately two times per year and would use explosives within the water column (see Chapter 2, Description of Proposed Action and Alternatives). This activity would occur closer to shore than other activities analyzed in the 2015 NWTT Final EIS/OEIS that involved the use of in-water explosives in the Offshore Area. Although this activity would occur closer to shore, it would typically occur in water depths greater than 100 feet. Therefore, the impacts to marine vegetation under Alternative 2 would be the same as those described above under Alternative 1 and in the 2015 NWTT Final EIS/OEIS.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of explosives during testing activities under Alternative 2 may have an adverse effect on EFH by reducing the quality and quantity of marine vegetation that constitutes EFH or HAPC. Impacts on attached macroalgae is determined to be minimal and temporary to long term throughout the Study Area and minimal and long term (stressor duration or recovery in more than 3 years but less than 20 years) on submerged rooted vegetation beds.

3.7.2.1.1.3 Impacts from Explosives Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Explosive stressors, as listed above, would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer explosive stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential impacts from explosive stressors on marine vegetation, but would not measurably improve growth, survival, or status of marine vegetation populations.

3.7.2.2 Physical Disturbance and Strike Stressors

This section analyzes the potential impacts on marine vegetation of the various types of physical disturbance and strike stressors during training and testing activities within the Study Area. Three types of physical disturbance and strike stressors are evaluated for their impacts on marine vegetation, including (1) vessels and in-water devices, (2) military expended materials, and (3) seafloor devices.

The evaluation of the impacts of physical disturbance stressors on marine vegetation focuses on proposed activities that may cause vegetation to be damaged by an object that is moving through the water (e.g., vessels and in-water devices), or dropped to the seafloor (e.g., military expended materials), or dropped to the seafloor and recovered (e.g., seafloor devices such as anchors). Not all activities are proposed to occur throughout the entire Study Area. Wherever appropriate, specific geographic areas of potential impact are identified within the Study Area boundaries.

3.7.2.2.1 Impacts from Vessels and In-Water Devices

As described in the 2015 NWTT Final EIS/OEIS, the potential impacts of Navy vessels used during training and testing activities on marine vegetation are based on the vertical distribution of the vegetation, and vessel disturbance of marine vegetation would be limited to floating marine algae. Vessel movements may disperse or injure algal mats. Training and testing activities would be on a small spatial scale, and because algal distribution is patchy, mats may re-form. Navy training and testing activities involving vessel movement would not impact the general health of marine algae; the impact would be minimal relative to their total population level.

3.7.2.2.1.1 Impacts from Vessels and In-Water Devices Under Alternative 1

Impacts from Vessels and In-Water Devices Under Alternative 1 for Training Activities

Under Alternative 1, the combined number of proposed training activities involving the movement of vessels and the use of in-water devices would increase (Table 3.0-12 and Table 3.0-13) compared to those proposed in the 2015 NWTT Final EIS/OEIS. The activities would occur in the same locations and in a similar manner as were analyzed previously. Vessel movement would decrease slightly in the Offshore Area (from 1,156 to 1,144 annual activities) and in the Inland Waters (from 368 to 327), so there would still be a net decrease in the Study Area. There is an overall increase in the use of in-water devices (Table 3.0-13), all of which are associated with small, slow-moving unmanned underwater vehicles. The proposed increase of approximately 104 in-water devices would not change the conclusion presented in the 2015 NWTT Final EIS/OEIS.

As stated in the 2015 NWTT Final EIS/OEIS, the impact of vessels and in-water devices on marine vegetation would remain inconsequential because impacts are expected to be short term and temporary, based on (1) the quick recovery of most vegetation types; (2) the short-term nature of most vessel movements and local disturbances of the surface water, with some temporary increase in suspended sediment in shallow areas; (3) the deployment of in-water devices at depths where they would not likely come in contact with marine vegetation; and (4) the implementation of Navy protective measures. Based on these factors, potential impacts on marine algae and vegetation from physical disturbance and strike are not expected to result in detectable changes to growth, survival, or propagation that would result in population-level impacts.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of vessels and in-water devices during training activities under Alternative 1 would have no impact on attached macroalgae or submerged rooted vegetation that constitutes EFH or HAPC.

Impacts from Vessels and In-Water Devices Under Alternative 1 for Testing Activities

Under Alternative 1, the combined number of proposed testing activities involving the movement of vessels and the use of in-water devices (Table 3.0-12 and Table 3.0-13) would increase compared to those proposed in the 2015 NWTT Final EIS/OEIS. Vessel movement would increase in the Offshore Area (from 181 to 283 annual activities), and increase slightly in the Inland Waters (from 916 to 918) and in the Western Behm Canal (60 to 63).

There is also an overall increase in the use of in-water devices during testing activities in the Study Area (Table 3.0-13), all of which are associated with small, slow-moving, and unmanned underwater vehicles. The number of testing activities increases in the Offshore Areas (156 to 215), Inland Waters (576 to 664), and in the western Behm Canal (8 to 19). The proposed increase of in-water devices would not change the conclusion presented in the 2015 NWTT Final EIS/OEIS. The activities would occur in the same locations and in a similar manner as were analyzed previously. In spite of these increases, and as described in the 2015 NWTT Final EIS/OEIS, these vessel and in-water device activities remain unlikely to impact marine vegetation. The proposed net increase of vessel and in-water device activities combined would not change that conclusion. As stated in the 2015 NWTT Final EIS/OEIS, the impact of vessels and in-water devices on marine vegetation would be inconsequential for the same reasons presented above for training activities. Based on these factors, potential impacts on marine algae and vegetation from physical disturbance and strike are not expected to result in detectable changes to growth, survival, or propagation that would result in population-level impacts.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of vessels and in-water devices during testing activities under Alternative 1 would have no impact on attached macroalgae or submerged rooted vegetation that constitutes EFH or HAPC.

3.7.2.2.1.2 Impacts from Vessels and In-Water Devices Under Alternative 2

Impacts from Vessels and In-Water Devices Under Alternative 2 for Training Activities

Under Alternative 2, the combined number of proposed training activities involving the movement of vessels and the use of in-water devices would be slightly greater than Alternative 1 (Table 3.0-12 and Table 3.0-13) and greater than those proposed in the 2015 NWTT Final EIS/OEIS. Vessel movement would increase in the Study Area compared to Alternative 1 (1,471 for Alternative 1 compared to 1,658 for Alternative 2), and increases (1,524 to 1,658) compared to levels presented in the 2015 NWTT Final EIS/OEIS (Table 3.0-12).

There would also be a slight total increase in the use of in-water devices compared to Alternative 1 (600 for Alternative 1 compared to 620) and an increase from levels presented in the 2015 NWTT final EIS/OEIS (496 to 620) (Table 3.0-13). All of the increased in-water device activities are associated with small, slow-moving unmanned underwater vehicles. The proposed increase of in-water devices would not change the conclusion presented in the 2015 NWTT Final EIS/OEIS. As stated in the 2015 NWTT Final EIS/OEIS, the impact of vessels and in-water devices on marine vegetation would remain inconsequential because impacts are expected to be short term and temporary based on (1) the quick recovery of most vegetation types; (2) the short-term nature of most vessel movements and local disturbances of the surface water, with some temporary increases in suspended sediment in shallow areas; (3) the deployment of in-water devices at depths where they would not likely come in contact with marine vegetation; and (4) the implementation of Navy protective measures. Based on these factors, potential impacts on marine algae and vegetation from physical disturbance and strike are not expected to result in detectable changes to growth, survival, or propagation that would result in population-level impacts.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of vessels and in-water devices during training activities under Alternative 2 would have no impact on attached macroalgae or submerged rooted vegetation that constitutes EFH or HAPC.

Impacts from Vessels and In-Water Devices Under Alternative 2 for Testing Activities

Under Alternative 2, the combined number of proposed testing activities involving the movement of vessels and the use of in-water devices would increase compared to Alternative 1 (Table 3.0-12 and Table 3.0-13) and those proposed in the 2015 NWTT Final EIS/OEIS. Vessel movement would increase slightly in the Offshore Area compared to Alternative 1 (from 283 to 295) and would increase compared to numbers presented in the 2015 NWTT Final EIS/OEIS (from 181 to 295). Vessel movements would increase in the Inland Waters compared to Alternative 1 (from 918 to 1,028) and would increase compared to numbers presented in the 2015 NWTT final EIS/OEIS (from 916 to 1,028). Similarly, vessel movement would increase in the Western Behm Canal (from 63 to 77) compared to Alternative 1 and would increase from 60 to 77 compared to the 2015 NWTT Final EIS/OEIS, resulting in a net increase in the Study Area.

There would also be a slight increase in the total use of in-water devices compared to Alternative 1 (898 for Alternative 1 compared to 932) and an increase from levels presented in the 2015 NWTT final EIS/OEIS (740 to 932) (Table 3.0-13). The activities would occur in the same locations and in a similar manner as were analyzed previously. In spite of these increases, and as described in the 2015 NWTT Final EIS/OEIS, impacts to marine vegetation during vessel and in-water device activities would be unlikely. The proposed increase of vessel and in-water device activities would not change that conclusion. As stated in the 2015 NWTT Final EIS/OEIS, the impact of vessels and in-water devices on marine vegetation would be inconsequential for the same reasons described above for training activities. Based on these factors, potential impacts on marine algae and vegetation from physical disturbance and strike are not expected to result in detectable changes to growth, survival, or propagation that would result in population-level impacts.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of vessels and in-water devices during testing activities under Alternative 2 would have no impact on attached macroalgae or submerged rooted vegetation that constitutes EFH or HAPC.

3.7.2.2.1.3 Impacts from Vessels and In-Water Devices Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Physical disturbance and strike stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer physical disturbance and strike stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential impacts from physical disturbance and strike stressors on marine vegetation, but would not measurably improve growth, survival, or status of marine vegetation populations.

3.7.2.2.2 Impacts from Military Expended Materials

Military expended materials that could impact marine vegetation includes non-explosive practice munitions (Table 3.0-14), other military materials that are expended or recovered (Table 3.0-15), and explosive munitions that may result in fragments (Table 3.0-16).

3.7.2.2.2.1 Impacts from Military Expended Materials Under Alternative 1

Impacts from Military Expended Materials Under Alternative 1 for Training Activities

Under Alternative 1, the number of military materials that would be expended during training activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from Tables 3.0-14 through 3.0-16 is combined, the number of items proposed to be expended under Alternative 1 decreases compared to ongoing activities. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts to marine vegetation would be expected to be the same or marginally reduced, as stated in the 2015 NWTT Final EIS/OEIS, and would be inconsequential for the same reasons described above for vessels and in-water devices.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended material during training activities under Alternative 1 may adversely affect EFH by reducing the quality and quantity of marine vegetation that constitutes EFH or HAPC. Any impacts of military expended materials on attached macroalgae or submerged rooted vegetation would be minimal and temporary..

Impacts from Military Expended Materials Under Alternative 1 for Testing Activities

Under Alternative 1, the number of military materials that would be expended during testing activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from Tables 3.0-14 through 3.0-16 is combined, the number of items proposed to be expended under Alternative 1 increases compared to ongoing activities. Although there are a few new activities, such as mine countermeasure and neutralization testing and kinetic energy weapon testing, that would generate military expended materials, impacts to marine vegetation would be expected to be the same as those described above for training activities and would be inconsequential for the same reasons described above for vessels and in-water devices.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended material during testing activities under Alternative 1 may adversely affect EFH by reducing the quality and quantity of marine vegetation that constitutes EFH or HAPC. Any impacts of military expended materials on attached macroalgae or submerged rooted vegetation would be minimal and temporary.

3.7.2.2.2.2 Impacts from Military Expended Materials Under Alternative 2

Impacts from Military Expended Materials Under Alternative 2 for Training Activities

Under Alternative 2, the number of military materials that would be expended during training activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from Tables 3.0-14 through Table 3.0-16 are combined, the number of items proposed to be expended under Alternative 2 increase compared to both Alternative 1 and ongoing activities. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts to marine vegetation would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS, the impact of military expended materials on marine vegetation would be inconsequential for the same reasons described above for vessels and in-water devices.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended material during training activities under Alternative 2 may adversely affect EFH by reducing the quality and quantity of marine vegetation that constitutes EFH or HAPC. Any impacts of military expended materials on attached macroalgae or submerged rooted vegetation would be minimal and temporary.

Impacts from Military Expended Materials Under Alternative 2 for Testing Activities

Under Alternative 2, the number of military materials that would be expended during testing activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from Tables 3.0-14 through 3.0-16 are combined, the number of items proposed to be expended under Alternative 2 increases compared to Alternative 1 and ongoing activities. Although there are a few new activities, such as mine countermeasure and neutralization testing and kinetic energy weapon testing, that would generate military expended materials, impacts to marine invertebrates would be expected to be the same as those described above and would be inconsequential for the same reasons described above for vessels and in-water devices.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended material during testing activities under Alternative 2 may adversely affect EFH by reducing the quality and quantity of marine vegetation that constitutes EFH or HAPC. Any impacts of military expended materials on attached macroalgae or submerged rooted vegetation would be minimal and temporary.

3.7.2.2.2.3 Impacts from Military Expended Materials Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Physical disturbance and strike stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer physical disturbance and strike stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential impacts from physical disturbance and strike stressors on marine vegetation, but would not measurably improve growth, survival, or status of marine vegetation populations.

3.7.2.2.3 Impacts from Seafloor Devices

Several training and testing activities include the use of seafloor devices—items that may contact the ocean bottom temporarily. The activities and the specific seafloor devices are (1) precision anchoring training, where anchors are lowered to the seafloor and recovered; (2) explosive ordnance disposal mine countermeasures training exercises, where some mine targets may be moored to the seafloor; (3) crawler unmanned underwater vehicle tests in which unmanned underwater vehicles “crawl” across the seafloor; and (4) various testing activities where small anchors are placed on the seafloor to hold instrumentation in place.

3.7.2.2.3.1 Impacts from Seafloor Devices Under Alternative 1

Impacts from Seafloor Devices Under Alternative 1 for Training Activities

Under Alternative 1, the number of training activities that include the use of all seafloor devices (anchors, bottom-placed mines, and mine shapes) would increase from 23 to 53 compared to ongoing activities, all of which would occur in the Inland Waters (Table 3.0-18). The activity is comprised of a vessel navigating to a precise, pre-determined location and releasing the ship's anchor to the bottom. The anchor is later recovered, and the activity is complete. Because of the nature of the activity, marine vegetation on the seafloor may be impacted by seafloor devices by physically removing vegetation (e.g., uprooting), crushing the vegetation, temporarily increasing the turbidity (sediment suspended in the water) of waters nearby, or shading seagrass, which may interfere with photosynthesis. However, the impact of seafloor devices on marine vegetation would be inconsequential because (1) the anchors will be deployed in previously disturbed areas; (2) most vegetation types will recover quickly; and (3) the implementation of Navy protective measures.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of seafloor devices during training activities under Alternative 1 may adversely affect EFH by reducing the quality and quantity of marine vegetation that constitutes EFH or HAPC.

Impacts from Seafloor Devices Under Alternative 1 for Testing Activities

Under Alternative 1, the number of testing activities that include the use of all seafloor devices (anchors, bottom-placed mines, and mine shapes) would increase slightly compared to ongoing activities (from 697 to 710) (Table 3.0-18). The majority of the activities involve the temporary placement of mine shapes in Inland Waters. Because of the nature of the activity, marine vegetation on the seafloor may be impacted by seafloor devices by physically removing vegetation (e.g., uprooting), crushing the vegetation, temporarily increasing the turbidity (sediment suspended in the water) of waters nearby, or shading seagrass, which may interfere with photosynthesis. However, the impact of seafloor devices on marine vegetation would be inconsequential for the same reasons given in the 2015 NWTT Final EIS/OEIS; that is, the size of the disturbed area would be small, and the activities would be short term and infrequent.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of seafloor devices during testing activities under Alternative 1 may adversely affect EFH by reducing the quality and quantity of marine vegetation that constitutes EFH or HAPC.

3.7.2.2.3.2 Impacts from Seafloor Devices Under Alternative 2

Impacts from Seafloor Devices Under Alternative 2 for Training Activities

Under Alternative 2, the number of training activities that include the use of all seafloor devices (anchors, bottom-placed mines, and mine shapes) would be slightly greater than Alternative 1 (53 to 61) and ongoing activities (23 to 61) (Table 3.0-18). Because of the nature of the activity, marine vegetation on the seafloor may be impacted by seafloor devices by physically removing vegetation (e.g., uprooting), crushing the vegetation, temporarily increasing the turbidity (sediment suspended in the water) of waters nearby, or shading seagrass, which may temporarily interfere with photosynthesis. However, the impact of seafloor devices on marine vegetation would be inconsequential for the same reasons described above under Alternative 1.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of seafloor devices during training activities under Alternative 2 may adversely affect EFH by reducing the quality and quantity of marine vegetation that constitutes EFH or HAPC.

Impacts from Seafloor Devices Under Alternative 2 for Testing Activities

Under Alternative 2, the total number of testing activities that include the use of all seafloor devices (anchors, bottom-placed mines, and mine shapes) would increase compared to both Alternative 1 (710 to 735) and ongoing activities (697 to 735) (Table 3.0-18). The majority of the activities involve mine shapes. Because of the nature of the activity, marine vegetation on the seafloor may be impacted by seafloor devices by physically removing vegetation (e.g., uprooting); crushing the vegetation; temporarily increasing the turbidity (sediment suspended in the water) of waters nearby; or shading seagrass, which may temporarily interfere with photosynthesis. However, the impact of seafloor devices on marine vegetation would be inconsequential for the same reasons described above under Alternative 1.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of seafloor devices during testing activities under Alternative 2 may adversely affect EFH by reducing the quality and quantity of marine vegetation that constitutes EFH or HAPC.

3.7.2.2.3.3 Impacts from Seafloor Devices Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Physical disturbance and strike stressors, as listed above, would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer physical disturbance and strike stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential impacts from physical disturbance and strike stressors on marine vegetation, but would not measurably improve growth, survival, or status of marine vegetation populations.

3.7.2.3 Secondary Stressors

As described in the 2015 NWTT Final EIS/OEIS, the Navy determined that neither state or federal standards or guidelines for sediments nor water quality would be violated by proposed training and testing activities. Because of these conditions, population-level impacts on marine vegetation are likely to be inconsequential and undetectable. Therefore, because these standards and guidelines are structured to protect human health and the environment, and the proposed activities do not violate them, no indirect impacts are anticipated on marine vegetation from the training and testing activities proposed by Alternative 1, or Alternative 2, or the No Action Alternative.

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Mach, K. J., B. B. Hale, M. W. Denny, and D. V. Nelson. (2007). Death by small forces: A fracture and fatigue analysis of wave-swept macroalgae. *The Journal of Experimental Biology, 210*(13), 2231–2243.

3.8 Marine Invertebrates

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3.8 Marine Invertebrates

3.8.1 Affected Environment

For purposes of this Supplemental Environmental Impact Statement (EIS)/Overseas EIS (OEIS), the region of influence for marine invertebrates remains the same as that identified in the 2015 Northwest Training and Testing (NWTT) Final EIS/OEIS. Following a review of recent literature since 2015, including government technical documents and reports, and online scientific journal databases managed by the Navy (e.g., MARLIN), the existing conditions of marine invertebrates in the Study Area, as listed in the 2015 NWTT Final EIS/OEIS, have not appreciably changed.

3.8.1.1 Taxonomic Groups

As described in the 2015 NWTT Final EIS/OEIS, all marine invertebrate taxonomic groups are represented in the Study Area (see Table 3.8-1), with the major taxonomic groups presented below in Invertebrate Hearing and Vocalization.

Following a review of recent literature, including government technical documents and reports and online scientific journal databases, the information presented on invertebrate hearing and vocalization, as described in the 2015 NWTT Final EIS/OEIS, has not appreciably changed. New research describes detection of particle motion in mechanical receptors on various invertebrate body parts (Roberts et al., 2016) and how acoustic sensory capabilities, if present, are apparently limited to detecting the local particle motion component of sound (Edmonds et al., 2016). As such, the information presented in the 2015 NWTT Final EIS/OEIS regarding invertebrate hearing and vocalization remains valid.

3.8.1.2 Sound Sensing and Production

Following a review of recent literature, including government technical documents and reports and online scientific journal databases, the information presented on invertebrate sound sensing and production, as described in the 2015 NWTT Final EIS/OEIS, has not appreciably changed. New information on particle motion detection by Roberts et al. (2016) reinforces the finding that mechanical receptors on some invertebrates are found on various body parts. In addition, these structures are connected to the central nervous system and can detect some movements or vibrations that are transmitted through substrate (Edmonds et al., 2016) (Roberts et al., 2016). As such, the information presented in the 2015 NWTT Final EIS/OEIS regarding invertebrate sound sensing and production remains valid.

3.8.1.3 General Threats

The general threats to marine invertebrates discussed in the 2015 NWTT Final EIS/OEIS included overexploitation and destructive fishing practices; habitat degradation from pollution and coastal development; disease; and invasive species, with compounding factors such as increasing temperature and decreasing pH of the ocean from pollution linked to global climate change. New information is regularly being published on the effects of global climate change and ocean acidification on various aspects of invertebrate life development such as larval development (McLaskey et al., 2016). However, the new research is generally in agreement with the information provided in the 2015 NWTT Final EIS/OEIS. As such, the information presented in the 2015 NWTT Final EIS/OEIS regarding general threats remains valid.

Table 3.8-1: Taxonomic Groups of Marine Invertebrates in the Study Area

Major Invertebrate Groups[1]		Presence in Study Area		
Common Name (Species Group)	**Description**	**Offshore**	**Inland Waters**	**Western Behm Canal, Alaska**
Foraminifera, radiolarians, ciliates (Phylum Foraminifera)	Benthic and pelagic single-celled organisms; shells typically made of calcium carbonate or silica.	Water column, seafloor	Water column, seafloor	Water column, seafloor
Sponges (Phylum Porifera)	Benthic animals; large species have calcium carbonate or silica structures embedded in cells to provide structural support.	Seafloor	Seafloor	Seafloor
Corals, hydroids, jellyfish (Phylum Cnidaria)	Benthic and pelagic animals with stinging cells.	Water column, seafloor	Water column, seafloor	Water column, seafloor
Flatworms (Phylum Platyhelminthes)	Mostly benthic; simplest form of marine worm with a flattened body.	Water column, seafloor	Water column, seafloor	Water column, seafloor
Ribbon worms (Phylum Nemertea)	Benthic marine worms with a long extension from the mouth (proboscis) from the mouth that helps capture food.	Water column, seafloor	Seafloor	Seafloor
Round worms (Phylum Nematoda)	Small benthic marine worms; many live in close association with other animals (typically as parasites).	Water column, seafloor	Water column, seafloor	Water column, seafloor
Segmented worms (Phylum Annelida)	Mostly benthic, highly mobile marine worms; many tube-dwelling species.	Seafloor	Seafloor	Seafloor
Bryozoans (Phylum Bryozoa)	Lace-like animals that exist as filter feeding colonies attached to the seafloor and other substrates.	Seafloor	Seafloor	Seafloor
Cephalopods, bivalves, sea snails, chitons (Phylum Molluska)	Mollusks are a diverse group of soft-bodied invertebrates with a specialized layer of tissue called a mantle. Mollusks such as squid are active swimmers and predators, while others such as sea snails are predators or grazers, and clams are filter feeders.	Water column, seafloor	Water column, seafloor	Water column, seafloor

Table 3.8-1: Taxonomic Groups of Marine Invertebrates in the Study Area (continued)

Major Invertebrate Groups[1]		Presence in Study Area		
Common Name (Species Group)	Description	Offshore	Inland Waters	Western Behm Canal, Alaska
Shrimp, crab, barnacles, copepods (Phylum Arthropoda - Crustacea)	Benthic or pelagic; some are immobile with an external skeleton; all feeding modes from predator to filter feeder.	Water column, seafloor	Water column, seafloor	Water column, seafloor
Sea stars, sea urchins, sea cucumbers (Phylum Echinodermata)	Benthic predators and filter feeders with tube feet.	Seafloor	Seafloor	Seafloor

[1] Major species groups (those with more than 1,000 species) are based on the World Register of Marine Species (Appeltans et al., 2010) and Catalogue of Life (Bisby et al., 2010)
Notes: Benthic = a bottom-dwelling organism; Pelagic = relating to, living, or occurring in the waters of the ocean.

3.8.1.4 Endangered Species Act-Listed Species

3.8.1.4.1 Offshore Area

No marine invertebrates listed as threatened or endangered under the Endangered Species Act (ESA) occur in the Offshore Area of the Study Area, as stated in the 2015 NWTT Final EIS/OEIS.

3.8.1.4.2 Inland Waters

As stated in the 2015 NWTT Final EIS/OEIS, no marine invertebrates listed as threatened or endangered under the ESA occur in the Inland Waters; but three species of concern, the Pinto abalone (*Haliotis kamtschatkana*), the Olympia oyster (*Ostreola conchaphila*), and the Newcomb's littorine snail (*Algamorda subrotundata*) do occur in the Inland Waters of the Study Area. Species of concern status does not carry any procedural or substantive protections under the ESA.

3.8.1.4.3 Western Behm Canal, Alaska

As stated in the 2015 NWTT Final EIS/OEIS, no marine invertebrates listed as threatened or endangered under the ESA occur in the Western Behm Canal; but three species of concern, the Pinto abalone (*Haliotis kamtschatkana*), the Olympia oyster (*Ostreola conchaphila*), and the Newcomb's littorine snail (*Algamorda subrotundata*) have potential to occur in the Western Behm Canal. Species of concern status does not carry any procedural or substantive protections under the ESA.

3.8.1.5 Federally Managed Species

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), which was reauthorized and amended by the Sustainable Fisheries Act (1996), requires eight regional fishery management councils to describe and identify Essential Fish Habitat (EFH) in their respective regions, to specify actions to conserve and enhance that EFH, and to minimize the adverse effects of fishing on EFH. Congress defined EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity." This definition also covers federally-managed invertebrates such as squid and krill.

3.8.1.5.1 Offshore Area

Market squid (*Doryteuthis opalescens*) and krill (euphausiids) are the only federally managed coastal pelagic invertebrate species found in the Offshore Area of the Study Area, as described in the 2015 NWTT Final Essential Fish Habitat Assessment (U.S. Department of the Navy, 2015), hereinafter referred to as the 2015 NWTT Final EFH Assessment. A literature review found that the information on these species in the Study Area has not substantially changed from what is shown in the 2015 NWTT Final EFH Assessment. As such, the information presented in the 2015 NWTT Final EFH Assessment remains valid.

3.8.1.5.2 Inland Waters

Market squid (*Doryteuthis opalescens*) and krill (euphausiids) are the only federally managed coastal pelagic invertebrate species found in the Inland Waters of the Study Area, as described in the 2015 NWTT Final EFH Assessment (U.S. Department of the Navy, 2015). A literature review found that the information on this species in the Study Area has not substantially changed from what is shown in the 2015 NWTT Final EFH Assessment. As such, the information presented in the 2015 NWTT Final EFH Assessment remains valid.

3.8.1.5.3 Western Behm Canal, Alaska

As described in the 2015 NWTT Final EIS/OEIS, four species of scallops including *Patinopecten caurinus, Chlamys rubida, Chlamys hastata,* and *Crassadoma gigantean* are federally-managed in the Western Behm Canal portion of the Study Area. A literature review found that the information on this species in the Study Area has not substantially changed from what is shown in the 2015 NWTT Final EIS/OEIS. Siddon et al. (2017) describes a standardized method for determining the age of *Patinopecten caurinus* in Alaska that helps provide the foundation for sound fisheries management. As such, the information presented in the 2015 NWTT Final EIS/OEIS remains valid. The analysis of impacts on commercial and recreational fisheries is provided in Section 3.12 (Socioeconomic Resources and Environmental Justice).

3.8.2 Environmental Consequences

In the Proposed Action for this Supplemental, some modifications have been made to the quantity and type of acoustic stressors under the two action alternatives. Because of new activities being proposed, two new stressors would be introduced that could potentially affect marine species; high-energy lasers (as an Energy stressor), as detailed in Section 3.0.3.3.2.2 (High-Energy Lasers), and biodegradable polymer (as an Entanglement stressor), as detailed in Section 3.0.3.5.3 (Biodegradable Polymer).

The 2015 NWTT Final EIS/OEIS considered training and testing activities proposed to occur in the Study Area that may have the potential to impact marine invertebrates. The stressors applicable to marine invertebrates in the Study Area for this Supplemental include the two new stressors and the same stressors considered in the 2015 NWTT Final EIS/OEIS:

- **Acoustic** (sonar and other transducers, vessel noise, aircraft noise, weapons noise)
- **Explosives** (in-air explosions, in-water explosions)
- **Energy** (in-water electromagnetic devices, high-energy lasers)
- **Physical disturbance and strike** (vessels and in-water devices, military expended materials, seafloor devices)
- **Entanglement** (wires and cables, decelerators/parachutes, biodegradable polymer)
- **Ingestion** (military expended materials – munitions and military expended materials – other than munitions)
- **Secondary** (impacts on habitat and impacts on prey availability)

This section evaluates how and to what degree potential impacts on marine invertebrates from stressors described in Section 3.0 (Introduction) may have changed since the analysis presented in the 2015 NWTT Final EIS/OEIS was completed. Tables 2.5-1, 2.5-2, and 2.5-3 in Chapter 2 (Description of Proposed Action and Alternatives) list the proposed training and testing activities and include the number of times each activity would be conducted annually and the locations within the Study Area where the activity would typically occur under each alternative. The tables also present the same information for activities described in the 2015 NWTT Final EIS/OEIS so that the proposed levels of training and testing under this Supplemental can be easily compared.

The Navy conducted a review of federal and state regulations and standards relevant to marine invertebrates and reviewed scientific literature published since 2015 for new information on marine invertebrates that could inform the analysis presented in the 2015 NWTT Final EIS/OEIS. The analysis presented in this section also considers standard operating procedures (see Section 2.3.3, Standard Operating Procedures) and mitigation measures that the Navy would implement to avoid jellyfish aggregations (see Appendix K, Geographic Mitigation Assessment, for more details). Mitigation for ESA-listed marine invertebrates will be coordinated with the National Marine Fisheries Service through the ESA consultation process.

3.8.2.1 Acoustic Stressors

Little information is available on the potential impacts on marine invertebrates from exposure to sonar and other sound-producing activities. Most studies have focused on a few species (squid or crustaceans) and the consequences of exposures to broadband impulsive air guns typically used for seismic exploration, rather than on sonar or explosions. Because research on the consequences of marine invertebrate exposures to anthropogenic sounds is limited, qualitative analyses were conducted to determine the effects of the following acoustic stressors on marine invertebrates within the Study Area: non-impulsive sources (including sonar, vessel noise, aircraft overflights, and other active acoustic sources) and impulsive acoustic sources (including explosives and weapons firing).

While the number of training and testing activities would change under this supplement, the analysis presented in the 2015 NWTT Final EIS/OEIS, Section 3.8.3.1 (Acoustic Stressors) remains applicable. The changes in training and testing activities are not substantial and would not result in an overall change to existing environmental conditions or an increase in the level or intensity of acoustic stressors within the Study Area.

As stated in the 2015 analysis, marine invertebrates are generally not sensitive to most sounds that would result from the proposed activities. Given that the activities would also be conducted in the same areas as described in the 2015 analysis, the amount of sound (i.e., the number of activities producing those sounds) would not change the conclusions. The analysis below analyzes the impacts from all acoustic sources such as sonar and other transducers.

3.8.2.1.1 Impacts from Sonar and Other Transducers

3.8.2.1.1.1 Impacts from Sonar and Other Transducers Under Alternative 1

Impacts from Sonar and Other Transducers Under Alternative 1 for Training Activities

Under Alternative 1, there will be an overall decrease in the number of sonar hours used in the Study Area during training activities and a slight increase in other sources of acoustic stressors (aircraft and weapons noise) (Table 3.0-2) compared to the number analyzed in the 2015 NWTT Final EIS/OEIS. The activities would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the analysis in the 2015 NWTT Final EIS/OEIS remains valid.

As described in the 2015 NWTT Final EIS/OEIS, invertebrates throughout the Study Area may be exposed to non-impulse sounds generated by low-, mid-, and high-frequency sonar and other acoustic sources, vessel noise, and aircraft noise. Acoustic impacts on marine invertebrates under Alternative 1 would be inconsequential because most marine invertebrates would not be close enough to intense sound sources to potentially experience impacts on sensory structures. Any marine invertebrate capable of sensing sound may alter its behavior and become disoriented due to masking of relevant environmental sounds if exposed to non-impulsive sound, although it is unknown if responses to non-impulsive sounds occur. Continuous noise, such as from vessels, may also contribute to masking of relevant environmental sounds. Because the distance over which most marine invertebrates are expected to detect any sounds is limited and vessels would be in transit, any sound exposures with the potential to cause masking or behavioral responses are anticipated to be of short duration. Furthermore, invertebrate species have their best sensitivity to sound below 1 kilohertz and would not be capable of detecting the majority of sonars and other acoustic sources used in the Study Area.

Non-impulsive sounds associated with training under Alternative 1 are not expected to impact the majority of marine invertebrates or cause more than a short-term behavioral disturbance (e.g., change in orientation or swim speeds) to those marine invertebrates capable of detecting nearby sound. No population-level impacts on the survival, growth, recruitment, or reproduction of marine invertebrate populations are expected under Alternative 1.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of sonar and other transducers during training activities, as described under Alternative 1, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or Habitat Areas of Particular Concern (HAPCs) within the Study Area.

Impacts from Sonar and Other Transducers Under Alternative 1 for Testing Activities

Under Alternative 1, there will be an increase in both the number of sonar hours and other sources of acoustic stressors used in the Study Area during testing (Table 3.0-2) compared to the number analyzed in the 2015 NWTT Final EIS/OEIS. The activities would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the analysis in the 2015 NWTT Final EIS/OEIS remains valid.

As described above, acoustic impacts on marine invertebrates would be inconsequential because most marine invertebrates would not be close enough to intense sound sources to potentially experience impacts on sensory structures. Non-impulsive sounds associated with testing under Alternative 1 are not expected to impact the majority of marine invertebrates or cause more than a short-term behavioral disturbance (e.g., change in orientation or swim speeds) to those marine invertebrates capable of detecting nearby sound. No population-level impacts on the survival, growth, recruitment, or reproduction of marine invertebrate populations are expected under Alternative 1. Therefore, acoustic impacts on marine invertebrates under Alternative 1 would be inconsequential.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of sonar and other transducers during testing activities, as described under Alternative 1, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

3.8.2.1.1.2 Impacts from Sonar and Other Transducers Under Alternative 2

Impacts from Sonar and Other Transducers Under Alternative 2 for Training Activities

Under Alternative 2, the number of sonar hours and noise generated by other acoustic sources used during training activities (Table 3.0-2) would increase compared to the numbers analyzed in the 2015 NWTT Final EIS/OEIS and compared to Alternative 1. Under Alternative 2, increases in the number of sonar hours would have no appreciable change on the impact conclusions for acoustic stressors as summarized above under Alternative 1 and as presented in the 2015 NWTT Final EIS/OEIS. Therefore, acoustic impacts on marine invertebrates under Alternative 2 would be negligible.

As stated in the 2015 NWTT Final EIS/OEIS and discussed above for Alternative 1, invertebrates throughout the Study Area may be exposed to non-impulse sounds generated by the same sound sources under Alternative 2. Acoustic impacts on marine invertebrates under Alternative 2 would be inconsequential because most marine invertebrates would not be close enough to intense sound sources to potentially experience impacts on sensory structures. Any marine invertebrate capable of sensing sound may alter its behavior and become disoriented due to masking of relevant environmental sounds if exposed to non-impulsive sound, although it is unknown if responses to non-impulsive sounds occur. Continuous noise, such as from vessels, may also contribute to masking of relevant environmental sounds. Because the distance over which most marine invertebrates are expected to detect any sounds is limited and vessels would be in transit, any sound exposures with the potential to cause masking or behavioral responses would last only minutes. Furthermore, invertebrate species have their best sensitivity to sound below 1 kilohertz and would not be capable of detecting the majority of sonars and other acoustic sources used in the Study Area.

Non-impulsive sounds associated with training and testing under Alternative 2 are not expected to impact the majority of marine invertebrates or cause more than a short-term behavioral disturbance (e.g., change in orientation or swim speeds) to those marine invertebrates capable of detecting nearby sound. No population-level impacts on the survival, growth, recruitment, or reproduction of marine invertebrate populations are expected under Alternative 2.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of sonar and other transducers during training activities, as described under Alternative 2, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

Impacts from Sonar and Other Transducers Under Alternative 2 for Testing Activities

Under Alternative 2, the number of sonar hours and noise generated by other acoustic sources used during testing activities (Table 3.0-2) would increase compared to the numbers analyzed in the 2015 NWTT Final EIS/OEIS and compared to Alternative 1. Under Alternative 2, increases in the number of sonar hours would have no appreciable change on the impact conclusions for acoustic stressors as summarized above under Alternative 1 and as presented in the 2015 NWTT Final EIS/OEIS. Therefore, acoustic impacts on marine invertebrates under Alternative 2 would be negligible.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of sonar and other transducers during testing activities, as described under Alternative 2, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

3.8.2.1.1.3 Impacts from Sonar and Other Transducers Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Acoustic stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer acoustic stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from acoustic stressors on individual invertebrates, but would not measurably improve the status of invertebrate populations or subpopulations.

3.8.2.2 Explosive Stressors

Explosives introduce loud, impulse, broadband sounds into the marine environment. Impulse sources are characterized by rapid pressure rise times and high peak pressures. Explosions produce high-pressure shock waves that could cause injury or physical disturbance due to rapid pressure changes. Impulse sounds are usually brief, but the associated rapid pressure changes can injure or startle marine invertebrates. While the number of training and testing activities would change under this supplement, the analysis presented in the 2015 NWTT Final EIS/OEIS, Section 3.8.3.1 (Acoustic Stressors), remains applicable. The changes in training and testing activities are not substantial and would not result in an overall change to existing environmental conditions or an increase in the level or intensity of explosive stressors within the Study Area.

As stated above and in the 2015 analysis, marine invertebrates are generally not sensitive to most sounds that would result from the proposed activities. Given that the activities would also be conducted in the same areas as described in the 2015 analysis, there would be no change to the conclusions.

Effects of explosions on marine invertebrates include physical disturbance, fragmentation, or mortality to sessile organisms and pelagic larvae. Energy from an explosion at the surface would dissipate below detectable levels before reaching the seafloor and would not injure or otherwise impact deep-water, benthic marine invertebrates. Additionally, the vast majority of explosions occur at distances greater than 3 nautical miles (NM) from shore, where water depths are greater than the depths where the majority of hard bottom associated invertebrates occur.

As discussed in Chapter 5 (Mitigation), the Navy will implement mitigation to avoid impacts from explosives on seafloor resources throughout the Study Area. For example, the Navy will not conduct explosive mine countermeasure and neutralization activities within a specified distance of live hard bottom, artificial reefs, and shipwrecks. The mitigation will consequently help to avoid potential impacts on invertebrates that inhabit these areas. In addition, procedural mitigations include the requirement to avoid jellyfish aggregations during the use of explosive torpedoes.

3.8.2.2.1 Impacts from Explosives

3.8.2.2.1.1 Impacts from Explosives Under Alternative 1

<u>Impacts from Explosives under Alternative 1 for Training Activities</u>

The quantity of explosives used during training activities under Alterative 1 would generally increase compared to levels presented in the 2015 NWTT Final EIS/OEIS (Table 3.0-7). The activities would occur in the same locations and in a similar manner as were analyzed previously, with underwater detonations typically occurring in waters greater than 200 ft. in depth and greater than 50 NM from shore, with the exception of mine countermeasure and neutralization testing proposed in the Offshore Area and existing mine warfare areas in Inland Waters (e.g., Crescent Harbor and Hood Canal Explosive Ordnance Disposal Training Ranges). Therefore, the impacts to marine invertebrates would be the same as those described in the 2015 NWTT Final EIS/OEIS. Both pelagic and benthic marine invertebrates could be impacted by explosive stressors. Explosions would likely kill or injure nearby marine invertebrates. The potential effects could include physical disturbance, fragmentation, or mortality to sessile organisms and pelagic larvae. Most explosions at the water surface would not injure benthic marine invertebrates because the explosive weights would be small compared to the water depth.

As stated in the 2015 NWTT Final EIS/OEIS, non-impulsive sounds from explosions associated with training and testing under Alternative 1 are not expected to impact the majority of marine invertebrates or cause more than a short-term behavioral disturbance (e.g., change in orientation or swim speeds) to those marine invertebrates capable of detecting nearby sound. Impacts to marine invertebrates from explosions would be inconsequential because most detonations would occur in deeper waters greater than 50 NM from shore in the offshore training area, and less than 1 percent would occur in Inland Waters. As water depth increases away from shore, benthic and pelagic invertebrates would be less likely to be impacted by detonations at or near the surface. Pelagic marine invertebrates are generally disturbed, rather than struck, as the water flows around the vessel or in-water device. Shockwaves created by explosions would impact invertebrates in a similar way, causing them to be disturbed rather than struck as water flows from around the explosion. In addition, detonations near the surface would release a portion of their explosive energy into the air, reducing the explosive impacts in the water. No population-level impacts on the survival, growth, recruitment, or reproduction of marine invertebrate populations are expected under Alternative 1.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of explosives during training activities, as described under Alternative 1, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

Impacts from Explosives under Alternative 1 for Testing Activities

The quantity of explosives used during testing activities under Alterative 1 would generally increase (Table 3.0-7) compared to levels presented in the 2015 NWTT Final EIS/OEIS. The activities that use explosive munitions would occur in the same general locations and in a similar manner as previously analyzed in the 2015 NWTT Final EIS/OEIS, with one exception. A new mine countermeasure and neutralization testing activity would occur in the Offshore Area two times per year and would use explosives within the water column (see Chapter 2, Description of Proposed Action and Alternatives). This activity would occur closer to shore than other activities analyzed in the 2015 NWTT Final EIS/OEIS that involved the use of in-water explosives in the Offshore Area. Although this activity would occur closer to shore, it would typically occur in water depths greater than 100 feet. Therefore, the impacts to marine invertebrates would be the same as those described in the 2015 NWTT Final EIS/OEIS and would be inconsequential because most detonations would occur greater than 50 NM from shore. As water depth increases away from shore, benthic and pelagic invertebrates would be less likely to be impacted by detonations at or near the surface. Pelagic marine invertebrates are generally disturbed, rather than struck, as the water flows around the vessel or in-water device. Shockwaves created by explosions would impact invertebrates in a similar way, causing them to be disturbed rather than struck as water flows from around the explosion. In addition, detonations near the surface would release a portion of their explosive energy into the air, reducing the explosive impacts in the water. No population-level impacts on the survival, growth, recruitment, or reproduction of marine invertebrate populations are expected under Alternative 1.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of explosives during testing activities, as described under Alternative 1, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

3.8.2.2.1.2 Impacts from Explosives Under Alternative 2

Impacts from Explosives under Alternative 2 for Training Activities

The quantity of explosives used during training activities under Alternative 2 would generally increase compared to levels presented above for Alternative 1 (Table 3.0-7) and levels presented in the 2015 NWTT Final EIS/OEIS. The activities would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts to marine vegetation would be the same. As stated in the 2015 NWTT Final EIS/OEIS and above for Alternative 1, both pelagic and benthic marine invertebrates could be impacted by explosive stressors during training activities under Alternative 2. However, impacts to marine invertebrates from underwater and surface explosions conducted for training activities would be inconsequential because most detonations would occur greater than 50 NM from shore in the offshore training area, and less than 1 percent would occur in Inland Waters. As water depth increases away from shore, benthic and pelagic invertebrates would be less likely to be impacted by detonations at or near the surface. Pelagic marine invertebrates are generally disturbed, rather than struck, as the water flows around the vessel or in-water device. Shockwaves created by explosions would impact invertebrates in a similar way, causing them to be disturbed rather than struck as water flows from around the explosion. In addition, detonations near the surface would release a portion of their explosive energy into the air, reducing the explosive impacts in the water. No population-level impacts on the survival, growth, recruitment, or reproduction of marine invertebrate populations are expected under Alternative 2. No population-level impacts on the survival, growth, recruitment, or reproduction of marine invertebrate populations are expected under Alternative 2.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of explosives during training activities, as described under Alternative 2, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

Impacts from Explosives under Alternative 2 for Testing Activities

The quantity of explosives used during testing activities under Alterative 2 would generally be the same as Alternative 1 (Table 3.0-7), but would increase slightly compared to levels presented in the 2015 NWTT Final EIS/OEIS. The activities that use explosive munitions would occur in the same general locations and in a similar manner as previously analyzed in the 2015 NWTT Final EIS/OEIS, with one exception. A new mine countermeasure and neutralization testing activity would occur in the Offshore Area approximately two times per year and would use explosives within the water column (see Chapter 2, Description of Proposed Action and Alternatives). This activity would occur closer to shore than other activities analyzed in the 2015 NWTT Final EIS/OEIS that involved the use of in-water explosives in the Offshore Area. Although this activity would occur closer to shore, it would typically occur in water depths greater than 100 feet. Therefore, the impacts to marine invertebrates would be the same as those described above for Alternative 1.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of explosives during testing activities, as described under Alternative 2, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

3.8.2.2.1.3 Impacts from Explosives Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Explosive stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer explosive stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from explosive stressors on individual invertebrates, but would not measurably improve the status of invertebrate populations or subpopulations.

3.8.2.3 Energy Stressors

The energy stressors that may impact marine invertebrates include in-water electromagnetic devices and high-energy lasers. Only one new energy stressor (high-energy lasers) used in testing activities differs from the energy stressors that were previously analyzed in the 2015 NWTT Final EIS/OEIS. Use of low-energy lasers was analyzed and dismissed as an energy stressor in the 2015 NWTT Final EIS/OEIS in Section 3.0.5.3.2.2 (Lasers). However, at that time high-energy laser weapons were not part of the proposed action for the Study Area.

3.8.2.3.1 Impacts from In-Water Electromagnetic Devices

3.8.2.3.1.1 Impacts from In-Water Electromagnetic Devices Under Alternative 1

Impacts from In-Water Electromagnetic Devices Under Alternative 1 for Training Activities

Under Alternative 1, the number of proposed training activities involving the use of in-water electromagnetic devices would remain the same (Table 3.0-9) as those proposed in the 2015 NWTT Final EIS/OEIS. The activities would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts to marine invertebrates would be the same as those described above for Alternative 1 and presented in the 2015 NWTT Final EIS/OEIS. As stated in the 2015 NWTT Final EIS/OEIS, the impact of in-water electromagnetic devices on marine invertebrates would be inconsequential because (1) the area exposed to the stressor is extremely small relative to most marine invertebrates' ranges; (2) the number of activities involving the stressor is low; (3) exposures would be localized, temporary, and would cease with the conclusion of the activity; and (4) even for susceptible invertebrates (e.g., some species of arthropods, mollusks, and echinoderms), the consequences of exposure are limited to temporary disruptions to navigation and orientation under Alternative 1.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of in-water electromagnetic devices during training activities, as described under Alternative 1, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

Impacts from In-Water Electromagnetic Devices Under Alternative 1 for Testing Activities

No in-water electromagnetic devices are proposed for testing activities under Alternative 1.

3.8.2.3.2 Impacts from In-Water Electromagnetic Devices Under Alternative 2

Impacts from In-Water Electromagnetic Devices Under Alternative 2 for Training Activities

Under Alternative 2, the number of proposed training activities involving the use of in-water electromagnetic devices would remain the same as Alternative 1 (Table 3.0-9) and those proposed in the

2015 NWTT Final EIS/OEIS. The activities would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts to marine invertebrates would be the same as those described above for Alternative 1 and presented in the 2015 NWTT Final EIS/OEIS. As described above for Alternative 1, marine invertebrates may be exposed to in-water electromagnetic devices during training activities and only exposed to high-energy lasers during testing activities. The impact of these stressors on marine invertebrates under Alternative 2 would be inconsequential because (1) the area exposed to the stressor is extremely small relative to most marine invertebrates' ranges; (2) the number of activities involving the stressor is low; (3) exposures would be localized, temporary, and would cease with the conclusion of the activity; and (4) even for susceptible invertebrates (e.g., some species of arthropods, mollusks, and echinoderms), the consequences of exposure are limited to temporary disruptions to navigation and orientation under Alternative 2.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of in-water electromagnetic devices during training activities, as described under Alternative 2, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

<u>Impacts from In-Water Electromagnetic Devices Under Alternative 2 for Testing Activities</u>

No in-water electromagnetic devices are proposed for testing activities under Alternative 2.

3.8.2.3.2.1 Impacts from In-Water Electromagnetic Devices Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Energy stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer energy stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from energy stressors on individual invertebrates, but would not measurably improve the status of invertebrate populations or subpopulations.

3.8.2.3.3 Impacts from High-Energy Lasers

High-Energy lasers were not proposed for use in the 2015 NWTT Final EIS/OEIS.

As discussed in Section 3.0.3.3.2.2 (High-Energy Lasers), high-energy laser weapons testing activities involve evaluating the effectiveness of a high-energy laser deployed from a surface ship or helicopter to create small but critical failures in potential targets from short ranges.

This section analyzes the potential impacts of high-energy lasers on marine invertebrates. The primary concern for high-energy weapons testing is the potential for a marine invertebrate to be struck by a high-energy laser beam at or near the water's surface, which could result in injury or death, resulting from traumatic burns from the beam.

Marine invertebrates could be exposed to a laser only if the beam missed the target. Should the laser strike the sea surface, individual invertebrates at or near the surface, such as jellyfish, floating eggs, and larvae could potentially be exposed. The potential for exposure to a high-energy laser beam decreases rapidly as water depth increases and with time of day, as many zooplankton species migrate away from the surface during the day. Most marine invertebrates are not susceptible to laser exposure because they occur beneath the sea surface.

3.8.2.3.3.1 Impacts from High-Energy Lasers Under Alternative 1

Impacts from High-Energy Lasers Under Alternative 1 for Training Activities

No high-energy lasers are proposed for training activities under Alternative 1.

Impacts from High-Energy Lasers Under Alternative 1 for Testing Activities

As discussed in Section 3.0.3.3.2.2 (High-Energy Lasers) and shown in Table 3.0-10, under Alternative 1 there would be up to 55 testing activities per year involving the use of high-energy lasers. One of those 55 activities is a test of a laser-based optical communication system, which was discussed in Section 3.0.3.3.2.2 and dismissed from further evaluation. The remaining 54 annual testing activities would involve the use of high-energy laser weapons in the Offshore portion of the Study Area. Invertebrates that do not occur at or near the sea surface would not be exposed due to the attenuation of laser energy with depth. Surface invertebrates such as squid, jellyfish, and zooplankton (which may include invertebrate larvae) exposed to high-energy lasers could be injured or killed, but the probability is low based on the relatively low number of events, very localized potential impact area of the laser beam, and the temporary duration of potential impact (seconds). Activities involving high-energy lasers are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at the population level because of the relatively small number of individuals that could be impacted. The impact of high-energy lasers on marine invertebrates would be inconsequential because: (1) it is highly unlikely that a high-energy laser would miss its target; (2) it is highly unlikely that the laser would miss in such a way that the laser beam would strike a marine invertebrate; and (3) it is highly unlikely that the marine invertebrate would be at or near the surface, just as two equally unlikely events take place.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of high-energy lasers during testing activities, as described under Alternative 1, would have no effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

3.8.2.3.3.2 Impacts from High-Energy Lasers under Alternative 2

Impacts from High-Energy Lasers Under Alternative 2 for Training Activities

No high-energy lasers are proposed for training activities under Alternative 2.

Impacts from High-Energy Lasers Under Alternative 2 for Testing Activities

As shown in Table 3.0-10, a total of 54 testing activities involving the use of high-energy laser weapons are proposed to be conducted in the Offshore Area under Alternative 2, the same as under Alternative 1. As stated above, this represents a new activity not covered in the 2015 NWTT Final EIS/OEIS. Therefore, the impacts would be the same as described under Alternative 1.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of high-energy lasers during testing activities, as described under Alternative 2, would have no effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

3.8.2.3.3.3 Impacts from High-Energy Lasers Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Energy stressors, as listed above, would not be introduced into the marine environment. Therefore, existing environmental conditions would remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer energy stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from energy stressors on individual invertebrates, but would not measurably improve the status of invertebrate populations or subpopulations.

3.8.2.4 Physical Disturbance and Strike

The physical disturbance and strike stressors that may impact marine invertebrates include (1) vessels and in-water devices, (2) military expended materials, and (3) seafloor devices. These stressors remain the same as analyzed in the 2015 NWTT Final EIS/OEIS.

3.8.2.4.1 Impacts from Vessels and In-Water Devices

3.8.2.4.1.1 Impacts from Vessels and In-Water Devices Under Alternative 1

Impacts from Vessels and In-Water Devices Under Alternative 1 for Training Activities

Under Alternative 1, the combined number of proposed training activities involving the movement of vessels and the use of in-water devices would increase (Table 3.0-12 and Table 3.0-13) compared to those proposed in the 2015 NWTT Final EIS/OEIS. Vessel movement would decrease slightly in the Offshore Area (from 1,156 to 1,144 annual activities) and in the Inland Waters (from 368 to 327), so there would still be a net decrease in the Study Area. The activities would occur in the same locations and in a similar manner as were analyzed previously. There is an overall increase in the use of in-water devices (Table 3.0-13), all of which are associated with small, slow-moving unmanned underwater vehicles. Because the increases are to activities in which the in-water devices are small and slow-moving, the impacts to marine invertebrates would be similar. The proposed increase of approximately 100 in-water devices would not change that conclusion. As stated in the 2015 NWTT Final EIS/OEIS, the impact of vessels and in-water devices on marine invertebrates would remain inconsequential because (1) the area exposed to the stressor amounts to a small portion of each vessel's and in-water device's footprint, and is extremely small relative to most marine invertebrates' ranges; (2) the frequency of activities involving the stressor is low such that few individuals could be exposed to more than one event; and (3) exposures would be localized, temporary, and would cease with the conclusion of the activity. Under Alternative 1, activities involving vessels and in-water devices are not expected to yield any behavioral changes or lasting impacts on the survival, growth, recruitment, or reproduction of invertebrate species at the population level.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of vessels and in-water devices during training activities, as described under Alternative 1, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

Impacts from Vessels and In-Water Devices Under Alternative 1 for Testing Activities

Under Alternative 1, the combined number of proposed testing activities involving the movement of vessels and the use of in-water devices (Table 3.0-12 and Table 3.0-13) would increase compared to those proposed in the 2015 NWTT Final EIS/OEIS. Vessel movement would increase in the Offshore Area (from 181 to 283 annual activities), and increases slightly in the Inland Waters (from 916 to 918) and Western Behm Canal (60 to 63).

There is also an overall increase in the use of in-water devices during testing activities in the Study Area (Table 3.0-13), all of which are associated with small, slow-moving, and unmanned underwater vehicles. The number of testing activities increases in the Offshore Areas (156 to 215), Inland Waters (576 to 664), and in the western Behm Canal (8 to 19). The proposed increase of in-water devices would not change the conclusion presented in the 2015 NWTT Final EIS/OEIS. The activities would occur in the same locations and in a similar manner as were analyzed previously. In spite of these increases, and as described in the 2015 NWTT Final EIS/OEIS, these vessel and in-water device activities remain unlikely to result in a strike to any marine invertebrate. The proposed increase of vessel and in-water device activities would not change that conclusion. As stated in the 2015 NWTT Final EIS/OEIS, the impact of vessels and in-water devices on marine invertebrates would remain inconsequential because (1) the area exposed to the stressor amounts to a small portion of each vessel's and in-water device's footprint, and is extremely small relative to most marine invertebrates' ranges; (2) the frequency of activities involving the stressor is low such that few individuals could be exposed to more than one event; and (3) exposures would be localized, temporary, and would cease with the conclusion of the activity. Under Alternative 1, activities involving vessels and in-water devices are not expected to yield any behavioral changes or lasting impacts on the survival, growth, recruitment, or reproduction of invertebrate species at the population level.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of vessels and in-water devices during testing activities, as described under Alternative 1, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

3.8.2.4.1.2 Impacts from Vessels and In-Water Devices Under Alternative 2

Impacts from Vessels and In-Water Devices Under Alternative 2 for Training Activities

Under Alternative 2, the combined number of proposed training activities involving the movement of vessels and the use of in-water devices would be slightly greater than Alternative 1 (Table 3.0-12 and Table 3.0-13) and greater than those proposed in the 2015 NWTT Final EIS/OEIS. Vessel movement would increase in the Study Area compared to Alternative 1 (1,471 for Alternative 1 compared to 1,658 for Alternative 2), and increases (1,524 to 1,658) compared to levels presented in the 2015 NWTT Final EIS/OEIS (Table 3.0-12).

There would also be a slight total increase in the use of in-water devices compared to Alternative 1 (600 for Alternative 1 compared to 620) and an increase from levels presented in the 2015 NWTT final EIS/OEIS (496 to 620) (Table 3.0-13). All of the increased in-water device activities are associated with small, slow-moving unmanned underwater vehicles. Because the increases are to activities in which the in-water devices are unlikely to have an impact to marine invertebrates (small, slow-moving in-water devices), the impacts to marine invertebrates would be similar. The proposed increase of in-water devices would not change that conclusion. The activities would occur in the same locations and in a similar manner as were analyzed previously. As stated in the 2015 NWTT Final EIS/OEIS, the impact of vessels and in-water devices on marine invertebrates would remain inconsequential because (1) the area exposed to the stressor amounts to a small portion of each vessel's and in-water device's footprint, and is extremely small relative to most marine invertebrates' ranges; (2) the frequency of activities involving the stressor is low such that few individuals could be exposed to more than one event; and (3) exposures would be localized, temporary, and would cease with the conclusion of the activity. Under Alternative 2, activities involving vessels and in-water devices are not expected to yield any behavioral changes or lasting impacts on the survival, growth, recruitment, or reproduction of invertebrate species at the population level.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of vessels and in-water devices during training activities, as described under Alternative 2, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

Impacts from Vessels and In-Water Devices Under Alternative 2 for Testing Activities

Under Alternative 2, the combined number of proposed testing activities involving the movement of vessels and the use of in-water devices would increase compared to Alternative 1 (Table 3.0-12 and Table 3.0-13) and those proposed in the 2015 NWTT Final EIS/OEIS. Vessel movement would increase slightly in the Offshore Area compared to Alternative 1 (from 283 to 295) and would increase compared to numbers presented in the 2015 NWTT Final EIS/OEIS (from 181 to 295). Vessel movements would increase in the Inland Waters compared to Alternative 1 (from 918 to 1,028) and would increase compared to numbers presented in the 2015 NWTT Final EIS/OEIS (from 916 to 1,028). Similarly, vessel movement would increase in the Western Behm Canal (from 63 to 77) compared to Alternative 1 and would increase from 60 to 77 compared to the 2015 NWTT Final EIS/OEIS, resulting in a net increase in the Study Area.

There would also be a slight increase in the use of in-water devices compared to Alternative 1 (898 for Alternative 1 compared to 932) and an increase from levels presented in the 2015 NWTT Final EIS/OEIS (740 to 932) (Table 3.0-13). The activities would occur in the same locations and in a similar manner as were analyzed previously. In spite of these increases, and as described in the 2015 NWTT Final EIS/OEIS, these vessel and in-water device activities remain unlikely to result in a strike to any marine invertebrate. The proposed increase of vessel and in-water device activities would not change that conclusion. As stated in the 2015 NWTT Final EIS/OEIS, the impact of vessels and in-water devices on marine invertebrates would remain inconsequential because (1) the area exposed to the stressor amounts to a small portion of each vessel's and in-water device's footprint, and is extremely small relative to most marine invertebrates' ranges; (2) the frequency of activities involving the stressor is low such that few individuals could be exposed to more than one event; and (3) exposures would be localized, temporary, and would cease with the conclusion of the activity. Under Alternative 2, activities involving vessels and in-water devices are not expected to yield any behavioral changes or lasting impacts on the survival, growth, recruitment, or reproduction of invertebrate species at the population level.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of vessels and in-water devices during testing activities, as described under Alternative 2, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

3.8.2.4.1.3 Impacts from Vessels and In-Water Devices Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Physical disturbance and strike stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer physical disturbance and strike stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from physical disturbance and strike stressors on individual invertebrates, but would not measurably improve the status of invertebrate populations or subpopulations.

3.8.2.4.2 Impacts from Military Expended Materials

Military expended materials include non-explosive practice munitions (Table 3.0-14), other military materials that are expended or recovered (Table 3.0-15), high explosives that may result in fragments (Table 3.0-16), and expended or recovered targets (Table 3.0-17).

3.8.2.4.2.1 Impacts from Military Expended Materials Under Alternative 1

Impacts from Military Expended Materials Under Alternative 1 for Training Activities

Under Alternative 1, the number of military materials that would be expended during training activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from Tables 3.0-14 through 3.0-16 are combined, the number of items proposed to be expended under Alternative 1 decreases compared to ongoing activities. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts to marine invertebrates would be expected to be the same as stated in the 2015 NWTT Final EIS/OEIS and would be inconsequential for the same reasons described above for vessels and in-water devices.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of military expended material during training activities, as described under Alternative 1, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

Impacts from Military Expended Materials Under Alternative 1 for Testing Activities

Under Alternative 1, the number of military materials that would be expended during testing activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from (Tables 3.0-14 through 3.0-16) are combined, the number of items proposed to be expended under Alternative 1 decreases slightly compared to ongoing activities. There are a few new activities, such as mine countermeasure and neutralization testing and kinetic energy weapon testing, that would generate military expended materials. Impacts to marine invertebrates would be expected to be the same as those described above and would be inconsequential for the same reasons described above for vessels and in-water devices.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of military expended material during testing activities, as described under Alternative 1, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

3.8.2.4.2.2 Impacts from Military Expended Materials Under Alternative 2

Impacts from Military Expended Materials Under Alternative 2 for Training Activities

Under Alternative 2, the number of military materials that would be expended during training activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from Table 3.0-14, Table 3.0-15, and Table 3.0-16 are combined, the number of items proposed to be expended under Alternative 2 increases compared to both Alternative 1 and ongoing activities. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts to marine invertebrates would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS, the impact of military expended materials on marine invertebrates would be inconsequential for the same reasons described above for vessels and in-water devices.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of military expended material during training activities, as described under Alternative 2, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

Impacts from Military Expended Materials Under Alternative 2 for Testing Activities

Under Alternative 2, the number of military materials that would be expended during testing activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from Tables 3.0-14 through 3.0-16 are combined, the number of items proposed to be expended under Alternative 2 increases compared to Alternative 1 and ongoing activities. Although there are a few new activities such as mine countermeasure and neutralization testing and kinetic energy weapon testing that would generate military expended materials, impacts to marine invertebrates would be expected to be the same as those described above and would be inconsequential for the same reasons described above for vessels and in-water devices.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of military expended material during testing activities, as described under Alternative 2, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

3.8.2.4.2.3 Impacts from Military Expended Materials Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Physical disturbance and strike stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer physical disturbance and strike stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from physical disturbance and strike stressors on individual invertebrates, but would not measurably improve the status of invertebrate populations or subpopulations.

3.8.2.4.3 Impacts from Seafloor Devices

Several training and testing activities include the use of seafloor devices—items that may contact the ocean bottom temporarily. The activities and the specific seafloor devices are: (1) precision anchoring training, where anchors are lowered to the seafloor and recovered; (2) explosive ordnance disposal mine countermeasures training exercises, where some mine targets may be moored to the seafloor; (3) crawler unmanned underwater vehicle tests in which unmanned underwater vehicles "crawl" across the seafloor; and (4) various testing activities where small anchors are placed on the seafloor to hold instrumentation in place.

3.8.2.4.3.1 Impacts from Seafloor Devices Under Alternative 1

Impacts from Seafloor Devices Under Alternative 1 for Training Activities

Under Alternative 1, the number of training activities that include the use of seafloor devices would increase from 10 to 40 compared to ongoing activities, all of which would occur in the Inland Waters (Table 3.0-18) as part of the Precision Anchoring exercise. The activity is comprised of a vessel navigating to a precise, pre-determined location and releasing the ship's anchor to the bottom. The anchor is later recovered and the activity is complete. Because of the nature of the activity, the risk to marine invertebrates would be discountable because (1) the area exposed to the stressor amounts to a small portion of footprint which is extremely small relative to most marine invertebrates' ranges; (2) the frequency of activities involving the stressor is low such that few individuals could be exposed to more than one event; and (3) exposures would be localized, temporary, and would cease with the conclusion of the activity. Under Alternative 1, activities involving seafloor devices are not expected to yield any behavioral changes or lasting impacts on the survival, growth, recruitment, or reproduction of invertebrate species at the population level.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of seafloor devices during training activities, as described under Alternative 1, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

Impacts from Seafloor Devices Under Alternative 1 for Testing Activities

Under Alternative 1, the total number of testing activities that include the use of seafloor devices would increase (Table 3.0-18) compared to ongoing activities (from 809 to 878). The majority of the activities involve the temporary placement of mine shapes in Inland Waters. Because of the nature of the activity, marine invertebrates on the seafloor may be impacted by seafloor devices by physically removing, crushing the individual, and temporarily increasing the turbidity (sediment suspended in the water) of waters nearby. However, the impact of seafloor devices on marine invertebrates would be inconsequential for the same reasons described above for training activities.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of seafloor devices during testing activities, as described under Alternative 1, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

3.8.2.4.3.2 Impacts from Seafloor Devices Under Alternative 2

Impacts from Seafloor Devices Under Alternative 2 for Training Activities

Under Alternative 2, the number of training activities that include the use of seafloor devices would be the same as under Alternative 1 (Table 3.0-18) and would increase compared to ongoing activities (from 10 to 40). Because of the nature of the activity, marine invertebrates on the seafloor may be impacted by seafloor devices by physically removing, crushing the individual, and temporarily increasing the turbidity (sediment suspended in the water) of waters nearby. However, the impact of seafloor devices on marine invertebrates would be inconsequential for the same reasons described above for Alternative 1.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of seafloor devices during training activities, as described under Alternative 2, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

Impacts from Seafloor Devices Under Alternative 2 for Testing Activities

Under Alternative 2, the total number of testing activities that include the use of seafloor devices would increase compared to both Alternative 1 (878 to 935) (Table 3.0-18) and ongoing activities (809 to 953). The majority of the activities involve mine shapes. Because of the nature of the activity, marine invertebrates on the seafloor may be impacted by seafloor devices by physically removing, crushing the individual, and temporarily increasing the turbidity (sediment suspended in the water) of waters nearby.

However, the impact of seafloor devices on marine invertebrates would be inconsequential for the same reasons described above for Alternative 1.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of seafloor devices during testing activities, as described under Alternative 2, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

3.8.2.4.3.3 Impacts from Seafloor Devices Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Physical disturbance and strike stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer physical disturbance and strike stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from physical disturbance and strike stressors on individual invertebrates, but would not measurably improve the status of invertebrate populations or subpopulations.

3.8.2.5 Entanglement Stressors

The entanglement stressors that may impact marine invertebrates include (1) wires and cables, (2) decelerators/parachutes, and (3) biodegradable polymer. Biodegradable polymer is a new stressor not previously analyzed, but the other two stressors remain the same as analyzed in the 2015 NWTT Final EIS/OEIS.

3.8.2.5.1 Impacts from Wires and Cables

Wires and cables include fiber optic cables, guidance wires, and sonobuoy wires (Table 3.0-19).

3.8.2.5.1.1 Impacts from Wires and Cables Under Alternative 1

Impacts from Wires and Cables Under Alternative 1 for Training Activities

Under Alternative 1, the number of wires and cables that would be expended during training activities (Table 3.0-19) is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. No fiber optic cables are used in the NWTT Study Area under training, either in the previous analysis or this Supplemental. Two guidance wires are proposed to be expended in the Offshore Area under Alternative 1, none were proposed in the previous analysis and no guidance wires would be expended in Inland Waters. As shown in (Table 3.0-19), the expenditure of sonobuoy wires in the Offshore Area is proposed to increase slightly (from 8,928 to 9,338), and no sonobuoys are proposed to be used in the Inland Waters, where none were proposed previously. The activities that expend wires and cables would generally occur in the same locations and in a similar manner as were analyzed previously. Because the number and locations of these wires and cables is similar to those analyzed in the 2015 NWTT Final EIS/OEIS, the impacts to marine invertebrates would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS, the impact of wires and cables on marine invertebrates would be inconsequential because: (1) the area exposed to the stressor is extremely small relative to most marine invertebrates' ranges, (2) the activities are dispersed such that few individuals could conceivably be exposed to more than one activity, (3) exposures would be localized, and (4) marine invertebrates are not particularly susceptible to entanglement stressors as most would avoid entanglement and simply be temporarily disturbed. Activities involving fiber optic cables and guidance wires are not expected to yield any behavioral changes or lasting impacts on the survival, growth, recruitment, or reproduction of invertebrate species at individual or population levels.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of wires and cables during training activities, as described under Alternative 1, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

Impacts from Wires and Cables Under Alternative 1 for Testing Activities

Under Alternative 1, the total number of wires and cables that would be expended during testing activities is increased (Table 3.0-19) compared to the number proposed for use in the 2015 NWTT Final EIS/OEIS. Fiber optic cables used in the Offshore Area would increase (20 to 36), guidance wires used in both the Offshore Area and the Inland Waters would increase (92 to 152 in Offshore Areas and 155 to 230 in Inland Waters), and sonobuoy wires expended would also increase in Offshore Areas (1,000 to 4,001) and increase from 6 to 48 in Inland Waters. Even though the number of cable and wires would increase during testing activities, the locations are similar to those analyzed in the 2015 NWTT Final EIS/OEIS, and impacts to marine invertebrates would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS, the impact of wires and cables on marine invertebrates would be inconsequential because: (1) the area exposed to the stressor is extremely small relative to most marine invertebrates' ranges, (2) the activities are dispersed such that few individuals could conceivably be exposed to more than one activity, (3) exposures would be localized, and (4) marine invertebrates are not particularly susceptible to entanglement stressors as most would avoid entanglement and simply be temporarily disturbed. Activities involving fiber optic cables and guidance wires are not expected to yield any behavioral changes or lasting impacts on the survival, growth, recruitment, or reproduction of invertebrate species at individual or population levels.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of wires and cables during testing activities, as described under Alternative 1, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

3.8.2.5.1.2 Impacts from Wires and Cables Under Alternative 2

Impacts from Wires and Cables Under Alternative 2 for Training Activities

Under Alternative 2, the total number of wires and cables that would be expended during training activities (9,380) is generally consistent with the number proposed for use under Alternative 1 (9,340) (Table 3.0-19) and in the 2015 NWTT Final EIS/OEIS (8,928). No fiber optic cables are used in the Study Area under training, either in the previous analysis or this Supplemental. Two guidance wires are proposed to be expended in the Offshore Area under Alternative 2, none were proposed in the previous analysis. As shown in Table 3.0-19, the expenditure of sonobuoy wires in the Offshore Area is proposed to increase (from 9,338 to 9,378), and no sonobuoys are proposed to be used in the Inland Waters, where none were proposed previously. The activities that expend wires and cables would generally occur in the same locations and in a similar manner as were analyzed previously. Because the number and locations of these wires and cables is similar to those analyzed in the 2015 NWTT Final EIS/OEIS, the impacts to marine invertebrates would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS, the impact of wires and cables on marine invertebrates would be inconsequential for the same reasons discussed above under Alternative 1.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of wires and cables during training activities, as described under Alternative 2, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

Impacts from Wires and Cables Under Alternative 2 for Testing Activities

Under Alternative 2, the total number of wires and cables that would be expended during testing activities increases compared to the number proposed for use under Alternative 1 (from 4,664 to 6,910) (Table 3.0-19) and in the 2015 NWTT Final EIS/OEIS (1,395 to 6,910). Fiber optic cables used in the Offshore Area and Inland Waters would be the same as Alternative 1 and increase compared to the 2015 NWTT Final EIS/OEIS. Guidance wires used in the Offshore Area would increase compared to Alternative 1 (from 152 to 192) and those proposed in the previous analysis (from 92 to 192). Guidance wires in Inland Waters would be the same as Alternative 1 (Table 3.0-19), but increase (from 155 to 230) compared to those proposed in the previous analysis. Sonobuoy wires expended in Offshore Areas would increase compared to Alternative 1 (from 4,001 to 6,207) and in the 2015 NWTT Final EIS/OEIS (from 1,000 to 6,207). Sonobuoy wires expended in Inland Waters would be the same as Alternative 1 (Table 3.0-19) and would increase from 6 to 48 compared to the 2015 NWTT Final EIS/OEIS. The activities that expend wires and cables would generally occur in the same locations and in a similar manner as were analyzed previously. As stated in the 2015 NWTT Final EIS/OEIS, the impact of wires and cables on marine invertebrates would be inconsequential for the same reasons discussed above under Alternative 1.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of fiber optic cables during testing activities, as described under Alternative 2, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

3.8.2.5.1.3 Impacts from Wires and Cables Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Entanglement stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer entanglement stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from entanglement stressors on individual invertebrates, but would not measurably improve the status of invertebrate populations or subpopulations.

3.8.2.5.2 Impacts from Decelerators/Parachutes

Decelerators/parachutes include small, medium, large, and extra-large decelerator parachutes (Table 3.0-20).

3.8.2.5.2.1 Impacts from Decelerators/Parachutes Under Alternative 1

Impacts from Decelerators/Parachutes Under Alternative 1 for Training Activities

Under Alternative 1, the total number of decelerators/parachutes that would be expended during training activities increases (9,097 to 9,456) compared to the number proposed for use in the 2015 NWTT Final EIS/OEIS. As shown in Table 3.0-20, the expenditure of small size decelerators/parachutes in the Offshore Area is proposed to increase (8,928 to 9,354), and no small decelerators/parachutes are proposed to be used in the Inland Waters, where none were proposed previously. The number of medium decelerators/parachutes in the Offshore Area decreases from 24 to 4, and the number of large decelerators/parachutes in the Offshore Area decreases from 145 to 98 (Table 3.0-20). The activities that expend decelerators/parachutes would generally occur in the same locations and in a similar manner as were analyzed previously. Because the number and locations of these decelerators/parachutes is similar to those analyzed in the 2015 NWTT Final EIS/OEIS, the impacts to marine invertebrates would be expected to be the same.

As stated in the 2015 NWTT Final EIS/OEIS, most marine invertebrates would never encounter a decelerator/parachute from training activities. The impact of decelerators/parachutes on marine invertebrates is not likely to cause injury or mortality to individuals, and impacts would be inconsequential for the same reasons described above for fiber optic cables and guidance wires. Activities involving decelerators/parachutes are not expected to yield any behavioral changes or lasting impacts on the survival, growth, recruitment, or reproduction of invertebrate species at individual or population levels.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of decelerators/parachutes during training activities, as described under Alternative 1, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

Impacts from Decelerators/Parachutes Under Alternative 1 for Testing Activities

Under Alternative 1, the total number of decelerators/parachutes that would be expended during testing activities is increased (1,181 to 1,887) compared to the number proposed for use in the 2015 NWTT Final EIS/OEIS. As shown in Table 3.0-20, the expenditure of small size decelerators/parachutes in the Offshore Area is proposed to increase (1,068 to 1,711), and in the Inland Waters to increase from 113 to 176. No other sizes of decelerators/parachutes are proposed during testing activities. The activities that expend decelerators/parachutes would generally occur in the same locations and in a similar manner as were analyzed previously. Even though the number of decelerators/parachutes would increase during testing activities, the locations are similar to those analyzed in the 2015 NWTT Final EIS/OEIS, and impacts to marine invertebrates would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS, the impact of decelerators/parachutes on marine invertebrates would be inconsequential for the same reasons presented above for wires and cables.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of decelerators/parachutes during testing activities, as described under Alternative 1, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

3.8.2.5.2.2 Impacts from Decelerators/Parachutes Under Alternative 2

Impacts from Decelerators/Parachutes Under Alternative 2 for Training Activities

Under Alternative 2, the total number of decelerators/parachutes that would be expended during training activities increases compared to the number proposed for use under Alternative 1 (from 9,456 to 9,563) (Table 3.0-20) and in the 2015 NWTT Final EIS/OEIS (9,097 to 9,563). As shown in Table 3.0-20, the expenditure of small size decelerators/parachutes in the Offshore Area is proposed to increase (9,354 to 9,394), and no small decelerators/parachutes are proposed to be used in the Inland Waters, where none were proposed previously. The number of medium decelerators/parachutes in the Offshore Area increases from 4 to 24 compared to Alternative 1 and is the same as the 2015 NWTT Final EIS/OEIS. The number of large decelerators/parachutes in the Offshore Area increases from 98 to 145 (Table 3.0-20) compared to Alternative 1 and is the same as the 2015 NWTT Final EIS/OEIS. The activities that expend decelerators/parachutes would generally occur in the same locations and in a similar manner as were analyzed previously. Because the number and locations of these decelerators/parachutes is similar to those analyzed in the 2015 NWTT Final EIS/OEIS, the impacts to marine invertebrates would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS, the impact of decelerators/parachutes on marine invertebrates would be inconsequential for the same reasons detailed above under Alternative 1.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of decelerators/parachutes during training activities, as described under Alternative 2, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

Impacts from Decelerators/Parachutes Under Alternative 2 for Testing Activities

Under Alternative 2, the total number of decelerators/parachutes that would be expended during testing activities increases compared to the number proposed for use under Alternative 1 (from 1,887 to 1,895) and in the 2015 NWTT Final EIS/OEIS (1,181 to 1,895). As shown in Table 3.0-20, the expenditure of small decelerators/parachutes would be the same in the Offshore Area compared to Alternative 1 and increase compared to the 2015 NWTT Final EIS/OEIS (from 1,068 to 1,711). The expenditure of small decelerators/parachutes in Inland Waters would increase compared to both Alternative 1 (176 to 184) and the previous analysis (113 to 184). The activities that expend decelerators/parachutes would generally occur in the same locations and in a similar manner as were analyzed previously. Even though the number of decelerators/parachutes would increase during testing activities, the locations are similar to those analyzed in the 2015 NWTT Final EIS/OEIS, and impacts to marine invertebrates would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS, the impact of decelerators/parachutes on marine invertebrates would be inconsequential for the same reasons presented above for wires and cables.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of decelerators/parachutes during testing activities, as described under Alternative 2, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

3.8.2.5.2.3 Impacts from Decelerators/Parachutes Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Entanglement stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer entanglement stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from entanglement stressors on individual invertebrates, but would not measurably improve the status of invertebrate populations or subpopulations.

3.8.2.5.3 Impacts from Biodegradable Polymer

Biodegradable polymers were not proposed for use in the 2015 NWTT Final EIS/OEIS, and for this Supplemental would be used only during proposed testing activities, not during training activities. For a discussion of where biodegradable polymers are used and how many activities would occur under each alternative, see Section 3.0.3.5.3 (Biodegradable Polymer). The biodegradable polymers that the Navy uses are designed to temporarily interact with the propeller(s) of a target craft rendering it ineffective. A biodegradable polymer is a high molecular weight polymer that degrades to smaller compounds as a result of microorganisms and enzymes. The rate of biodegradation could vary from hours to years and the type of small molecules formed during degradation can range from complex to simple products, depending on whether the polymers are natural or synthetic (Karlsson & Albertsson, 1998). Based on the constituents of the biodegradable polymer the Navy proposes to use, it is anticipated that the material will break down into small pieces within a few days to weeks. This will break down further and dissolve into the water column within weeks to a few months. The final products which are all environmentally benign will be dispersed quickly to undetectable concentrations. Unlike other entanglement stressors, biodegradable polymers only retain their strength for a relatively short period of time, therefore the potential for entanglement by a marine invertebrate would be limited. Furthermore, the longer the biodegradable polymer remains in the water, the weaker it becomes making it more brittle and likely to break. A marine invertebrate would have to encounter the biodegradable polymer immediately after it was expended for it to be a potential entanglement risk. If a marine invertebrate were to encounter the polymer a few hours after it was expended, it is very likely that it would break easily and would no longer be an entanglement stressor.

3.8.2.5.3.1 Impacts from Biodegradable Polymer Under Alternative 1

<u>Impacts from Biodegradable Polymer Under Alternative 1 for Training Activities</u>

No biodegradable polymers are proposed to be used for training activities under Alternative 1.

<u>Impacts from Biodegradable Polymer Under Alternative 1 for Testing Activities</u>

As shown in Table 3.0-21, four testing activities involving the use of biodegradable polymers are proposed to only be conducted in the Inland Waters under Alternative 1. As detailed above and in the 2015 NWTT Final EIS/OEIS, marine invertebrates are not particularly susceptible to entanglement stressors, including biodegradable polymers and would likely only be temporarily disturbed. It is conceivable that relatively large pelagic invertebrates such as jellyfish would be temporarily entangled, although the probability is low due to the polymer design. The most likely effect would be temporary displacement as the material floats past an animal. Impacts on benthic species would not be expected. Activities involving biodegradable polymer would not yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at individual or population levels.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of biodegradable polymer during testing activities, as described under Alternative 1, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

3.8.2.5.3.2 Impacts from Biodegradable Polymer Under Alternative 2

<u>Impacts from Biodegradable Polymer Under Alternative 2 for Training Activities</u>

No biodegradable polymers are proposed to be used for training activities under Alternative 2.

Impacts from Biodegradable Polymer Under Alternative 2 for Testing Activities

As shown in Table 3.0-21, four testing activities involving the use of biodegradable polymers are proposed to be conducted in the Inland Waters under Alternative 2, the same number as Alternative 1. As detailed above and in the 2015 NWTT Final EIS/OEIS, marine invertebrates are not particularly susceptible to entanglement stressors, including biodegradable polymers and would likely only be temporarily disturbed. It is conceivable that relatively large pelagic invertebrates such as jellyfish would be temporarily entangled, although the probability is low due to the polymer design. The most likely effect would be temporary displacement as the material floats past an animal. Impacts on benthic species would not be expected. Therefore, as described above for Alternative 1, activities involving biodegradable polymer would not yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at individual or population levels.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of biodegradable polymer during testing activities, as described under Alternative 2, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

3.8.2.5.3.3 Impacts from Biodegradable Polymer Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Entanglement stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer entanglement stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from entanglement stressors on individual invertebrates, but would not measurably improve the status of invertebrate populations or subpopulations.

3.8.2.6 Ingestion Stressors

The ingestions stressors that may impact marine invertebrates include military expended materials from munitions (non-explosive practice munitions and fragments from high-explosives) and military expended materials other than munitions (fragments from targets, chaff and flare components, and biodegradable polymers). Biodegradable polymer is a new source for existing entanglement and ingestion stressors not previously analyzed, but the other stressors remain the same as analyzed in the 2015 NWTT Final EIS/OEIS.

3.8.2.6.1 Impacts from Military Expended Materials – Munitions

Ingestion of intact military expended materials – munitions is not likely for most types of expended items because they are too large to be ingested by most marine invertebrates. Though ingestion of intact munitions or large fragments is conceivable in some circumstances (e.g., a relatively large invertebrate such as an octopus or lobster ingesting a small-caliber projectile), such a scenario is unlikely due to the animal's ability to discriminate between food and non-food items. Indiscriminate deposit- and detritus-feeding invertebrates, such as some marine worms, could potentially ingest munitions fragments that have degraded to sediment size. In addition, metal particles in the water column may be taken up by suspension feeders (e.g., copepods, mussels) (Chiarelli & Roccheri, 2014; Griscom & Fisher, 2004). Although most metals do not technically dissolve in water, many react with water to form a soluble compound, and researchers often refer to these compounds as dissolved metals. Investigations of silver ingestion by marine invertebrates found that the metal is less toxic when dissolved in water (Brix et al., 2012), and an investigation of metals in a nearshore area heavily influenced by industrial activities found that concentrations were substantially greater in the sediment than in the water column (Bazzi, 2014). The results of these studies suggest that suspension-feeding invertebrates could be less susceptible to impacts than invertebrates that might consume metal particles directly from the sediment.

3.8.2.6.1.1 Impacts from Military Expended Materials – Munitions Under Alternative 1

Impacts from Military Expended Materials – Munitions Under Alternative 1 for Training Activities

Under Alternative 1, the number of military expended materials – munitions that would be used during training activities (Table 3.0-14 and Table 3.0-16) is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from munitions are combined, the number of items proposed to be expended under Alternative 1 decreases compared to ongoing activities. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts to marine invertebrates would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS, the impact of military expended materials – munitions on marine invertebrates would be inconsequential because most military expended materials and fragments of military expended materials are too large to be ingested by marine invertebrates. The potential for marine invertebrates to encounter fragments of ingestible size increases as the military expended materials degrade into smaller fragments. The fractions of military expended materials of ingestible size, or that become ingestible after degradation, may impact individual marine invertebrates, but are unlikely to impact populations.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of military expended materials – munitions of ingestible size associated with training activities, as described under Alternative 1, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

Impacts from Military Expended Materials – Munitions Under Alternative 1 for Testing Activities

Under Alternative 1, the number of military expended materials – munitions that would be used during testing activities (Table 3.0-14 and Table 3.0-16) is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from munitions are combined, the number of items proposed to be expended under Alternative 1 increases compared to ongoing activities. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts to marine invertebrates would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS, the impact of military expended materials – munitions on marine invertebrates would be inconsequential because most military expended materials and fragments of military expended materials are too large to be ingested by marine invertebrates. The potential for marine invertebrates to encounter fragments of ingestible size increases as the military expended materials degrade into smaller fragments. The fractions of military expended materials of ingestible size, or that become ingestible after degradation, may impact individual marine invertebrates, but are unlikely to impact populations.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of military expended materials – munitions of ingestible size associated with testing activities, as described under Alternative 1, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

3.8.2.6.1.2 Impacts from Military Expended Materials – Munitions Under Alternative 2

Impacts from Military Expended Materials – Munitions Under Alternative 2 for Training Activities

Under Alternative 2, the number of military expended materials – munitions that would be used during training activities (Table 3.0-14 and Table 3.0-16) is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from munitions are combined, the number of items proposed to be expended under Alternative 2 increases compared to both Alternative 1 (Table 3.0-14 and Table 3.0-16) and ongoing activities. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts to marine invertebrates would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS and above under Alternative 1, the impact of military expended materials – munitions on marine invertebrates would be inconsequential because most military expended materials and fragments of military expended materials are too large to be ingested by marine invertebrates. The potential for marine invertebrates to encounter fragments of ingestible size increases as the military expended materials degrade into smaller fragments. The fractions of military expended materials of ingestible size, or that become ingestible after degradation, may impact individual marine invertebrates, but are unlikely to impact populations.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of military expended materials – munitions of ingestible size associated with training activities, as described under Alternative 2, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

Impacts from Military Expended Materials – Munitions Under Alternative 2 for Testing Activities

Under Alternative 2, the number of military expended materials – munitions that would be used during testing activities (Table 3.0-14 and Table 3.0-16) is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from munitions are combined, the number of items proposed to be expended under Alternative 2 increases compared to both Alternative 1 (Table 3.0-14 and Table 3.0-16) and ongoing activities. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts to marine invertebrates would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS and above under Alternative 1, the impact of military expended materials – munitions on marine invertebrates would be inconsequential because most military expended materials and fragments of military expended materials are too large to be ingested by marine invertebrates. The potential for marine invertebrates to encounter fragments of ingestible size increases as the military expended materials degrade into smaller fragments. The fractions of military expended materials of ingestible size, or that become ingestible after degradation, may impact individual marine invertebrates, but are unlikely to impact populations.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of military expended materials – munitions of ingestible size associated with testing activities, as described under Alternative 2, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

3.8.2.6.1.3 Impacts from Military Expended Materials – Munitions Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Ingestion stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer ingestion stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from ingestion stressors on individual invertebrates, but would not measurably improve the status of invertebrate populations or subpopulations.

3.8.2.6.2 Impacts from Military Expended Materials – Other than Munitions

3.8.2.6.2.1 Impacts from Military Expended Materials – Other than Munitions Under Alternative 1

Impacts from Military Expended Materials – Other than Munitions Under Alternative 1 for Training Activities

Under Alternative 1, the number of military expended materials other than munitions that would be used during training activities (Table 3.0-17, Table 3.0-20, Table 3.0-21, and Table 3.0-22) is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials other than munitions (fragments from targets, chaff and flare components, and biodegradable polymers) are combined, the number of items proposed to be expended under Alternative 1 (Table 3.0-17, Table 3.0-20, Table 3.0-21, and Table 3.0-22) increases compared to ongoing activities. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts to marine invertebrates would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS, the impact of military expended materials – other than munitions on marine invertebrates would be inconsequential because most military expended materials and fragments of military expended materials are too large to be ingested by marine invertebrates. The potential for marine invertebrates to encounter fragments of ingestible size increases as the military expended materials degrade into smaller fragments. The fractions of military expended materials of ingestible size, or that become ingestible after degradation, may impact individual marine invertebrates, but are unlikely to impact populations.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of military expended materials – other than munitions of ingestible size associated with training activities, as described under Alternative 1, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

Impacts from Military Expended Materials – Other than Munitions Under Alternative 1 for Testing Activities

Under Alternative 1, the number of military expended materials other than munitions that would be used during testing activities decreases (Table 3.0-17, Table 3.0-20, Table 3.0-21, and Table 3.0-22) compared to the number proposed for use in the 2015 NWTT Final EIS/OEIS. Other than the addition of biodegradable polymer, which would occur four times annually in the Inland Waters, the activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Based on the constituents of the biodegradable polymer the Navy proposes to use, it is anticipated that the material will breakdown into small pieces within a few days to weeks, eventually dissolving into the water column as environmentally benign products. Being benign, if ingested, the remnants of the biodegradable polymer would pose limited risk to marine invertebrates. Even though there would be a substantial increase in the number of military expended material – other than munitions and as stated in the 2015 NWTT Final EIS/OEIS, the impact on marine invertebrates would be inconsequential because most military expended materials and fragments of military expended materials are too large to be ingested by marine invertebrates. The potential for marine invertebrates to encounter fragments of ingestible size increases as the military expended materials degrade into smaller fragments. The fractions of military expended materials of ingestible size, or that become ingestible after degradation, may impact individual marine invertebrates, but are unlikely to impact populations.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of military expended materials – other than munitions of ingestible size associated with testing activities, as described under Alternative 1, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

3.8.2.6.2.2 Impacts from Military Expended Materials – Other than Munitions Under Alternative 2

Impacts from Military Expended Materials – Other than Munitions Under Alternative 2 for Training Activities

Under Alternative 2, the number of military expended materials other than munitions that would be used during training activities (Table 3.0-17, Table 3.0-20, Table 3.0-21, and Table 3.0-22) is generally consistent with the number proposed for use under Alternative 1 and in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials other than munitions (fragments from targets, chaff and flare components, and biodegradable polymers) are combined, the number of items proposed to be expended under Alternative 2 increases slightly compared to Alternative 1 (Table 3.0-17, Table 3.0-20, Table 3.0-21, and Table 3.0-22) and increases compared to ongoing activities. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts to marine invertebrates would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS, the impact of military expended materials – other than munitions on marine invertebrates would be inconsequential because most military expended materials and fragments of military expended materials are too large to be ingested by marine invertebrates. The potential for marine invertebrates to encounter fragments of ingestible size increases as the military expended materials degrade into smaller fragments. The fractions of military expended materials of ingestible size, or that become ingestible after degradation, may impact individual marine invertebrates, but are unlikely to impact populations.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of military expended materials – other than munitions of ingestible size associated with training activities, as described under Alternative 2, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

Impacts from Military Expended Materials – Other than Munitions Under Alternative 2 for Testing Activities

Under Alternative 2, the number of military expended materials other than munitions that would be used during testing activities increases (Table 3.0-17, Table 3.0-20, Table 3.0-21, and Table 3.0-22) compared to the number proposed for use under Alternative 1 and decreases slightly from ongoing activities. Other than the addition of biodegradable polymer, which would occur four times annually in the Inland Waters, the activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Based on the constituents of the biodegradable polymer the Navy proposes to use, it is anticipated that the material will breakdown into small pieces within a few days to weeks, eventually dissolving into the water column as environmentally benign products. Being benign, if ingested, the remnants of the biodegradable polymer would pose limited risk to marine invertebrates. Even though there would be a substantial increase in the number of military expended material – other than munitions and as stated in the 2015 NWTT Final EIS/OEIS, the impact on marine invertebrates would be inconsequential because most military expended materials and fragments of military expended materials are too large to be ingested by marine invertebrates. The potential for marine invertebrates to encounter fragments of ingestible size increases as the military expended materials degrade into smaller fragments. The fractions of military expended materials of ingestible size, or that become ingestible after degradation, may impact individual marine invertebrates, but are unlikely to impact populations.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of military expended materials – other than munitions of ingestible size associated with testing activities, as described under Alternative 2, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

3.8.2.6.2.3 Impacts from Military Expended Materials – Other than Munitions Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Ingestion stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer ingestion stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from ingestion stressors on individual invertebrates, but would not measurably improve the status of invertebrate populations or subpopulations.

3.8.2.7 Secondary Stressors

Potential impacts on marine invertebrates exposed to stressors could occur indirectly through sediments and water quality. Stressors from Navy training and testing activities could pose secondary or indirect impacts on marine invertebrates via habitat, sediment, or water quality. Components of these stressors that could pose indirect impacts include (1) explosives and explosives byproducts; (2) metals; (3) chemicals; and (4) other materials such as targets, chaff, and plastics.

While the number of training and testing activities would change under this supplement, the analysis presented in the 2015 NWTT Final EIS/OEIS, Section 3.8.3.6 (Secondary Stressors) remains valid.

As stated in the 2015 NWTT Final EIS/OEIS, indirect impacts of explosives and unexploded ordnance on marine invertebrates via water are likely to be inconsequential and not detectable for two reasons. First, most explosives and explosive degradation products have very low solubility in sea water. This means that dissolution occurs extremely slowly, and harmful concentrations of explosives and degradation are not likely to accumulate except within confined spaces. Second, a low concentration of byproducts, slowly delivered into the water column, is readily diluted to non-harmful concentrations. Filter feeders in the immediate vicinity of degrading explosives may be more susceptible to bioaccumulation of chemical byproducts. While marine invertebrates may be adversely impacted by the indirect effects of degrading explosives via water (Rosen & Lotufo, 2007; 2010), this is extremely unlikely in realistic scenarios.

Impacts on marine invertebrates, including zooplankton, eggs, and larvae, are likely only within a very small radius of the ordnance (1–6 feet [0.3–1.8 meters]). These impacts may continue as the ordnance degrades over months to decades. Because most ordnance is deployed as projectiles, multiple unexploded or low-order detonations would accumulate on spatial scales of 1–6 feet (0.3–1.8 meters); therefore, potential impacts are likely to remain local and widely separated. Given these conditions, the possibility of population-level impacts on marine invertebrates is inconsequential. However, if the sites of the depositions are the same over time, this could alter the benthic composition, affect bioaccumulation, and impact local invertebrate communities.

As stated in the 2015 NWTT Final EIS/OEIS, concentrations of metals in water are extremely unlikely to be high enough to cause injury or mortality to marine invertebrates; therefore, indirect impacts of metals via water are likely to be inconsequential and not detectable. Given these conditions, the possibility of population-level impacts on marine invertebrates is likely to be inconsequential and not detectable. In addition, concentrations of chemicals in sediment and water are not likely to cause injury or mortality to marine invertebrates; therefore, indirect impacts of chemicals via sediment and water are likely to be inconsequential and not detectable. Population-level impacts on marine invertebrates would be inconsequential and not detectable.

In addition, as stated in the 2015 NWTT Final EIS/OEIS, the only material that could impact marine invertebrates via sediment is plastics. Harmful chemicals in plastics interfere with metabolic and endocrine processes in many plants and animals (Derraik, 2002). Potentially harmful chemicals in plastics are not readily adsorbed to marine sediments; instead, marine invertebrates are most at risk via ingestion or bioaccumulation. Because plastics retain many of their chemical properties as they are physically degraded into microplastic particles (Singh & Sharma, 2008), the exposure risks to marine invertebrates are dispersed over time. Marine invertebrates could be indirectly impacted by chemicals from plastics but, absent bioaccumulation, these impacts would be limited to direct contact with the material. Because of these conditions, population-level impacts on marine invertebrates attributable to Navy-expended materials are likely to be inconsequential and not detectable.

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3.9 Fishes

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3.9 Fishes

3.9.1 Introduction and Methods

This section analyzes the potential impacts of the Proposed Action on fishes found in the Northwest Training and Testing (NWTT) Study Area (Study Area). Section 3.9 (Fishes) provides a synopsis of the United States (U.S.) Department of the Navy's (Navy's) determinations of the impacts of the Proposed Action on fishes. Section 3.9.2 (Affected Environment) introduces the species and taxonomic groups known to occur in the Study Area and discusses the baseline affected environment. The complete analysis of environmental consequences is in Section 3.9.3 (Environmental Consequences).

For this Supplemental Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) (Supplemental), marine and anadromous fishes are evaluated as groups of species characterized by distribution, body type, or behavior relevant to the stressor being evaluated. Activities are evaluated for their potential impact on all fishes in general, by taxonomic groupings, and the 34 fish in the Study Area listed under the Endangered Species Act (ESA).

Major taxonomic groups in the Study Area are described in the 2015 NWTT Final EIS/OEIS and remain valid as written. Fish species listed under the ESA are updated in this document. Marine fish species that are regulated under the Magnuson-Stevens Fishery Conservation and Management Act are discussed in Section 3.9.2.5 (Federally Managed Fisheries). Additional general information on the biology, life history, distribution, and conservation of marine and anadromous fishes can be found on the websites of the following agencies and organizations, as well as many others:

- National Marine Fisheries Service (NMFS), Office of Protected Resources (including ESA-listed species distribution maps)
- Regional Fishery Management Councils
- International Union for Conservation of Nature
- Essential Fish Habitat Text Descriptions

Fishes are not distributed uniformly throughout the Study Area but are closely associated with a variety of habitats. Some species, such as large sharks, tuna, and billfishes, range across thousands of square miles (thousands of square kilometers), while others have small home ranges and restricted distributions (Helfman et al., 2009a). The movements of some open-ocean species may never overlap with coastal species that spend their lives within several hundred feet (a few hundred meters) of the shore. Even within species, the distribution and specific habitats in which individuals occur may be influenced by age, developmental stage, size, sex, reproductive condition, health, and other factors.

3.9.2 Affected Environment

For purposes of this Supplemental, the region of influence for fishes remains the same as that identified in the 2015 NWTT Final EIS/OEIS.

The 2015 NWTT Final EIS/OEIS provided a general overview of fish hearing and vocalizations and general threats. New information since the publication of the 2015 NWTT Final EIS/OEIS is included below to better understand potential stressors and impacts on fishes resulting from training and testing activities.

3.9.2.1 Hearing and Vocalization

A summary of fish hearing and vocalizations is described in the 2015 NWTT Final EIS/OEIS. Due to the availability of new literature, including revised sound exposure criteria, the information provided below will supplement the 2015 NWTT Final EIS/OEIS for fishes.

All fishes have two sensory systems that can detect sound in the water: the inner ear, which functions similarly to the inner ear in other vertebrates, and the lateral line, which consists of a series of receptors along the body of a fish (Popper & Schilt, 2008). The lateral line system is sensitive to external particle motion arising from sources within a few body lengths of an animal. The lateral line detects particle motion at low frequencies from below 1 hertz (Hz) up to at least 400 Hz (Coombs & Montgomery, 1999; Hastings & Popper, 2005; Higgs & Radford, 2013; Webb et al., 2008). Generally, the inner ears of fish contain three dense otoliths (i.e., small calcareous bodies, although some fishes may have more) that sit atop many delicate mechanoelectric hair cells within the inner ear of fishes, similar to the hair cells found in the mammalian ear. Underwater sound waves pass through the fish's body and vibrate the otoliths. This causes a relative motion between the dense otoliths and the surrounding tissues, causing a deflection of the hair cells, which is sensed by the nervous system.

Although a propagating sound wave contains pressure and particle motion components, particle motion is most significant at low frequencies (up to at least 400 Hz) and is most detectible at high sound levels or very close to a sound source. The inner ears of fishes are directly sensitive to acoustic particle motion rather than acoustic pressure (acoustic particle motion and acoustic pressure are discussed in Appendix D, Acoustic and Explosive Concepts). Historically, studies that have investigated hearing in, and effects to, fishes have been carried out with sound pressure metrics. Although particle motion may be the more relevant exposure metric for many fish species, there is little data available that actually measures it due to a lack of standard measurement methodology and experience with particle motion detectors (Hawkins et al., 2015; Martin et al., 2016). In these instances, particle motion can be estimated from pressure measurements (Nedelec et al., 2016a).

Some fishes possess additional morphological adaptations or specializations that can enhance their sensitivity to sound pressure, such as a gas-filled swim bladder (Astrup, 1999; Popper & Fay, 2010). The swim bladder can enhance sound detection by converting acoustic pressure into localized particle motion, which may then be detected by the inner ear (Radford et al., 2012). Fishes with a swim bladder generally have greater hearing sensitivity and can detect higher frequencies than fishes without a swim bladder (Popper & Fay, 2010; Popper et al., 2014). In addition, structures such as gas-filled bubbles near the ear or swim bladder, or even connections between the swim bladder and the inner ear, also increase sensitivity and allow for high-frequency hearing capabilities and better sound pressure detection.

Although many researchers have investigated hearing and vocalizations in fish species (Ladich & Fay, 2013; Popper et al., 2014), hearing capability data only exist for just over 100 of the currently known 34,000 marine and freshwater fish species (Eschmeyer & Fong, 2016). Therefore, fish hearing groups are defined by species that possess a similar continuum of anatomical features, which result in varying degrees of hearing sensitivity (Popper & Fay, 2010; Popper & Hastings, 2009b). Categories and descriptions of hearing sensitivities are further defined in this document (modified from Popper et al., 2014) as the following:

- Fishes without a swim bladder—hearing capabilities are limited to particle motion detection at frequencies well below 2 kilohertz (kHz).
- Fishes with a swim bladder not involved in hearing—species lack notable anatomical specializations, and primarily detect particle motion at frequencies below 2 kHz.
- Fishes with a swim bladder involved in hearing—species can detect frequencies below 2 kHz and possess anatomical specializations to enhance hearing and are capable of sound pressure detection up to a few kHz.

- Fishes with a swim bladder and high-frequency hearing—species can detect frequencies below 2 kHz and possess anatomical specializations and are capable of sound pressure detection at frequencies up to 10 kHz to over 100 kHz.

Both the quantitative literature review conducted by Wiernicki et al. (2020) and x-ray and image processing performed by Schulz-Mirbach et al. (2020), and hearing measurements and dissections of black sea bass by Stanley et al. (2020) continue to support the above hearing group classifications. Additional research is still needed to better understand species-specific frequency detection capabilities and overall sensitivity to sound.

Data suggest that most species of marine fish either lack a swim bladder (e.g., sharks and flatfishes) or have a swim bladder not involved in hearing and can only detect sounds below 1 kHz. Some marine fishes (Clupeiformes) with a swim bladder involved in hearing are able to detect sounds to about 4 kHz (Colleye et al., 2016; Mann et al., 2001; Mann et al., 1997). One subfamily of clupeids (i.e., Alosinae) can detect high- and very high-frequency sounds (i.e., frequencies from 10 to 100 kHz, and frequencies above 100 kHz, respectively), although auditory thresholds at these higher frequencies are elevated and the range of best hearing is still in the low-frequency range (below 1 kHz) similar to other fishes. Mann et al. (1997, 1998) theorize that this subfamily may have evolved the ability to hear relatively high sound levels at these higher frequencies in order to detect echolocations of nearby foraging dolphins. For fishes that have not had their hearing tested, such as deep sea fishes, the suspected hearing capabilities are based on the structure of the ear, the relationship between the ear and the swim bladder, and other potential adaptations such as the presence of highly developed areas of the brain related to inner ear and lateral line functions (Buran et al., 2005; Deng et al., 2011, 2013). It is believed that most fishes have their best hearing sensitivity from 100 to 400 Hz (Popper, 2003).

Species listed under the ESA within the Study Area include several salmonid and rockfish species, as well as Pacific eulachon and green sturgeon. Species-specific hearing studies for each of the ESA-listed species present in the Study Area are not available. Instead, each ESA-listed species is considered part of a hearing group described above based on data from similar, or surrogate, species, and knowledge of that species physiology. As discussed above, most marine fishes investigated to date lack hearing capabilities greater than 1,000 Hz. This notably includes sturgeon and salmonid species, fishes that have a swim bladder that is not involved in hearing. Although it is assumed that sturgeon and salmon species can detect frequencies up to 1,000 Hz, available hearing data has only tested these species up to about 800 Hz (Hawkins & Johnstone, 1978; Kane et al., 2010; Lovell et al., 2005; Meyer et al., 2010; Tavolga & Wodinsky, 1963). Rockfish also have a swim bladder that is not involved in hearing similar to Salmoniformes (Hastings & Popper, 2005) and therefore likely have similar hearing capabilities. Eulachon do not have a swim bladder (Gauthier & Horne, 2004). Available data suggest species without a swim bladder can detect sounds from 20 to 1,000 Hz, with best sensitivity at lower ranges (Casper et al., 2003; Casper & Mann, 2006; Casper & Mann, 2009; Myrberg, 2001). This data is largely derived from studies conducted using cartilaginous fishes, such as sharks and rays. There are no ESA-listed species that occur in the Study Area that have a swim bladder that is involved in hearing, or that have high frequency hearing (the two most sensitive hearing groups).

Some fishes are known to produce sound. Bony fishes can produce sounds in a number of ways and use them for a number of behavioral functions (Ladich, 2008, 2014). Over 30 families of fishes are known to use vocalizations in aggressive interactions, and over 20 families are known to use vocalizations in mating (Ladich, 2008). Sounds generated by fishes as a means of communication are generally below 500 Hz (Slabbekoorn et al., 2010). The air in the swim bladder is vibrated by the sound producing structures (often muscles that are integral to the swim bladder wall) and radiates sound into the water (Zelick et al., 1999). Sprague and Luczkovich (2004) calculated that silver perch, of the family Sciaenidae, can produce drumming sounds ranging from 128 to 135 decibels referenced to 1 micropascal (dB re 1 µPa). Female midshipman fish apparently detect and locate the "hums" (approximately 90 to 400 Hz) of vocalizing males during the breeding season (McIver et al., 2014; Sisneros & Bass, 2003). Sciaenids produce a variety of sounds, including calls produced by males on breeding grounds (Ramcharitar et al., 2001), and a "drumming" call produced during chorusing that suggests a seasonal pattern to reproductive-related function (McCauley & Cato, 2000). Other sounds produced by chorusing reef fishes include "popping," "banging," and "trumpet" sounds; altogether, these choruses produce sound levels 35 decibels (dB) above background levels, at peak frequencies between 250 and 1,200 Hz, and source levels between 144 and 157 dB re 1 µPa (McCauley & Cato, 2000).

Additional research using visual surveys (such as baited underwater video and monitoring by divers) and passive acoustic monitoring continue to reveal new sounds produced by fishes, both in the marine and freshwater environments, and allow for specific behaviors to be paired with those sounds (Radford et al., 2018; Rountree et al., 2018; Rowell et al., 2020; Rowell et al., 2018).

3.9.2.2 General Threats

A summary of the major threats to fish species within the Study Area are described in the 2015 NWTT Final EIS/OEIS. Overfishing and associated factors, such as bycatch, fisheries-induced evolution, and intrinsic vulnerability to overfishing were described. Two species present in the Study Area, coho salmon (*Oncorhynchus kisutch*) stocks in Hood Canal, Washington, and yelloweye rockfish (*Sebastes ruberrimus*), were listed as overfished in a 2016 NMFS Federal Register (FR) notice (National Marine Fisheries Service, 2016). Another species present in the Study Area, Pacific ocean perch (*Sebastes alutus*), was previously considered overfished but is now considered "rebuilt" and not subject to overfishing, according to the 2017 stock assessment (National Marine Fisheries Service, 2020).

Pollution, including the effect of oceanic circulation patterns scattering coastal pollution throughout the open ocean, was described. The effects of organic and inorganic pollutants to marine fishes, including bioaccumulation of pollutants, behavioral and physiological changes, or genetic damage, were described, as well as entanglement in abandoned commercial and recreational fishing gear.

Other human-caused stressors on marine fishes described were the introduction of non-native species, climate change shifting fish distribution from lower to higher latitudes, aquaculture, energy production, vessel movement, and underwater noise.

Climate change related threats impacting marine fish and fisheries in addition to those described in the 2015 NWTT Final EIS/OEIS have been documented. In addition to affecting species ranges, increasing temperature has been shown to alter the sex-ratio in fish species that have temperature-dependent sex determination mechanisms (Ospina-Alvarez & Piferrer, 2008). It appears that diadromous and benthic fish species are most vulnerable to climate change impacts on abundance or productivity (Hare et al., 2016).

Ocean acidification, a climate change related process where increasing atmospheric carbon dioxide concentrations are reducing ocean pH and carbonate ion concentrations, may have serious impacts on fish development and behavior (Munday et al., 2009; Munday et al., 2011; Raven et al., 2005; Williams et al., 2018). Physiological development of fishes can be affected by increases in pH that can increase the size, density, and mass of fish otoliths (e.g., fish ear stones), which would affect sensory functions (Bignami et al., 2013). Ocean acidification may affect fish larvae behavior and could impact fish populations (Munday et al., 2009). A range of behavioral traits critical to survival of newly settled fish larvae are affected by ocean acidification. Settlement-stage larval marine fishes exposed to elevated carbon dioxide were less responsive to threats than controls (Munday et al., 2009). This decrease in sensitivity to risk might be directly related to impaired olfactory ability (Munday et al., 2009). Ocean acidification may cause a shift in phytoplankton community composition and biochemical composition that can impact the transfer of essential compounds to planktivorous organisms (Bermudez et al., 2016) and can cause shifts in community composition up the food chain.

Another effect of climate change is ocean deoxygenation. Netburn and Koslow (2015) found that the depth of the lower boundary of the deep scattering layer (so-called because the sonic pulses of a sonar can reflect off the millions of fish swim bladders) is most strongly correlated with dissolved oxygen concentration.

A study by Deutsch et al. (2015) used climate models to see how the projected temperature and oxygen levels by 2100 due to climate change would affect four ocean species' ability to meet their future energy needs. If current emissions continue, the near-surface ocean is projected to warm by several degrees Celsius by the end of this century. Seawater at that temperature would hold 5–10 percent less oxygen than it does now. The combined effects of warming and oxygen loss this century are projected to reduce the upper ocean's metabolic index by approximately 20 percent globally and by approximately 50 percent in northern high-latitude regions, forcing poleward and vertical contraction of metabolically viable habitats and species ranges. Keller et al. (2015) suggested that within the California Current System, shoaling of the oxygen minimum zone is expected to produce complex changes and onshore movement of the oxygen minimum zone that could lead to habitat compression for species with higher oxygen requirements while allowing expansion of species tolerant of low bottom dissolved oxygen.

With the exception of new information about overfishing and climate change, the extent of the effects of general threats has not changed since they were last described in the 2015 NWTT Final EIS/OEIS. Therefore, the information presented in the 2015 NWTT Final EIS/OEIS remains valid.

3.9.2.3 Taxonomic Group Descriptions and Distribution

Seventeen taxonomic groups of fishes and their distribution in the Study Area (Offshore Area and Inshore Waters and the Western Behm Canal portion of the Study Area) were described in the 2015 NWTT Final EIS/OEIS and summarized in Table 3.9-1. Neither the taxonomic groups nor their distribution within the Study Area has changed since it was last described in the 2015 NWTT Final EIS/OEIS. Therefore, the information presented in the 2015 NWTT Final EIS/OEIS remains valid.

3.9.2.4 Endangered Species Act-Listed Species

There are 33 fish species occurring in the Study Area that are listed as either threatened or endangered under the ESA (Table 3.9-2). NMFS has listed 28 species of salmon and steelhead, two rockfish species, Pacific eulachon, and green sturgeon on the west coast, all of which occur within the Study Area. The U.S. Fish and Wildlife Service (USFWS) has listed bull trout throughout its range, which overlaps with the Study Area. In addition, nine species of concern occur within the Study Area. Species of Concern are identified by NMFS when there is concern regarding species status, but for which insufficient information is available to indicate a need to list the species (69 FR 19975). Candidate species are any species that are undergoing a status review that NMFS has announced through a FR notice (71 FR 61022). Candidate species and Species of Concern do not carry any procedural or substantive protections under the ESA (71 FR 61022). The emphasis on species-specific information in the following profiles will be on the ESA protected species because any threats or potential impacts on those species are subject to consultation with regulatory agencies.

Critical habitat and the associated Primary Constituent Elements (PCEs), if applicable, within the Study Area are identified and described. Potential impacts on critical habitat were assessed by determining the effects of the project on the PCEs of the critical habitat. Critical habitat is defined as (1) specific areas within the geographical area occupied by the species at the time of listing, if those areas contain physical or biological features essential to conservation, and those features may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by the species if the agency determines that the area itself is essential for conservation. PCEs are defined as sites or habitat components that support one or more life stages deemed essential to the conservation of the species. Critical habitat maps were provided only for species in which the critical habitat extended into the Study Area.

The Sikes Act Improvement Act of 1997 (16 United States Code 670a) (Sikes Act) requires each military installation that includes land and water suitable for the conservation and management of natural resources to complete an integrated natural resources management plan (INRMP). NMFS and USFWS shall not designate (exempt) as critical habitat any lands or other geographical areas owned or controlled by the Department of Defense (DoD), or designated for its use, that are subject to an INRMP if the Secretary of the Service determines in writing that such plan provides a benefit to the species for which critical habitat is proposed for designation. Under section 4(b)(2) of the ESA, the Services consider where a national security impact might exist where the benefits of exclusion outweigh the benefits of inclusion.

Since the publication of the 2015 NWTT Final EIS/OEIS, critical habitat has been designated for two threatened species: Puget Sound Steelhead Distinct Population Segment (DPS) and Lower Columbia River coho Salmon Evolutionarily Significant Unit (ESU) (81 FR 9251). Critical habitat designated for Puget Sound steelhead and Lower Columbia River coho salmon is entirely freshwater and marine habitat has not been designated. As a result, there is no critical habitat for these two species in the Study Area. The Puget Sound/Georgia Basin DPS of canary rockfish has been delisted and its designated critical habitat removed (82 FR 7711). Also, bigeye thresher shark, common thresher shark, and smooth hammerhead shark (*Sphyrna zygaena*) have been removed from candidate status after status reviews determined that listing was not warranted (81 FR 18979; 81 FR 41934). Table 3.9-2 contains a summary of the status and presence of all ESA-listed fish species potentially found in the Study Area. The five-year status reviews for all Pacific salmon and steelhead were published in 2016 with no changes in listing status warranted (National Marine Fisheries Service, 2016). In addition, several salmonid hatchery programs have been either added or removed from their respective species' ESUs/DPSs (Jones 2015). With the exception of these recent changes in species status or the inclusion/exclusion of hatchery populations in ESUs/DPSs, the information presented in the 2015 NWTT Final EIS/OEIS remains valid.

Table 3.9-1: Taxonomic Groups of Fishes Within the Northwest Training and Testing Study Area

Taxonomic Groups[1]		Distribution Within Study Area		
Taxonomic Grouping	**Description**	**Offshore Area**	**Inland Waters**	**Western Behm Alaska**
Hagfish and lamprey (orders Myxiniformes and Petromyzontiformes)	Primitive and jawless with an eel-like body shape that prey on fishes, feed on dead fishes, or are parasitic	Water column, seafloor	Seafloor	Seafloor
Sharks, rays, and chimaeras (class Chondrichthyes)	Cartilaginous (non-bony) fishes, some of which are open ocean predators	Surface, water column, seafloor	Surface, water column, seafloor	Surface, water column, seafloor
Eels and spiny eels (order Anguilliformes))	Undergo a unique larval stage with a small head and elongated body; very different from other fishes	Surface, water column, seafloor	Surface, water column, seafloor	Surface, water column, seafloor
Sturgeons (order Acipenseriformes)	Cartilaginous skeleton, anadromous, and long lived	Water column, seafloor	Water column, seafloor	Water column, seafloor
Herring, eulachon, and salmonids (orders Clupeiformes, Osmeriformes, and Salmoniformes)	Some are anadromous while others are migratory between the ocean, bays, estuaries, and rivers	Surface	Surface, water column	Surface, water column
Lanternfishes (order Myctophiformes)	Largest group of deepwater fishes, most possess adaptations for low-light conditions	Water column	Water column, seafloor	Not Present
Lizardfishes and lancetfishes (order Aulopiformes)	Predatory fish typically found in deep waters	Seafloor	Water column, seafloor	Water column, seafloor
Cods, hakes, and brotulas (orders Gadiformes and Ophidiiformes)	Important commercial fishery resources, associated with bottom habitats	Water column, seafloor	Water column, seafloor	Water column, seafloor
Toadfishes (order Batrachoidiformes)	Temperate and tropical a lie-in-wait predator	Seafloor	Seafloor	Seafloor

Table 3.9-1: Taxonomic Groups of Fishes Within the Northwest Training and Testing Study Area (continued)

Taxonomic Groups[1]		Distribution Within Study Area		
Taxonomic Grouping	**Description**	**Offshore Area**	**Inland Waters**	**Western Behm Alaska**
Pacific saury and Silversides (orders Atheriniformes and Beloniformes)	Small-sized nearshore/coastal fishes, primarily feed on organic debris; also includes the surface-oriented flyingfishes	Surface	Surface, water column	Surface, water column
Opahs and ribbonfishes, (order Lampridiformes)	Primarily open ocean or deepwater fishes	Surface, water column	Surface, water column	Surface, water column
Pipefish and sticklebacks (order Gasterosteiformes)	Small mouth with tubular snout and armor like scales; shows a high level of parental care	None	Surface	Surface
Rockfishes (order Scorpaeniformes)	Larval and juvenile stages pelagic; depending on species, adults bottom oriented or pelagic	Surface, water column, seafloor	Surface, water column, seafloor	Surface, water column, seafloor
Gobies (order Perciformes: family Gobiidae)	Gobies are the largest and most diverse family of marine fishes, mostly found in bottom habitats of coastal areas	None	Bottom Habitat	Surface
Jacks, tunas, and mackerels, (order Perciformes: families Carangidae, Scombridae)	Highly migratory predators found near the surface; they make up a major component of fisheries	Surface	Surface, water column	Surface, water column
Flounders and soles (order Pleuronectiformes)	Occur in bottom habitats throughout the world where they are well camouflaged	Seafloor	Seafloor	Seafloor
Ocean sunfish (*Mola mola*) (order Tetraodontiformes)	Unique body shapes and characteristics to avoid predators	Surface, water column	Surface, water column	Surface, water column

[1] Taxonomic groups are based on the following commonly accepted references: Hart (1973); Helfman et al. (2009b); Moyle & Cech (2004); Nelson et al. (2016).

Table 3.9-2: Status and Presence of Endangered Species Act (ESA)-Listed Fish Species and their Designated Critical Habitat, Candidate Species, and Species of Concern Found in the Northwest Training and Testing Study Area

Species and Regulatory Status				Presence in Study Area		
Common Name (Scientific Name)	**Distinct Population Segment (DPS)[1]/ Evolutionarily Significant Unit (ESU)[2]**	**Federal Status**	**Critical Habitat Designation**	**Offshore Area**	**Inland Waters**	**Western Behm Canal**
Salmonid Species						
Chinook Salmon (*Oncorhynchus tshawytscha*)	Puget Sound ESU	T	Designated (Inland Waters)	✓	✓	✓
	Upper Columbia River Spring-Run ESU	E	Designated (Not in Study Area)	✓		✓
	Lower Columbia River ESU	T	Designated (Not in Study Area)	✓		✓
	Upper Willamette River ESU	T	Designated (Not in Study Area)	✓		✓
	Snake River Spring/Summer-Run ESU	T	Designated (Not in Study Area)	✓		✓
	Snake River Fall-Run ESU	T	Designated (Not in Study Area)	✓		✓
	California Coastal ESU	T	Designated (Not in Study Area)	✓		
	Central Valley, Fall and Late-Fall Run ESU	SOC[3]	Not Designated	✓		
	Central Valley Spring-Run ESU	T	Designated (Not in Study Area)	✓		
	Sacramento River Winter-Run ESU	E	Designated (Not in Study Area)	✓		
Coho Salmon (*Oncorhynchus kisutch*)	Lower Columbia ESU	T	Designated (Not in Study Area)	✓		✓
	Oregon Coast ESU	T	Designated (Not in Study Area)	✓		✓

Table 3.9-2: Status and Presence of Endangered Species Act (ESA)-Listed Fish Species, Candidate Species, and Species of Concern Found in the Northwest Training and Testing Study Area (continued)

Species and Regulatory Status				Presence in Study Area		
Common Name (Scientific Name)	**Distinct Population Segment (DPS)[1]/ Evolutionarily Significant Unit (ESU)[2]**	**Federal Status**	**Critical Habitat Designation**	**Offshore Area**	**Inland Waters**	**Western Behm Canal**
Salmonid Species (continued)						
	Southern Oregon/Northern California Coast ESU	T	Designated (Not in Study Area)	✓		
	Puget Sound/Strait of Georgia ESU	SOC[3]	Not Designated	✓	✓	✓
	Central California Coast ESU	E	Designated (Not in Study Area)	✓		
Chum Salmon (*Oncorhynchus keta*)	Hood Canal Summer-Run ESU	T	Designated (Inland Waters)	✓	✓	
	Columbia River ESU	T	Designated (Not in Study Area)	✓		
Sockeye Salmon (*Oncorhynchus nerka*)	Ozette Lake ESU	T	Designated (Not in Study Area)	✓		
	Snake River ESU	E	Designated (Not in Study Area)	✓		
Steelhead (*Oncorhynchus mykiss*)	Puget Sound DPS	T	Designated (Not in Study Area[4])	✓	✓	
	Upper Columbia River DPS	T	Designated (Not in Study Area)	✓		
	Middle Columbia River DPS	T	Designated (Not in Study Area)	✓		
	Lower Columbia River DPS	T	Designated (Not in Study Area)	✓		
	Upper Willamette River DPS	T	Designated (Not in Study Area)	✓		

Table 3.9-2: Status and Presence of Endangered Species Act (ESA)-Listed Fish Species, Candidate Species, and Species of Concern Found in the Northwest Training and Testing Study Area (continued)

Species and Regulatory Status				Presence in Study Area		
Common Name (Scientific Name)	**Distinct Population Segment (DPS)[1]/ Evolutionarily Significant Unit (ESU)[2]**	**Federal Status**	**Critical Habitat Designation**	**Offshore Area**	**Inland Waters**	**Western Behm Canal**
Salmonid Species (continued)						
	Snake River Basin DPS	T	Designated (Not in Study Area)	✓		
	Northern California Coast DPS	T	Designated (Not in Study Area)	✓		
	Oregon Coast DPS	SOC[3]	Not Designated	✓		
	California Central Valley DPS	T	Designated (Not in Study Area)	✓		
	Central California Coast DPS	T	Designated (Not in Study Area)	✓		
	South-Central California Coast DPS	T	Designated (Not in Study Area)	✓		
	Southern California DPS	E	Designated (Not in Study Area)	✓		
Bull Trout (*Salvelinus confluentus*)	Coastal-Puget Sound DPS	T	Designated (Inland Waters)	✓	✓	
Rockfish Species						
Bocaccio Rockfish (*Sebastes paucispinis*)	Puget Sound/Georgia Basin DPS	E	Designated (Inland Waters)		✓	
	Southern DPS (Northern California to Mexico)	SOC[3]	Not Designated	✓		
Cowcod Rockfish (*Sebastes levis*)	Central Oregon to central Baja California and Guadalupe Island, Mexico	SOC[3]	Not Designated	✓		
Yelloweye Rockfish (*Sebastes ruberrimus*)	Puget Sound/Georgia Basin DPS	T	Designated (Inland Waters)		✓	

Table 3.9-2: Status and Presence of Endangered Species Act (ESA)-Listed Fish Species, Candidate Species, and Species of Concern Found in the Northwest Training and Testing Study Area (continued)

Species Name and Regulatory Status				Presence in Study Area		
Common Name (Scientific Name)	**Distinct Population Segment (DPS)[1]/ Evolutionarily Significant Unit (ESU)[2]**	**Federal Status**	**Critical Habitat Designation**	**Offshore Area**	**Inland Waters**	**Western Behm Canal**
Other Marine Fish Species						
Basking Shark (*Cetorhinus maximus*)	Eastern North Pacific DPS	SOC[3]	Not Designated	✓		
Green Sturgeon (*Acipenser medirostris*)	Southern DPS	T	Designated (Offshore and Inland Waters)	✓	✓	
	Northern DPS	SOC[3]	Not Designated	✓	✓	
Pacific Cod (*Gadus macrocephalus*)	Salish Sea	SOC[3]	Not Designated		✓	
Pacific Eulachon (*Thaleichthys pacificus*)	Southern DPS	T	Designated (Not in Study Area[4])	✓	✓	
Pacific Hake (*Merluccius productus*)	Georgia Basin (Canada to Washington State) DPS	SOC[3]	Not Designated		✓	

[1] A species with more than one DPS can have more than one ESA listing status, as individual DPSs can be either not listed under the ESA or can be listed as an endangered, threatened, or candidate species.

[2] ESU is a population of organisms that is considered distinct for purposes of conservation.

[3] Species of Concern status does not carry any procedural or substantive protections under the ESA, but these species are included in this table for informational purposes.

[4] Critical habitat does not overlap with any of the activities because it is a freshwater designation.

Notes: Federal Status: E = Endangered, T = Threatened, SOC = Species of Concern

3.9.2.4.1 Salmonid Species

Since the publication of the 2015 NWTT Final EIS/OEIS, critical habitat for two species listed as threatened, the Lower Columbia River coho Salmon ESU and Puget Sound Steelhead DPS, was designated (81 FR 9251). In 2016, five-year status review updates for all Pacific salmon and steelhead were published with no changes in listing status warranted for any of the listed salmon and steelhead (National Marine Fisheries Service, 2016). In addition, the listing status under the ESA of hatchery programs associated with 28 salmon ESUs and steelhead DPSs was reviewed in Jones (2015). The origin of each hatchery population and its divergence level from the source population was evaluated in determining removal from or addition to an ESU/DPS. Coded wire tagging (National Marine Fisheries Service, 2003; Weitkamp, 2010) and genetic analysis (Beacham et al., 2016; Tucker et al., 2012) has identified six Chinook salmon ESUs (Puget Sound, Upper Columbia River spring-run, Lower Columbia River, Upper Willamette River, Snake River spring/summer-run, and Snake River fall-run) and three coho salmon ESUs (Puget Sound, Lower Columbia River, and Oregon Coast) with a potential of occurring in the vicinity of the Western Behm Canal. In addition, Teel et al. (2015) used microsatellite DNA data and genetic stock identification methods to describe coastal distributions of juvenile Chinook salmon between central Oregon and northern Washington. Recent literature has also documented toxic stormwater runoff as a species-specific threat to coho salmon in urbanized areas (Feist et al., 2017; McIntyre et al., 2018). With the exception of these recent changes in designated critical habitat, salmonid presence in Western Behm Canal, species-specific threats to coho salmon, or the inclusion/exclusion of hatchery populations in ESUs/DPSs, the information presented in the 2015 NWTT Final EIS/OEIS remains valid.

3.9.2.4.1.1 Chinook Salmon (Oncorhynchus tshawytscha)

A map of critical habitat designated for Puget Sound Chinook salmon in the Study Area was provided in Figure 3.9-1 of the 2015 NWTT Final EIS/OEIS. Figure 3.9-1, displaying Chinook salmon critical habitat and DoD areas excluded or exempted for designation, is provided below.

Since the publication of the 2015 NWTT Final EIS/OEIS, the following changes have occurred in the number of hatchery programs included in five of the nine listed Chinook ESUs (Jones, 2015): Upper Columbia River (decrease from 6 to 5), Lower Columbia River (decrease from 17 to 14), Upper Willamette River (decrease from 7 to 6), Snake River spring/summer-run (decrease from 15 to 11), and California Coastal (decrease from 6 to 0). Coded wire tag information indicates that adult Puget Sound, Lower Columbia River, Upper Willamette River, and Snake River fall-run Chinook are likely to be seasonally present in the vicinity of the Western Behm Canal (National Marine Fisheries Service, 2003; Weitkamp, 2010). Genetic analysis of juvenile Chinook sampled in the vicinity of the Western Behm Canal indicates the seasonal presence of juvenile Upper Columbia River spring-run, Upper Willamette River, and Snake River spring/summer-run Chinook (Tucker et al., 2012). Teel et al. (2015) found that in Oregon and Washington coastal waters, Columbia River system spring yearling Chinook were typically more abundant in May than June, and by June were largely more abundant off the northern Washington coastal waters relative to the Columbia River plume. Fall subyearling Chinook were relatively absent in May but were more prevalent in June and September. Teel et al. (2015) also noted that a number of studies documented that selected spring juveniles quickly migrate from Oregon and Washington coastal waters northward until they reach Alaskan coastal waters in the summer, before moving off the continental shelf by fall (Fisher et al., 2014; Orsi et al., 2000; Trudel et al., 2009; Tucker et al., 2011). With the exception of the changes in hatchery programs included in the five ESUs and species presence in the Western Behm Canal and the addition of the U.S. Navy lands and Navy security zones exempted or excluded from critical habitat, the information presented in the 2015 NWTT Final EIS/OEIS remains valid.

3.9.2.4.1.2 Coho Salmon (*Oncorhynchus kisutch*)

Since the publication of the 2015 NWTT Final EIS/OEIS, critical habitat for the Lower Columbia River coho ESU, listed as threatened, was designated (81 FR 9251). However, the critical habitat designation only includes the Lower Columbia River system and does not include the Study Area. The following changes have occurred in the number of hatchery programs included in two of the four listed coho ESUs (Jones, 2015): Lower Columbia River (decrease from 25 to 21) and Central California Coast (decrease from 4 to 2).

Genetic analysis of juvenile coho salmon sampled in the vicinity of the Western Behm Canal indicates the seasonal presence of juvenile Lower Columbia River, Oregon Coast, and Puget Sound coho salmon (Beacham et al., 2016). New information has documented a species-specific threat to coho salmon in the form of toxic stormwater runoff in urbanized regions creating recurrent prespawn die-offs of adult coho spawners (Feist et al., 2017; McIntyre et al., 2018). With the exception of the designation of critical habitat for the Lower Columbia River coho ESU, the changes in hatchery programs included in the two ESUs, species presence in the Western Behm Canal, and the new species-specific threat, the information presented in the 2015 NWTT Final EIS/OEIS remains valid.

3.9.2.4.1.3 Chum Salmon (*Oncorhynchus keta*)

Since the publication of the 2015 NWTT Final EIS/OEIS, the following changes have occurred in the number of hatchery programs included in the two listed chum ESUs (Jones, 2015): Hood Canal summer-run (decrease from 8 to 4) and Columbia River (decrease from 3 to 2).

Critical Habitat for the Hood Canal summer-run chum ESU in the Study Area is presented in Figure 3.9-2. In the 2015 NWTT Final EIS/OEIS, exempted or excluded U.S. Navy lands and Navy security zones were not included on Figure 3.9-2. The sites below mean lower low water exempted or excluded from the Puget Sound Chinook salmon critical habitat in Section 3.9.2.4.1.1 [Chinook Salmon (*Oncorhynchus tshawytscha*)] of this document are also excluded from Hood Canal summer-run chum critical habitat.

With the exception of the changes in hatchery programs included in the two ESUs and the exempted/excluded Hood Canal summer-run chum critical habitat, the information presented in the 2015 NWTT Final EIS/OEIS remains valid.

3.9.2.4.1.4 Sockeye Salmon (*Oncorhynchus nerka*)

Since the publication of the 2015 NWTT Final EIS/OEIS, the number of hatchery programs included in the Lake Ozette sockeye ESU decreased from 2 to 1 (Jones, 2015). With the exception of the reduction in hatchery programs included in the Lake Ozette sockeye ESU, the information presented in the 2015 NWTT Final EIS/OEIS remains valid.

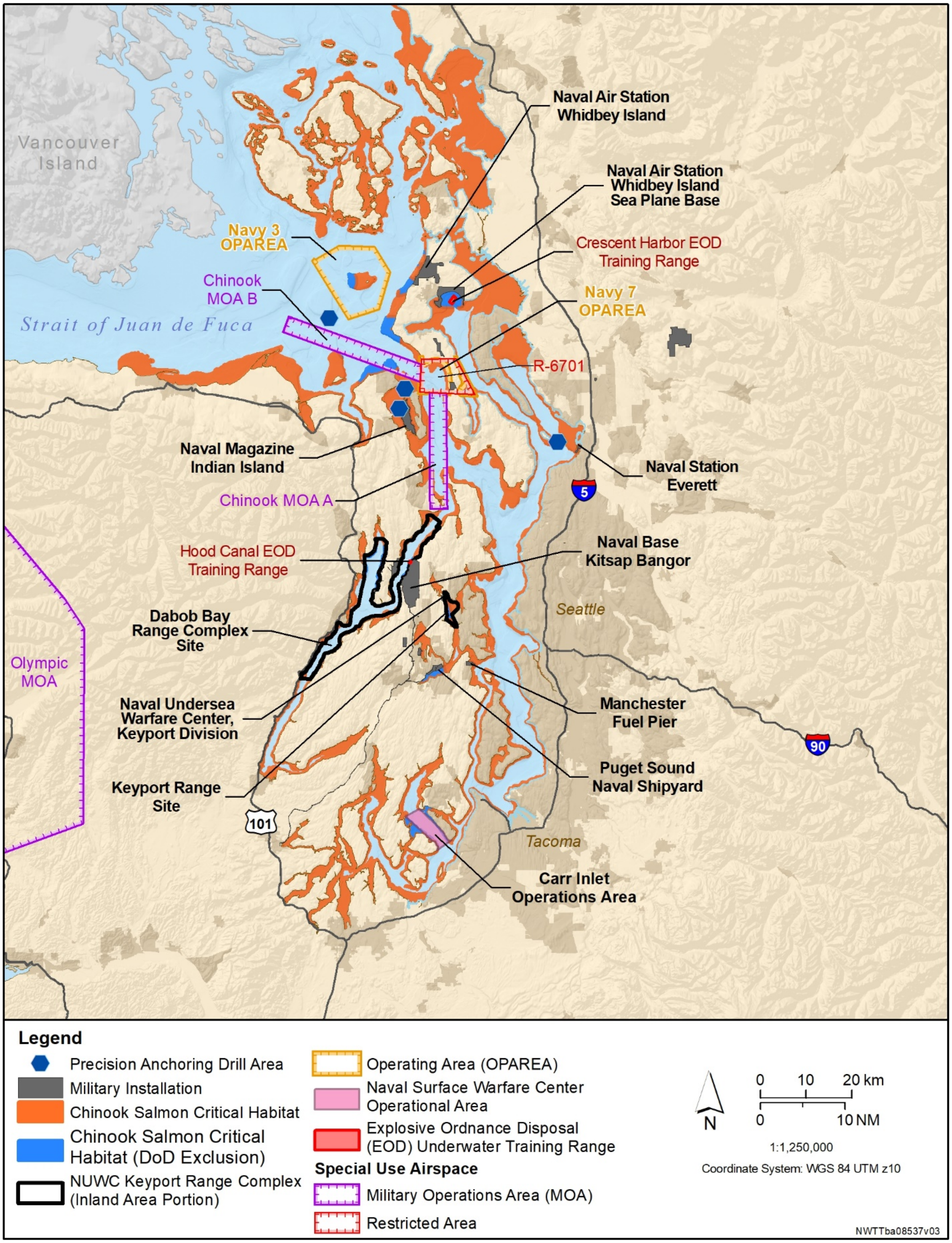


Figure 3.9-1: Marine Critical Habitat for the Puget Sound Chinook Salmon Evolutionarily Significant Units

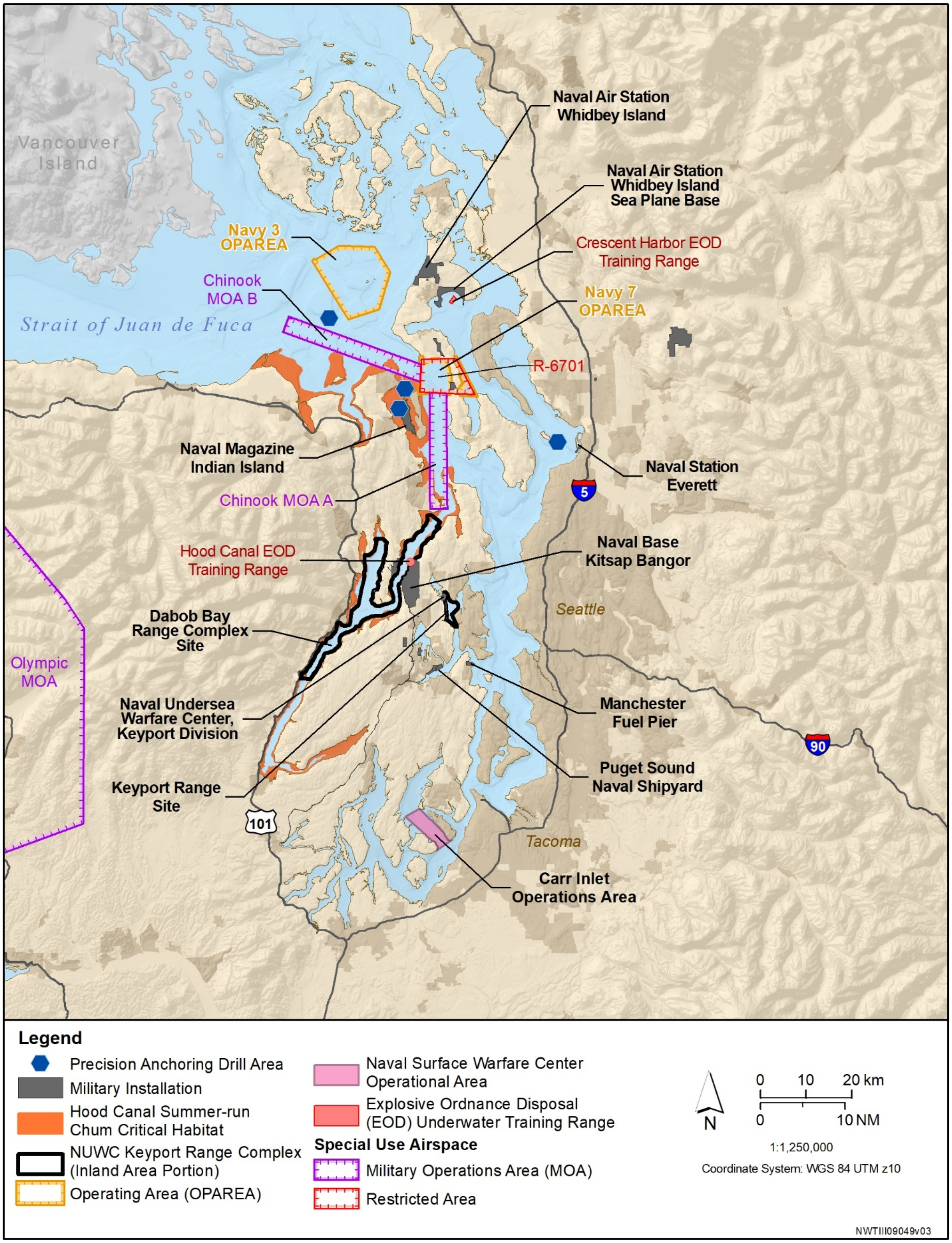


Figure 3.9-2: Marine Critical Habitat for the Hood Canal Summer-Run Chum Salmon Evolutionarily Significant Units

3.9.2.4.1.5 Steelhead (*Oncorhynchus mykiss*)

Since the publication of the 2015 NWTT Final EIS/OEIS, critical habitat for the Puget Sound Steelhead DPS, listed as threatened, was designated (81 FR 9251). However, critical habitat for this DPS has only been designated in freshwater and estuarine areas outside of the Study Area. There is no critical habitat for steelhead in the Study Area.

The following changes have occurred in the number of hatchery programs included in 8 of the 11 listed steelhead salmon DPSs (Jones, 2015): Puget Sound (increase from 2 to 6), Upper Columbia River (decrease from 6 to 5), Lower Columbia River (decrease from 10 to 7), Upper Willamette River (increase from 0 to 1), Snake River Basin (increase from 6 to 7), Northern California (decrease from 2 to 1), California Central Valley (increase from 0 to 2), and Central California Coast (increase from 0 to 2). With the exception of the designation of critical habitat for the Puget Sound Steelhead DPS and the changes in hatchery programs included/excluded in the eight DPSs, the information presented in the 2015 NWTT Final EIS/OEIS remains valid.

3.9.2.4.1.6 Bull Trout (*Salvelinus confluentus*)

A map of critical habitat designated for bull trout in the Study Area is provided in Figure 3.9-3. Figure 3.9-3 displays designated marine bull trout critical habitat, including areas excluded or exempted for the DoD, Habitat Conservation Plans (HCPs), or tribes.

Bull trout are managed as a single DPS, and the former Coastal-Puget Sound Bull Trout DPS has been incorporated into part of the Coastal Recovery Unit (U.S. Fish and Wildlife Service, 2015). A literature review indicates that individual bull trout have been documented to switch between fluvial and anadromous life histories in alternate years (Goetz, 2016). Bull trout in marine waters are shoreline-oriented (Goetz, 2016) and enter marine water for the primary purpose of foraging on smaller fish in the intertidal and subtidal zones of the photic zone, primarily in water less than 10 m in depth. Prey species may include surf smelt, sand lance, juvenile herring, shiner perch, three-spine stickleback, and juvenile salmonids (Goetz, 2016; Goetz et al., 2004).

Acoustic tagged bull trout in Puget Sound are usually detected less than 0.4 kilometers (km) from the shoreline in water less than 4 m deep (Goetz, 2016; Hayes et al., 2011). Bull trout occasionally enter water up to 25 m in depth (Goetz et al., 2004); to transit to the shoreline of Whidbey Island, they must cross Skagit Bay in waters 7–84 m in depth (Goetz, 2016). On a few rare occasions, bull trout have been tracked crossing water up to 250 m deep for as far as 6.9 km (Goetz, 2016), but do not maintain position in deep water and soon return to shallower water(Hayes et al., 2011).

Puget Sound anadromous bull trout enter marine waters in early spring, with residence time in salt water averaging two months, with a maximum of four months (Goetz, 2016). Anadromous bull trout on the Olympic coast of Washington State enter their natal streams at about the same time as Puget Sound bull trout (late spring and early summer), but overwinter in the Pacific Ocean or migrate through marine water to non-natal rain-fed streams, optimizing winter refugia and forage opportunities (Brenkman & Corbett, 2005; Goetz, 2016). The radiotelemetry studies conducted by Brenkman and Corbett (2005) revealed that adult bull trout moved between freshwater and the Pacific Ocean and between watersheds along coastal Washington. Radio signals did not transmit while fish occupied saltwater but resumed transmission when fish reentered an estuary and freshwater. In 2019, 17 bull trout were tagged by NMFS with VEMCO acoustic tags to better understand their marine distribution as part of a Navy-funded monitoring project (Matsubu, 2019; Smith & Huff, 2020). Eleven bull trout were tagged in Kalaloch Creek and six bull trout were tagged in the Hoh River. Eight of the Kalaloch Creek tagged fish

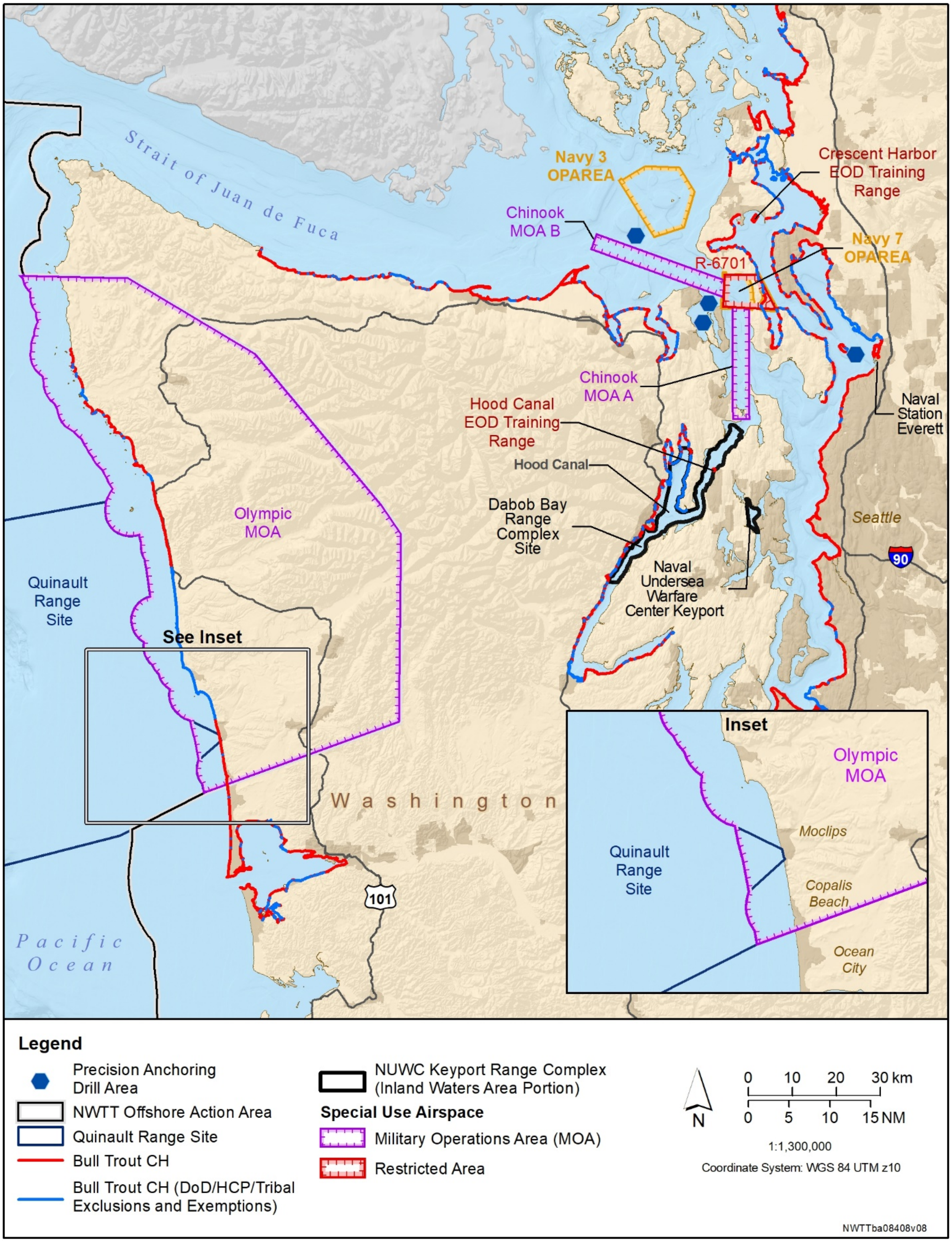


Figure 3.9-3: Marine Critical Habitat for the Bull Trout Distinct Population Segment

were later detected in the Quinault River and one Kalaloch Creek fish was detected in the Quileute River. A single bull trout that was tagged in Kalaloch Creek was detected within the offshore portion of the Study Area (Smith & Huff, 2020).The only other reports of captured bull trout along the Washington coast are from recreational anglers targeting surf perch in the surf zone (Brenkman, 2017).

The information on bull trout in the Study Area confirms the strong shoreline orientation of bull trout but has not substantially changed the conclusions of the 2015 NWTT Final EIS/OEIS. With the exception of the addition of DoD land exempted from critical habitat and Navy security zones, land subject to HCPs, and tribal land excluded from critical habitat, the information presented in the 2015 NWTT Final EIS/OEIS remains valid.

3.9.2.4.1.7 Dolly Varden (*Salvelinus malma*)

A literature review indicates that Washington State populations of Dolly Varden have not been documented to exhibit an anadromous life history and are not found in marine waters within the Study Area. The only Washington State population of Dolly Varden not isolated above a barrier is a population in a small headwater tributary of the upper Quinault River with a resident life history (Goetz et al., 2004). The information on Dolly Varden in the Study Area has not substantially changed the conclusions of the 2015 NWTT Final EIS/OEIS. Dolly Varden are not listed as threatened in Washington State and are not present in marine waters in the Study Area. With the exception that Dolly Varden do not occur in the Study Area, the information presented in the 2015 NWTT Final EIS/OEIS remains valid; however, the inclusion of a species absent from the Study Area was in error.

3.9.2.4.2 Rockfish Species

A map of critical habitat designated for the Puget Sound/Georgia Basin DPSs of the bocaccio, and yelloweye rockfish in the Study Area is provided below in Figure 3.9-4. Since the publication of the 2015 NWTT Final EIS/OEIS, the Puget Sound/Georgia Basin canary rockfish DPS has been delisted and designated critical habitat removed (82 FR 7711). Figure 3.9-4, displaying designated bocaccio and yelloweye rockfish critical habitat, including areas excluded or exempted for the DoD, HCPs, or tribes, is provided below.

A literature review found that the information on bocaccio and yelloweye rockfish in the Study Area has not substantially changed from what is included in the 2015 NWTT Final EIS/OEIS. With the exception of the addition of the U.S. Navy lands and Navy security zones exempted or excluded from critical habitat, the information presented in the 2015 NWTT Final EIS/OEIS remains valid.

3.9.2.4.2.1 Bocaccio (*Sebastes paucispinis*)

A literature review found that the information on the Puget Sound/Georgia Basin and Southern DPSs of the bocaccio rockfish in the Study Area has not substantially changed from what is included in the 2015 NWTT Final EIS/OEIS. Additional information was added for U.S. Navy security zones not included as critical habitat on Figure 3.9-4. Therefore, the information presented in the 2015 NWTT Final EIS/OEIS remains valid.

3.9.2.4.2.2 Canary Rockfish (*Sebastes pinniger*)

Since the publication of the 2015 NWTT Final EIS/OEIS, the Puget Sound/Georgia Basin DPS of the canary rockfish has been delisted and designated critical habitat removed (82 FR 7711). These actions were based on newly obtained samples and genetic analysis that demonstrated that the Puget Sound/Georgia Basin canary rockfish population does not meet the DPS criteria and therefore does not qualify for listing under the ESA. Therefore, the ESA status and designated critical habitat information presented in the

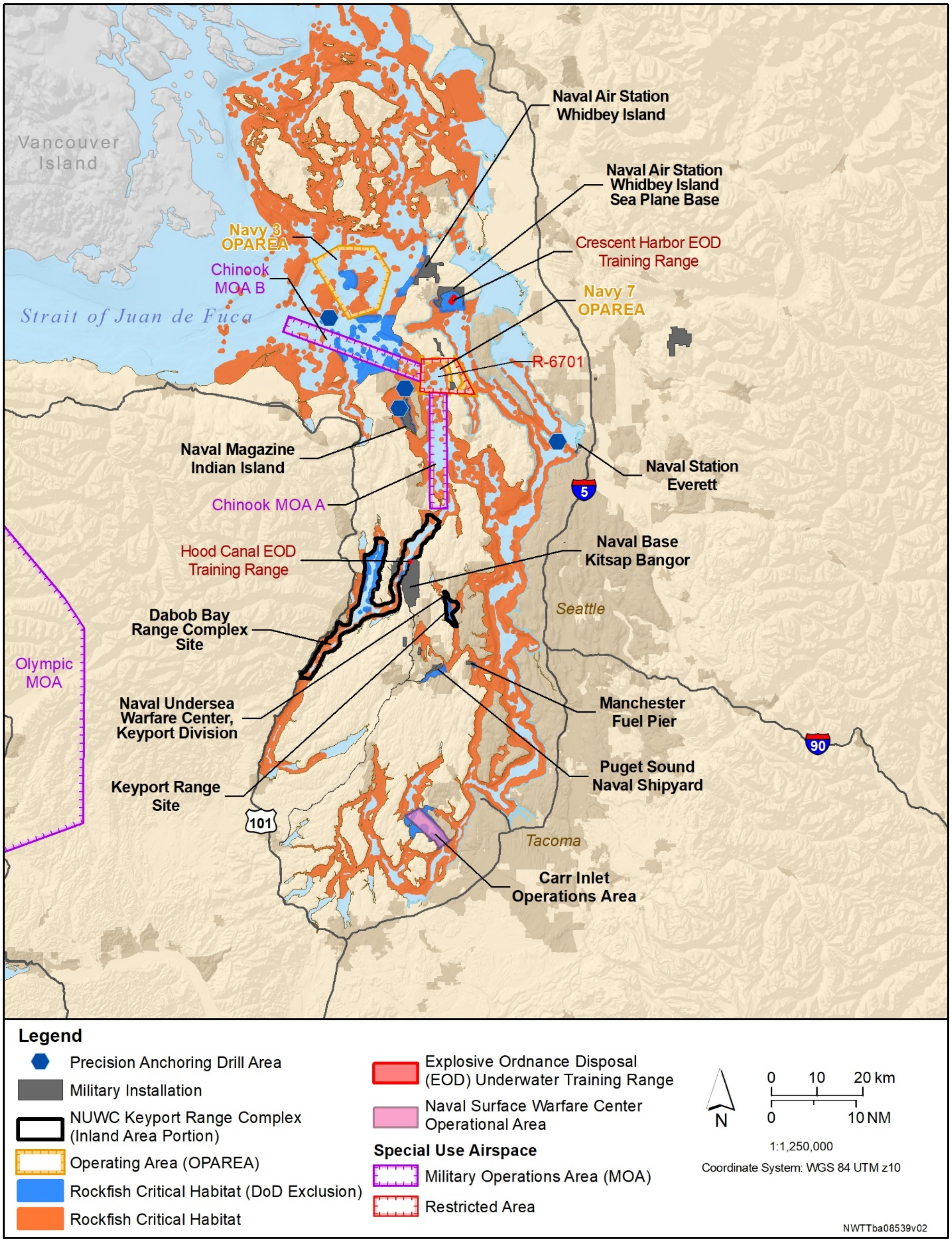


Figure 3.9-4: Critical Habitat for the Bocaccio and Yelloweye Rockfish Distinct Population Segments

2015 NWTT Final EIS/OEIS is no longer valid. Since the canary rockfish is no longer listed as federally threatened in the Study Area, it is not further addressed as an ESA listed species in this Supplemental.

3.9.2.4.2.3 Yelloweye Rockfish (*Sebastes ruberrimus*)

A literature review found that the information on the Puget Sound/Georgia Basin DPS of the yelloweye rockfish in the Study Area has not substantially changed from what is included in the 2015 NWTT Final EIS/OEIS. Additional information was added for U.S. Navy security zones not included as critical habitat on Figure 3.9-4. Therefore, the information presented in the 2015 NWTT Final EIS/OEIS remains valid.

3.9.2.4.3 Other Species

A literature review found that the information on other fish species in the Study Area has not substantially changed from what is included in the 2015 NWTT Final EIS/OEIS.

Since the publication of the 2015 NWTT Final EIS/OEIS, a status review (81 FR 18980) of the bigeye thresher shark (*Alopias supercilious*) and common thresher shark (*Alopias vulpinus*) and a status review (81 FR 41934) of the smooth hammerhead shark determined that listing of these candidate species was unwarranted. Therefore, the candidate status information presented in the 2015 NWTT Final EIS/OEIS is no longer valid and bigeye and common thresher sharks and the smooth hammerhead shark are not addressed as ESA candidate species further in this Supplemental.

3.9.2.4.3.1 Pacific Eulachon (*Thaleichthys pacificus*)

A literature review found that the information on the Southern DPS of Pacific eulachon in the Study Area has not substantially changed from what is included in the 2015 NWTT Final EIS/OEIS. Therefore, the information presented in the 2015 NWTT Final EIS/OEIS remains valid.

3.9.2.4.3.2 Green Sturgeon (*Acipenser medirostris*)

A map of critical habitat designated for green sturgeon in the Study Area was provided in Figure 3.9-3 of the 2015 NWTT Final EIS/OEIS. Figure 3.9-5, displaying green sturgeon critical habitat and DoD areas excluded or exempted for designation, is provided below.

NMFS (2009) determined that the Strait of Juan de Fuca and Whidbey Island Naval Restricted Area, Strait of Juan de Fuca Naval Air-to-Surface Weapon Range Restricted Area, Admiralty Inlet Naval Restricted Area, and Navy 3 Operating area are excluded from designated green sturgeon critical habitat. NMFS (2009) also determined that six Naval facilities with INRMPs overlap with the specific areas under consideration for critical habitat designation (all located in Puget Sound, WA). These installations include Bremerton Naval Hospital, Naval Air Station Everett, Naval Magazine Indian Island, Naval Fuel Depot Manchester, Naval Undersea Warfare Center Keyport, and Naval Air Station, Whidbey Island. The INRMPs from these facilities provide measures that would benefit green sturgeon and are therefore not eligible for designation as critical habitat.

A literature review found new information on the Southern DPS of the North American green sturgeon in the Study Area. Smith & Huff (2020) detected 124 green sturgeon at nearshore receiver locations.

3.9.2.5 Federally Managed Fisheries

Descriptions of Essential Fish Habitat (EFH) were presented in the 2015 NWTT Final EIS/OEIS. This Supplemental addresses the same activities within the Study Area that were addressed in the 2015 NWTT Final EIS/OEIS. The Pacific Fishery Management Council (Council) has four Fishery Management Plans (FMPs) in effect for the Groundfish, Coastal Pelagic, Highly Migratory, and Salmon Fishery Species

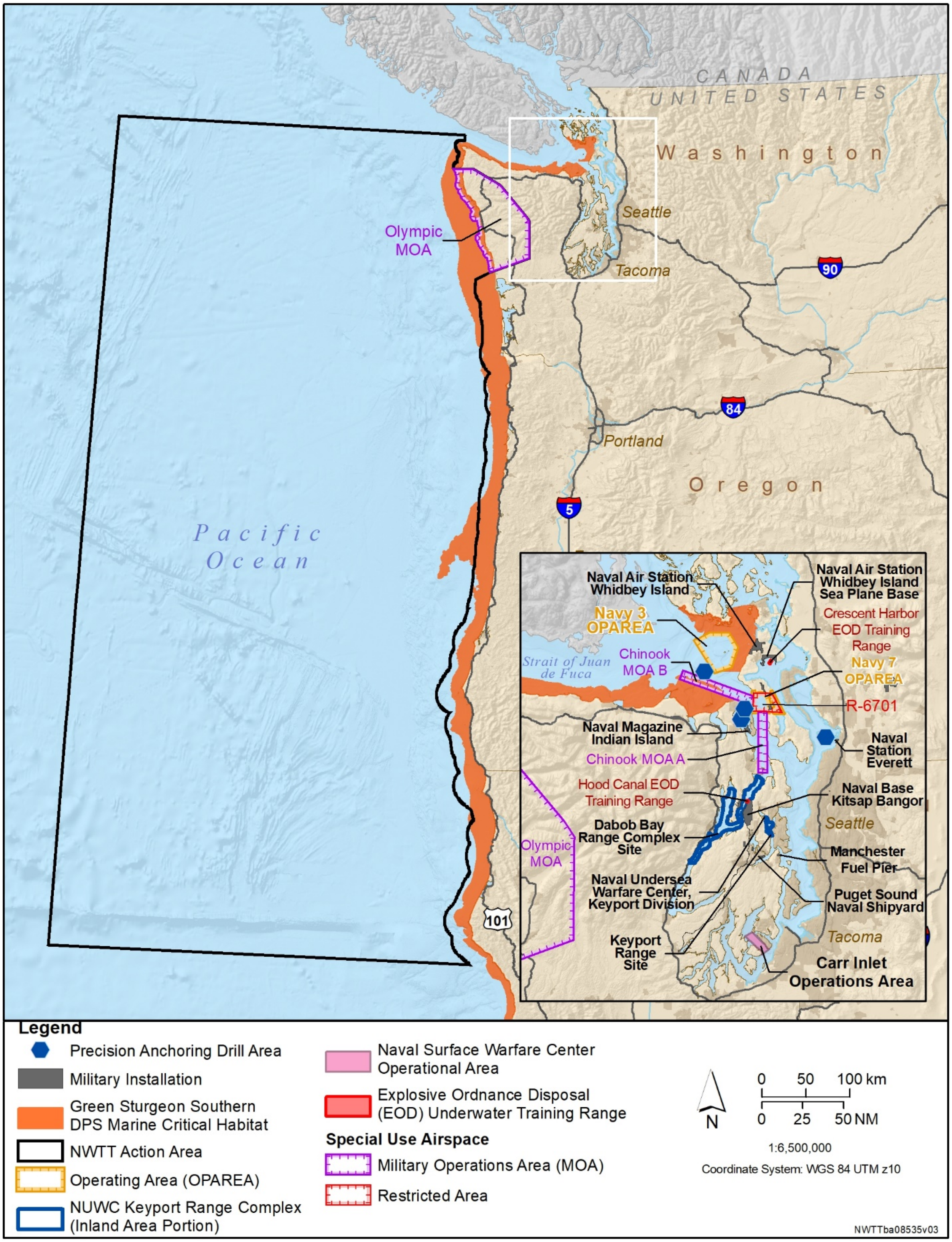


Figure 3.9-5: Critical Habitat for the Southern Distinct Population Segment of North American Green Sturgeon

in the Study Area. Although a few updates have occurred to the FMPs since the 2015 NWTT Final EIS/OEIS, none has changed or affected the previous information or analyses. As such, the general description of the EFH within the Study Area in the 2015 NWTT Final EIS/OEIS has not changed; thus, the information presented remains valid.

3.9.2.5.1 Groundfish Fishery Management Plan

As presented in the 2015 NWTT Final EIS/OEIS, the Pacific Fishery Management Plan has a Groundfish FMP. A recent review of the FMP and associated documents indicated that in June 2016, the Council adopted Amendment 27 to the plan, which reclassified big skate from an Ecosystem Component (EC) species to "in the fishery," listed deacon rockfish in Table 3-1, and revised Chapter 5.5 to describe a new in-season process in California, which would occur outside of a Council meeting and allow NMFS to take action based upon attainment or projected attainment of Federal harvest limits of black rockfish, canary rockfish, and yelloweye rockfish. Additionally, updates to the FMP were made to clarify matters from Amendment 23 and acknowledge the successful rebuilding of canary rockfish and petrale sole. Since these amendments were included to help facilitate a sustainable groundfish fishery by reducing overall catch and did not impose new environmental baseline restrictions, the information in the 2015 NWTT Final EIS/OEIS remains valid. Therefore, no additional update to the 2015 NWTT Final EIS/OEIS is required.

3.9.2.5.2 Coastal Pelagic Fishery Management Plan

As presented in the 2015 NWTT Final EIS/OEIS, the Pacific Fishery Management Plan has a Coastal Pelagic FMP. A recent review of the FMP and associated documents indicated that no additional amendments to the plan have been adopted. Since additional amendments to the plan have not been adopted, the information in the 2015 NWTT Final EIS/OEIS remains valid. Therefore, no additional update to the 2015 NWTT Final EIS/OEIS is required.

3.9.2.5.3 Highly Migratory Fishery Management Plan

As presented in the 2015 NWTT Final EIS/OEIS, the Pacific Fishery Management Plan has a Highly Migratory FMP. A recent review of the FMP and associated documents indicated that the Council has adopted or proposed three amendments to the plan. Amendment 3, adopted in 2015, added a suite of lower trophic level species to the FMP's list of EC species. Consistent with the objectives of the Council's FMPs and its Fishery Ecosystem Plan, Amendment 3 prohibits future development of directed commercial fisheries for the suite of EC species shared between all four FMPs ("Shared EC Species") until and unless the Council has had an adequate opportunity to both assess the scientific information relating to any proposed directed fishery and consider potential impacts on existing fisheries, fishing communities, and the greater marine ecosystem. In March 2017, the Council was presented with proposed amendments, but did not finalize changes to the Highly Migratory Species FMP that would revise dated and inaccurate text as Amendment 4. Also in March 2017, the Council took final action to adopt Amendment 5 to the Fishery Management Plan for West U.S. Coast Fisheries for Highly Migratory Species. This amendment would create a Federal limited entry permit for the California large mesh drift gillnet fishery. Since these amendments did not impose new environmental baseline restrictions, the information in the 2015 NWTT Final EIS/OEIS remains valid. Therefore, no additional update to the 2015 NWTT Final EIS/OEIS is required.

3.9.2.5.4 Salmon Fishery Management Plan

As presented in Section 3.9.2.5.5 of the 2015 NWTT Final EIS/OEIS, the Pacific Fishery Management Council has a Pacific Coast Salmon FMP that manages chinook, coho, and pink (*Oncorhynchus gorbuscha*) salmon. A recent review of the FMP and associated documents indicated that one additional amendment to the plan was adopted in 2016 (Pacific Fishery Management Council, 2016). The new amendment added a suite of lower trophic level species to the FMP's list of Ecosystem Component species. The amendment also prohibits future development of commercial fisheries for those Ecosystem Component species that are shared between all four FMPs (e.g., round herring, Pacific sand lance, smelts, Pelagic squids) until the Council has had an adequate opportunity to assess both the scientific information relating to any proposed directed fishery and potential impacts on existing fisheries, fishing communities, and the greater marine ecosystem. Even though an additional amendment to the plan was adopted, the information in the 2015 NWTT Final EIS/OEIS remains valid. Therefore, no additional update to the 2015 NWTT Final EIS/OEIS is required.

3.9.3 Environmental Consequences

In the Proposed Action for this Supplemental, some modifications have been made to the quantity and type of acoustic stressors under the two action alternatives. Because of new activities being proposed, two new stressors would be introduced that could potentially affect marine species; high-energy lasers (as an Energy stressor), as detailed in Section 3.0.3.3.2.2 (High-Energy Lasers), and biodegradable polymer (as an Entanglement stressor), as detailed in Section 3.0.3.5.3 (Biodegradable Polymer).

The 2015 NWTT Final EIS/OEIS considered training and testing activities proposed to occur in the Study Area that may have the potential to impact marine fishes. The stressors applicable to marine fishes in the Study Area include the two new stressors as well as the same stressors considered in the 2015 NWTT Final EIS/OEIS:

- Acoustic (sonar and other transducers, vessel noise, aircraft noise, weapon noise)
- Explosives (in-air explosions, in-water explosions)
- Energy (in-water electromagnetic devices, high-energy lasers)
- Physical disturbance and strike (vessels and in-water devices, military expended materials, seafloor devices)
- Entanglement (wires and cables, decelerators/parachutes, biodegradable polymer)
- Ingestion (military expended materials – munitions and military expended materials – other than munitions)
- Secondary (impacts on habitat and impacts on prey availability)

This section evaluates how and to what degree potential impacts on marine fishes from stressors described in Section 3.0.1 (Overall Approach to Analysis) may have changed since the analysis presented in the 2015 NWTT Final EIS/OEIS was completed. Tables 2.5-1, 2.5-2, and 2.5-3 in Chapter 2 (Description of Proposed Action and Alternatives) list the proposed training and testing activities and include the number of times each activity would be conducted annually and the locations within the Study Area where the activity would typically occur under each alternative. The tables also present the same information for activities described in the 2015 NWTT Final EIS/OEIS so that the proposed levels of training and testing under this Supplemental can be easily compared.

The Navy conducted a review of federal and state regulations and standards relevant to marine fishes and reviewed scientific literature published since 2015 for new information on marine fishes that could update the analysis presented in the 2015 NWTT Final EIS/OEIS. The analysis presented in this section also considers standard operating procedures (see Section 2.3.3, Standard Operating Procedures) and mitigation measures that the Navy would implement to avoid potential impacts on marine fishes from stressors associated with the proposed training and testing activities (see Appendix K, Geographic Mitigation Assessment, for more details). Mitigation for marine fishes will be coordinated with NMFS through the ESA consultation process.

3.9.3.1 Acoustic Stressors

The analysis of effects to fishes follows the concepts outlined in Section 3.0.3.7 (Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities). This section begins with a summary of relevant data regarding acoustic impacts on fishes in Section 3.9.3.1.1 (Background). This is followed by an analysis of estimated impacts on fishes due to specific Navy acoustic stressors (sonar and other transducers, vessel noise, aircraft noise, and weapon noise). Additional explanations of the acoustic terms and sound energy concepts used in this section are found in Appendix D (Acoustic and Explosive Concepts).

The Navy will rely on the previous 2015 NWTT Final EIS/OEIS analysis for the analysis of vessel noise, and weapon noise, as there has been no substantive or otherwise meaningful change in the action, although new applicable and emergent science in regard to these sub-stressors is presented in the sections that follow. Due to available new literature, adjusted sound exposure criteria, and new acoustic effects modeling, the analysis provided in Section 3.9.3.1.2 (Impacts from Sonar and Other Transducers) and Section 3.9.3.1.4 (Impacts from Aircraft Noise) of this Supplemental supplants the 2015 NWTT Final EIS/OEIS for fishes, and changes estimated impacts for some species since the 2015 NWTT Final EIS/OEIS.

3.9.3.1.1 Background

Effects of human-generated sound on fishes have been examined and summarized in numerous publications (de Jong et al., 2020; Hastings & Popper, 2005; Hawkins et al., 2015; Ladich & Popper, 2004; Lindseth & Lobel, 2018; Mann, 2016; Mickle & Higgs, 2018; National Research Council, 1994, 2003; Neenan et al., 2016; Popper & Hawkins, 2019; Popper, 2003, 2008; Popper et al., 2016; Popper & Hastings, 2009b; Popper & Hawkins, 2018; Popper et al., 2014). The potential impacts from Navy activities are based on the analysis of available literature related to each type of effect. Where applicable, interim criteria and thresholds and relative risk factors presented in the *ANSI Sound Exposure Guideline* technical report (Popper et al., 2014) were used to assist in the analysis of effects on fishes from Navy activities.

There are limited studies of fish responses to aircraft and weapon noise. Based on the general characteristics of these sound types, for stressors where data is lacking (such as aircraft noise), studies of the effects of similar non-impulsive/continuous noise sources (such as sonar or vessel noise) are used to inform the analysis of fish responses. Similarly, studies of the effects from impulsive sources (such as air guns or pile driving) are used to inform fish responses to other impulsive sources (such as weapon noise). Non-impulsive or continuous sources may be presented as a proxy source to better understand potential reactions from fish where data from sonar and vessel noise exposures are limited. Additional information on the acoustic characteristics of these sources can be found in Appendix D (Acoustic and Explosive Concepts).

Although air guns and pile driving are not used during NWTT training and testing activities, the analysis of some explosive impacts (Section 5.4.2, Explosive Stressors) will in part rely on data from fishes exposed to impulsive sources where appropriate. Therefore, background information on impulsive sources are provided below.

3.9.3.1.1.1 Injury

Injury refers to the direct effects on the tissues or organs of a fish. Moderate- to low-level noise from vessels, aircraft, and weapons use are described in Section 3.0.3.1 (Acoustic Stressors) and lacks the amplitude and energy to cause any direct injury. Section 3.0.3.7 (Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities) provides additional information on injury and the framework used to analyze this potential impact.

Injury due to Impulsive Sound Sources

Impulsive sounds, such as those produced by seismic air guns and impact pile driving, may cause injury or mortality in fishes. Although air guns and pile driving would not occur in the Study Area, this information aids in the analysis of other impulsive sources (i.e., weapons noise or in some cases, explosions). Mortality and potential damage to the cells of the lateral line have been observed in fish larvae, fry, and embryos after exposure to single shots from a seismic air gun within close proximity to the sound source (0.1 to 6 m) (Booman et al., 1996; Cox et al., 2012). However, exposure of adult fish to a single shot from an air gun array (four air guns) within similar ranges (6 m), has not resulted in any signs of mortality within seven days after exposure (Popper et al., 2016). Although injuries occurred in adult fishes, they were similar to injuries seen in control subjects (i.e., fishes that were not exposed to the air gun) so there is little evidence that the air gun exposure solely contributed to the observed effects.

Injuries, such as ruptured swim bladders, hematomas, and hemorrhaging of other gas-filled organs, have been reported in fish exposed to a large number of simulated impact pile driving strikes with cumulative sound exposure levels up to 219 dB referenced to 1 micropascal squared seconds (dB re 1 μPa^2-s) under highly controlled settings where fish were unable to avoid the source (Casper et al., 2013a; Casper et al., 2012b; Casper et al., 2013b; Halvorsen et al., 2012a; Halvorsen et al., 2011, 2012b). However, it is important to note that these studies exposed fish to 900 or more strikes as the studies aimed to evaluate the equal energy hypothesis, which suggests that the effects of a large single pulse of energy is equivalent to the effects of energy received from many smaller pulses (as discussed in Smith & Gilley, 2008). Halvorsen et al. (2011) and Casper et al. (2017) found that the equal energy hypothesis does not apply to effects of pile driving; rather, metrics relevant to injury could include, but not be limited to, cumulative sound exposure level, single strike sound exposure level, and number of strikes (Halvorsen et al., 2011). Furthermore, Casper et al. (2017) found the amount of energy in each pile strike and the number of strikes determines the severity of the exposure and the injuries that may be observed. For example, hybrid striped bass (white bass *Morone chrysops* x striped bass *M. saxatilis*) exposed to fewer strikes with higher single strike sound exposure values resulted in a higher number of, and more severe, injuries than bass exposed to an equivalent cumulative sound exposure level that contained more strikes with lower single strike sound exposure values. This is important to consider when comparing data from pile driving studies to potential effects from an explosion. Although single strike peak sound pressure levels were measured during these experiments (at average levels of 207 dB re 1 µPa), the injuries were only observed during exposures to multiple strikes; therefore, it is anticipated that a peak value much higher than the reported values would be required to lead to injury in fishes exposed to a single strike or explosion.

These studies included species both with and without swim bladders. The majority of fish that exhibited injuries were those with swim bladders. Lake sturgeon (*Acipenser fulyescens*), a physostomous fish, was found to be less susceptible to injury from impulsive sources than Nile tilapia (*Oreochromis niloticus*) or hybrid striped bass, physoclistous fishes (Casper et al., 2017; Halvorsen et al., 2012a). As reported by Halvorsen et al. (2012a), the difference in results is likely due to the type of swim bladder in each fish. Physostomous fishes have an open duct connecting the swim bladder to their esophagus and may be able to quickly adjust the amount of gas in their body by gulping or releasing air. Physoclistous fishes do not have this duct; instead, special tissues or glands regulate gas pressure in the swim bladder. There were no mortalities reported during these experiments, and in the studies where recovery was observed, the majority of exposure related injuries healed within a few days in a laboratory setting. In many of these controlled studies, neutral buoyancy was determined in the fishes prior to exposure to the simulated pile driving. However, fishes with similar physiology to those described in these studies that are exposed to actual pile driving activities may show varying levels of injury depending on their state of buoyancy.

By exposing caged juvenile European sea bass (*Dicentrarchus labrax*) to actual pile driving operations, Debusschere et al. (2014) confirmed the results discussed in the paragraph above. No differences in mortality were found between control and experimental groups at similar levels tested in the experiments described in the paragraph above (sound exposure levels up to 215–222 dB re 1 μPa^2-s), and many of the same types of injuries occurred (Casper et al., 2013a; Casper et al., 2012b; Casper et al., 2013b; Halvorsen et al., 2012a; Halvorsen et al., 2011, 2012b). Fishes with injuries from impulsive sources such as these may not survive in the wild due to harsher conditions and risk of predation.

Other potential effects from exposure to impulsive sound sources include potential bubble formation and neurotrauma. It is speculated that high sound pressure levels may also cause bubbles to form from micronuclei in the blood stream or other tissues of animals, possibly causing embolism damage (Hastings & Popper, 2005). Fishes have small capillaries where these bubbles could be caught and lead to the rupturing of the capillaries and internal bleeding. It has also been speculated that this phenomena could take place in the eyes of fish due to potentially high gas saturation within the eye tissues (Popper & Hastings, 2009b). Additional research is necessary to verify if these speculations apply to exposures to non-impulsive sources such as sonars. These phenomena have not been well studied in fishes and are difficult to recreate under real-world conditions.

As summarized in the *ANSI Sound Exposure Guideline* technical report (Popper et al., 2014), exposure to high intensity and long duration impact pile driving or air gun shots did not cause mortality, and fishes typically recovered from injuries in controlled laboratory settings. Species tested to date can be used as viable surrogates for investigating injury in other species exposed to similar sources (Popper et al., 2014).

Injury due to Sonar and Other Transducers

Non-impulsive sound sources (e.g., sonar, acoustic modems, and sonobuoys) 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). Potential direct injuries (e.g., barotrauma, hemorrhage or rupture of organs or tissue) from non-impulsive sound sources, such as sonar, are unlikely because of slow rise times,[1] lack of a strong shock wave such as that associated with an explosive, and relatively low peak pressures. General categories and characteristics of Navy sonar systems are described in

[1] Rise time: the amount of time for a signal to change from static pressure (the ambient pressure without the added sound) to high pressure. Rise times for non-impulsive sound typically have relatively gradual increases in pressure where impulsive sound has near-instantaneous rise to a high peak pressure. For more detail, see Appendix D (Acoustic and Explosive Concepts).

Section 3.0.3.1.1 (Sonar and Other Transducers).

The effects of mid-frequency sonar-like signals (1.5–6.5 kHz) on larval and juvenile Atlantic herring (*Clupea harengus*), Atlantic cod (*Gadus morhura*), saithe (*Pollachius virens*), and spotted wolffish (*Anarhichas minor*) were examined by Jørgensen et al. (2005). Researchers investigated potential effects on survival, development, and behavior in this study. Among fish kept in tanks and observed for one to four weeks after sound exposure, no significant differences in mortality or growth-related parameters between exposed and unexposed groups were observed. Examination of organs and tissues from selected herring experiments did not reveal obvious differences between unexposed and exposed groups. However, two (out of 42) of the herring groups exposed to sound pressure levels of 189 dB re 1 μPa and 179 dB re 1 μPa had a post-exposure mortality of 19 and 30 percent, respectively. It is not clear if this increased mortality was due to the received level or to other unknown factors, such as exposure to the resonance frequency of the swim bladder. Jørgensen et al. (2005) estimated a resonant frequency of 1.8 kHz for herring and saithe ranging in size from 6.3 to 7.0 centimeters, respectively, which lies within the range of frequencies used during sound exposures and therefore may explain some of the noted mortalities.

Individual juvenile fish with a swim bladder resonance in the frequency range of the operational sonars may be more susceptible to injury or mortality. Past research has demonstrated that fish species, size and depth influences resonant frequency (Løvik & Hovem, 1979; McCartney & Stubbs, 1971). At resonance, the swim bladder, which can amplify vibrations that reach the fish's hearing organs, may absorb much of the acoustic energy in the impinging sound wave. It is suspected that the resulting oscillations may cause mortality, harm the auditory organs or the swim bladder (Jørgensen et al., 2005; Kvadsheim & Sevaldsen, 2005b). However, damage to the swim bladder and to tissues surrounding the swim bladder was not observed in fishes exposed to sonar at their presumed swim bladder resonant frequency (Jørgensen et al., 2005). Sonar is expected to physiologically affect adult fish less than juveniles because adult fish are in a more robust stage of development, and their swim bladder resonant frequencies would be lower than that of mid-frequency active sonar. Additionally, adult fish have more ability to move from an unpleasant stimulus (Kvadsheim & Sevaldsen, 2005a). Lower frequencies (i.e., generally below 1 kHz) are expected to produce swim bladder resonance in adult fishes from about 10 to 100 centimeters (McCartney & Stubbs, 1971). Fish, especially larval and small juveniles, are more susceptible to injury from swim bladder resonance when exposed to continuous signals within the resonant frequency range.

Hastings (1991; 1995) tested the limits of acoustic exposure on two freshwater fish species. Hastings found "acoustic stunning" (loss of consciousness) in blue gouramis (*Trichogaster trichopterus*) following an eight-minute continuous exposure in captivity to a 150 Hz pure tone with a sound pressure level of 198 dB re 1 μPa (Hastings, 1995). This species of fish has an air bubble in the mouth cavity directly adjacent to the animal's braincase that may have caused this injury. Hastings (1991; 1995) also found that goldfish (*Carassius auratus*), exposed to a 250 Hz continuous wave sound with peak pressures of 204 dB re 1 μPa for two hours, and blue gourami exposed to a 150 Hz continuous wave sound at a sound pressure level of 198 dB re 1 μPa for 0.5 hour did not survive. These studies illustrate the highest known levels tested on fishes with hearing specializations. These high levels of noise were also projected for relatively long durations of time and in a small tank test environment; therefore, direct comparisons to results in natural settings should be treated with caution. Stunning and mortality due to exposure to non-impulsive sound exposure has not been observed in other studies.

Three freshwater species of fish, the rainbow trout (*Oncorhynchus mykiss,* also known as steelhead), channel catfish (*Ictalurus punctatus*), and the hybrid sunfish (*Lepomis* sp.), were exposed to both low- and mid-frequency sonar (Kane et al., 2010; Popper et al., 2007). Low-frequency exposures with received sound pressure levels of 193 dB re 1 µPa occurred for either 324 or 648 seconds. Mid-frequency exposures with received sound pressure levels of 210 dB re 1 µPa occurred for 15 seconds. No fish mortality resulted from either experiment, and during necropsy after test exposures, both studies found that none of the subjects showed signs of tissue damage related to exposure (Kane et al., 2010; Popper et al., 2007).

As summarized in the *ANSI Sound Exposure Guideline* technical report (Popper et al., 2014), although fish have been injured and killed due to intense, long-duration, non-impulsive sound exposures, fish exposed under more realistic conditions have shown no signs of injury. Those species tested to date can be used as viable surrogates for estimating injury in other species exposed to similar sources.

3.9.3.1.1.2 Hearing Loss

Researchers have examined the effects on hearing in fishes from sonar-like signals, tones, and different non-impulsive noise sources. Section 3.0.3.7 (Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities) provides additional information on hearing loss and the framework used to analyze this potential impact.

Exposure to high-intensity sound can cause hearing loss, also known as a noise-induced threshold shift, or simply a threshold shift (Miller, 1974). A temporary threshold shift (TTS) is a temporary, recoverable loss of hearing sensitivity. A TTS may last several minutes to several weeks, and the duration may be related to the intensity of the sound source and the duration of the sound exposure (including multiple exposures). A permanent threshold shift (PTS) is non-recoverable, results from the destruction of tissues within the auditory system, permanent loss of hair cells, or damage to auditory nerve fibers (Liberman, 2016), and can occur over a small range of frequencies related to the sound exposure. However, the sensory hair cells of the inner ear in fishes are regularly replaced over time when they are damaged, unlike in mammals where sensory hair cell loss is permanent (Lombarte et al., 1993; Popper et al., 2014; Smith et al., 2006). Consequently, PTS has not been known to occur in fishes, and any hearing loss in 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). As with TTS, the animal does not become deaf but requires a louder sound stimulus, relative to the amount of PTS, to detect a sound within the affected frequencies. For example, if 5 dB of PTS occurs at a certain frequency, then a sound at that same frequency would need to be 5 dB louder for the animal to detect it. Although available data for some terrestrial mammals have shown signs of nerve damage after severe threshold shifts (e.g., Kujawa & Liberman, 2009; Lin et al., 2011), it is not known if damage to auditory nerve fibers could also occur in fishes and, if so, whether fibers would recover during this process. One example that demonstrated a lack of damage to sensory receptors when TTS occurred was in a study on hearing loss in zebrafish (*Danio rerio,* a freshwater species with a swim bladder involved in hearing). This was one of the first studies to look at both auditory threshold shifts and potential physical effects on the inner ear. However, marine species have yet to be tested and future research should evaluate other potential mechanisms of cellular or structural damage if in fact physical damage occurs in fishes with the onset of a threshold shift (Breitzler et al., 2020).

Hearing Loss due to Impulsive Sound Sources

Popper et al. (2005) examined the effects of a seismic air gun array on a fish with a swim bladder that is involved in hearing, the lake chub (*Couesius plumbeus*), and two species that have a swim bladder that is not involved in hearing, the northern pike (*Esox lucius*) and the broad whitefish (*Coregonus nasus*), a salmonid. In this study, the lowest received cumulative sound exposure level at which effects were noted was 186 dB re 1 µPa^2-s (five shots with a mean sound pressure level of 177 dB re 1 µPa). The results showed temporary hearing loss for both lake chub and northern pike to both 5 and 20 air gun shots, but not for the broad whitefish. Hearing loss was approximately 20–25 dB at some frequencies for both species, and full recovery of hearing took place within 18 hours after sound exposure. Examination of the sensory surfaces of the ears after allotted recovery times (one hour for five shot exposures, and up to 18 hours for 20 shot exposures) showed no damage to sensory hair cells in any of the fish from these exposures (Song et al., 2008).

McCauley et al. (2003) and McCauley and Kent (2012) showed loss of a small percent of sensory hair cells in the inner ear of caged fish exposed to a towed air gun array simulating a passing seismic vessel. Pink snapper (*Pargus auratus*), a species that has a swim bladder that is not involved in hearing, were exposed to multiple air gun shots for up to 1.5 hours (McCauley et al., 2003) where the maximum received sound exposure levels exceeded 180 dB re 1 µPa^2-s. The loss of sensory hair cells continued to increase for up to at least 58 days post exposure to 2.7 percent of the total cells. Gold band snapper (*Pristipomoides multidens*) and sea perch (*Lutjanus kasmira*), both fishes with a swim bladder involved in hearing, were also exposed to a towed air gun array simulating a passing seismic vessel (McCauley & Kent, 2012). Although received levels for these exposures have not been published, hair cell damage increased as the range of the exposure (i.e., range to the source) decreased. Again, the amount of damage was considered small in each case (McCauley & Kent, 2012). It is not known if this hair cell loss would result in hearing loss since fish have tens or even hundreds of thousands of sensory hair cells in the inner ear and only a small portion were affected by the sound (Lombarte & Popper, 1994; Popper & Hoxter, 1984). The reason McCauley and Kent (2012) found damage to sensory hair cells, while Popper et al. (2005) did not, may be in their distinct methodologies. Their studies had many differences, including species and the precise sound source characteristics.

Hastings et al. (2008) exposed a fish with a swim bladder that is involved in hearing, the pinecone soldierfish (*Myripristis murdjan*), and three species that have a swim bladder that is not involved in hearing, the blue green damselfish (*Chromis viridis*), the saber squirrelfish (*Sargocentron spiniferum*), and the bluestripe seaperch (*Lutjanus kasmira*), to an air gun array. Fish in cages were exposed to multiple air gun shots with a cumulative sound exposure level of 190 dB re 1 µPa^2-s. The authors found no hearing loss in any fish examined up to 12 hours after the exposures.

In an investigation of another impulsive source, Casper et al. (2013b) found that some fishes may actually be more susceptible to barotrauma (e.g., swim bladder ruptures, herniations, and hematomas) than hearing effects when exposed to simulated impact pile driving. Hybrid striped bass (white bass x striped bass) and Mozambique tilapia (*Oreochromis mossambicus*), two species with a swim bladder not involved in hearing, were exposed to sound exposure levels between 213 and 216 dB re 1 µPa^2-s. The subjects exhibited barotrauma, and although researchers began to observe signs of inner ear hair cell loss, these effects were small compared to the other non-auditory injuries incurred. Researchers speculated that injury might occur prior to signs of hearing loss or TTS. These sound exposure levels may present the lowest threshold at which hearing effects may begin to occur.

Overall, PTS has not been known to occur in fishes tested to date. Any hearing loss in 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 μPa^2-s. As reviewed in the *ANSI Sound Exposure Guideline* technical report (Popper et al., 2014), fishes without a swim bladder, or fishes with a swim bladder that is not involved in hearing, would be less susceptible to hearing loss (i.e., TTS) than fishes with swim bladders involved in hearing, even at higher levels and longer durations.

Hearing Loss due to Sonar and Other Transducers

Several studies have examined the effects of the sound exposures from low-frequency sonar on fish hearing (i.e., Halvorsen et al., 2013; Kane et al., 2010; Popper et al., 2007). Hearing was measured both immediately post exposure and for up to several days thereafter (Halvorsen et al., 2013; Kane et al., 2010; Popper et al., 2007). Maximum received sound pressure levels were 193 dB re 1 μPa for 324 or 648 seconds (a cumulative sound exposure level of 218 or 220 dB re 1 μPa^2-s, respectively) at frequencies ranging from 170 to 320 Hz (Kane et al., 2010; Popper et al., 2007) and 195 dB re 1 μPa for 324 seconds (a cumulative sound exposure level of 215 dB re 1 μPa^2-s) in a follow-on study (Halvorsen et al., 2013). Two species with a swim bladder not involved in hearing, the largemouth bass (*Micropterus salmoides*) and yellow perch (*Perca flavescens*), showed no loss in hearing sensitivity from sound exposure immediately after the test or 24 hours later. Channel catfish, a fish with a swim bladder involved in hearing, and some specimens of rainbow trout, a fish with a swim bladder not involved in hearing, showed a threshold shift (up to 10 to 20 dB of hearing loss) immediately after exposure to the low-frequency sonar when compared to baseline and control animals. Small thresholds shifts were detected for up to 24 hours after the experiment in some channel catfish. Although some rainbow trout in one test group showed signs of hearing loss, rainbow trout in another group showed no hearing loss. The different results between rainbow trout test groups are difficult to understand, but may be due to development or genetic differences in the various groups of fish. Catfish hearing returned to, or close to, normal within about 24 hours after exposure to low-frequency sonar. Examination of the inner ears of the fish during necropsy revealed no differences from the control groups in ciliary bundles or other features indicative of hearing loss. The maximum time fish were held post exposure before sacrifice was 96 hours (Kane et al., 2010).

The same investigators examined the potential effects of mid-frequency active sonar on fish hearing and the inner ear (Halvorsen et al., 2012c; Kane et al., 2010). The maximum received sound pressure level was 210 dB re 1 μPa at a frequency of 2.8 to 3.8 kHz for a total duration of 15 seconds (cumulative sound exposure level of 220 dB re 1 μPa^2-s). Out of the species tested (rainbow trout and channel catfish), only one test group of channel catfish showed any hearing loss after exposure to mid-frequency active sonar. The investigators tested catfish during two different seasons and found that the group tested in October experienced TTS, which recovered within 24 hours, but fish tested in December showed no effect. It was speculated that the difference in hearing loss between catfish groups might have been due to the difference in water temperature during the testing period or due to differences between the two stocks of fish (Halvorsen et al., 2012c). Any effects on hearing in channel catfish due to sound exposure appeared to be short-term and non-permanent (Halvorsen et al., 2012c; Kane et al., 2010).

Some studies have suggested that there may be some loss of sensory hair cells due to high intensity sources, indicating a loss in hearing sensitivity; however, none of those studies concurrently investigated the subjects' actual hearing range after exposure to these sources. Enger (1981) found loss of ciliary bundles of the sensory cells in the inner ears of Atlantic cod following one to five hours of exposure to pure tone sounds between 50 and 400 Hz with a sound pressure level of 180 dB re 1 µPa. Hastings (1995) found auditory hair-cell damage in goldfish, a freshwater species with a swim bladder that is involved in hearing. Goldfish were exposed to 250 Hz and 500 Hz continuous tones with maximum peak sound pressure levels of 204 dB re 1 µPa and 197 dB re 1 µPa, respectively, for about two hours. Similarly, Hastings et al. (1996) demonstrated damage to some sensory hair cells in oscars (*Astronotus ocellatus*) observed one to four days following a one-hour exposure to a pure tone at 300 Hz with a sound pressure level of 180 dB re 1 µPa, but no damage to the lateral line was observed. Both studies found a relatively small percentage of total hair cell loss from hearing organs despite long duration exposures. Effects from long-duration noise exposure studies are generally informative; however, they are not necessarily a direct comparison to intermittent short-duration exposures produced during Navy activities involving sonar and other transducers.

As noted in the *ANSI Sound Exposure Guideline* technical report (Popper et al., 2014), some fish species with a swim bladder that is involved in hearing may be more susceptible to TTS from high-intensity non-impulsive sound sources, such as sonar and other transducers, depending on the duration and frequency content of the exposure. Fishes with a swim bladder involved in hearing and fishes with high-frequency hearing may exhibit TTS from exposure to low- and mid-frequency sonar, specifically at cumulative sound exposure levels above 215 dB re 1 μPa^2-s. However, fishes without a swim bladder and fishes with a swim bladder that is not involved in hearing would be unlikely to detect mid- or other high-frequency sonars and would likely require a much higher sound exposure level to exhibit the same effect from exposure to low-frequency active sonar.

Hearing Loss due to Vessel Noise

Little data exist on the effects of vessel noise on hearing in fishes. However, TTS has been observed in fishes exposed to elevated background noise and other non-impulsive sources (e.g., white noise). Caged studies on pressure sensitive fishes (i.e., fishes with a swim bladder involved in hearing and those with high-frequency hearing) show some hearing loss after several days or weeks of exposure to increased background sounds, although the hearing loss seems to recover (e.g., Breitzler et al., 2020; Scholik & Yan, 2002a; Smith et al., 2006; Smith et al., 2004a). Smith et al. (2006; 2004a) exposed goldfish, to noise with a sound pressure level of 170 dB re 1 µPa and found a clear relationship between the amount of hearing loss and the duration of exposure until maximum hearing loss occurred at about 24 hours of exposure. A 10-minute exposure resulted in 5 dB of TTS, whereas a three-week exposure resulted in a 28 dB TTS that took over two weeks to return to pre-exposure levels (Smith et al., 2004a). Recovery times were not measured by investigators for shorter exposure durations. It is important to note that these exposures were continuous and subjects were unable to avoid the sound source for the duration of the experiment.

Scholik and Yan (2001) demonstrated TTS in fathead minnows (*Pimephales promelas*) after a 24-hour continuous exposure to white noise (0.3–2.0 kHz) at 142 dB re 1 µPa that took up to 14 days post-exposure to recover. This is the longest recorded time for a threshold shift to recover in a fish. The same authors also found that the bluegill sunfish (*Lepomis macrochirus*), a species that primarily detects particle motion and lacks specializations for hearing, did not show significant elevations in auditory thresholds when exposed to the same stimulus (Scholik & Yan, 2002b). This demonstrates again that fishes with a swim bladder involved in hearing and those with high-frequency hearing may be more sensitive to hearing loss than fishes without a swim bladder or those with a swim bladder not involved in hearing. Breitzler et al. (2020) exposed zebrafish (a freshwater species with a swim bladder involved in hearing) to 24 hours of white noise at various frequencies and sound levels. This is one of the first studies that measured hearing thresholds, physical damage (i.e., loss of hair cells) and recovery post-exposure. Overall, results were similar to those from previous studies. As the noise level increased, the amount of TTS observed in zebrafish also increased and frequencies that were most affected were those within the fishes best hearing sensitivity. Breitzler et al. (2020) also observed an increase in response latency in fish with TTS (i.e., the fish were slower to respond to auditory stimuli during hearing tests). Threshold shifts in fish exposed to sound pressure levels of 130 and 140 dB re 1 µPa recovered within three days whereas it took up to 14 days for fish exposed to the highest sound pressure level (150 dB re 1 µPa) to return to pre-exposure levels. Similarly, response latency was time dependent and sometimes took up to 14 days to recover to pre-exposure levels. The highest threshold shifts recorded also resulted in significant hair cell loss, whereas lower exposure levels did not. Similar to the other effects measured in this study, hair cell loss attributed to the highest exposure level returned to baseline levels within seven days post-exposure. This further demonstrates the ability for fish to rejuvenate hair cells and for hearing thresholds to recover to baseline levels (lacking evidence of PTS).

Butler et al. (2020) presented playbacks of pure tones ranging from 100 to 2,000 Hz to African cichlids (*Astatotilapia burtoni*), a freshwater species with a swim bladder involved in hearing, stationed in a small aquarium to investigate the effects on hearing. Playbacks were presented at a sound pressure level of 140 dB re 1 µPa for three hours. After review of the playback, the authors note that the sound source was more broadband than intended and therefore may not be analogous to other tonal sources (such as sonar) but rather and could more comparable to vessel noise playbacks or an example of elevated background levels. Observed threshold shifts were only significantly different than controls in lower frequencies (200 and 300 Hz) which corresponds to the species best range of sensitivity. Recovery of hearing thresholds was not measured during this study.

When reviewing results from the above studies, it is important to note that the fish were unable to avoid the sound source (e.g., held stationary in a tubs or tanks) and were subject to long, continuous duration exposures (e.g., days to weeks). A direct comparison of these results to fish exposed to continuous sound sources in natural settings should be treated with caution. For example, fishes that are exposed to noise produced by a vessel passing by in their natural environment, even in areas with high levels of vessel movement, would only be exposed for periods of short durations (e.g., seconds or minutes) and therefore relatively low sound exposure levels as vessels pass by. As evidence suggests that fish can recover from hearing loss (both threshold sensitivity and actual physical damage) even after long duration exposures in a confined space, it also indicates similar results to lower level and shorter duration exposures. Therefore, overall effects would not likely rise to the level of impact demonstrated in the summarized laboratory studies.

As noted in the *ANSI Sound Exposure Guideline* technical report (Popper et al., 2014), some fish species with a swim bladder that is involved in hearing may be more susceptible to TTS from long duration continuous noise, such as broadband[2] white noise, depending on the duration of the exposure (thresholds are proposed based on continuous exposure of 12 hours). However, it is not likely that TTS would occur in fishes with a swim bladder not involved in hearing or in fishes without a swim bladder.

[2] A sound or signal that contains energy across multiple frequencies.

3.9.3.1.1.3 Masking

Masking refers to the presence of a noise that interferes with a fish's ability to hear biologically important sounds including those produced by prey, predators, or other fishes. Masking occurs in all vertebrate groups and can result in a reduction in communication and listening space, effectively limiting the distance over which an animal can communicate and detect biologically relevant sounds (Pine et al., 2020). Human-generated continuous sounds (e.g., some sonar, vessel or aircraft noise, and vibratory pile driving) have the potential to mask sounds that are biologically important to fishes. Researchers have studied masking in fishes using continuous masking noise, but masking due to intermittent, short-duty cycle sounds has not been studied. Section 3.0.3.7 (Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities) provides additional information on masking and the framework used to analyze this potential impact.

Masking is likely to occur in most fishes due to varying levels of ambient or natural noise in the environment such as wave action, precipitation, or other animal vocalizations (Popper et al., 2014). Ambient noise during higher sea states in the ocean has resulted in elevated thresholds in several fish species (Chapman & Hawkins, 1973; Ramcharitar & Popper, 2004). Although the overall intensity or loudness of ambient or human-generated noise may result in masking effects in fishes, masking may be most problematic when human-generated signals or ambient noise levels overlap the frequencies of biologically important signals (Buerkle, 1968, 1969; Popper et al., 2014; Tavolga, 1974).

Wysocki and Ladich (2005) investigated the influence of continuous white noise exposure on the auditory sensitivity of two freshwater fish with notable hearing specializations for sound pressure detection; the goldfish; the lined Raphael catfish (*Platydoras costatus*), a freshwater fish without notable specializations; and the pumpkinseed sunfish (*Lepomis gibbosus*). For the goldfish and catfish, baseline thresholds were lower than masked thresholds. Continuous white noise with a sound pressure level of approximately 130 dB re 1 µPa at 1 m resulted in an elevated threshold of 23 to 44 dB within the subjects' region of best sensitivity between 500 and 1,000 Hz. There was less evidence of masking in the sunfish during the same exposures with only a shift of 11 dB. Wysocki and Ladich (2005) suggest that ambient sound regimes may limit acoustic communication and orientation, especially in animals with notable hearing specializations for sound pressure detection.

Masking could lead to potential fitness costs depending on the severity of the reaction and the animals' ability to adapt or compensate during an exposure (de Jong et al., 2020; Radford et al., 2014; Slabbekoorn et al., 2010). For example, masking could result in changes in predator-prey relationships potentially inhibiting a fish's ability to detect predators and therefore increase its risk of predation (Astrup, 1999; Mann et al., 1998; Simpson et al., 2015; Simpson et al., 2016). Masking may also limit the distance over which fish can communicate or detect important signals (Alves et al., 2016; Codarin et al., 2009; Ramcharitar et al., 2006; Ramcharitar et al., 2001; Stanley et al., 2017), including vocalizations made during reproductive phases or sounds emitted from a reef for navigating larvae (de Jong et al., 2020; Higgs, 2005; Neenan et al., 2016). If the masking signal is brief (a few seconds or less), biologically important signals may still be detected, resulting in little effect to the individual. If the signal is longer in duration (minutes or hours) or overlaps with important frequencies for a particular species, more severe consequences may occur such as the inability to attract a mate and reproduce. Holt and Johnston (2014) were the first to demonstrate the Lombard effect in one species of fish, a potentially compensatory behavior where an animal increases the source level of its vocalizations in response to elevated noise levels. The Lombard effect is currently understood to be a reflex that may be unnoticeable to the animal, or it could lead to increased energy expenditure during communication.

The *ANSI Sound Exposure Guideline* technical report (Popper et al., 2014) highlights a lack of data that exists for masking by sonar but suggests that the narrow bandwidth and intermittent nature of most sonar signals would result in only a limited probability of any masking effects. In addition, most sonars (mid-, high-, and very high-frequency) are above the hearing range of most marine fish species, eliminating the possibility of masking for these species. In most cases, the probability of masking would further decrease with increasing distance from the sound source.

In addition, no data are available on masking by impulsive signals (e.g., impact pile driving and air guns) (Popper et al., 2014). Impulsive sounds are typically brief, lasting only fractions of a second, where masking could occur only during that brief duration of sound. Biological sounds can typically be detected between pulses within close distances to the source unless those biological sounds are similar to the masking noise, such as impulsive or drumming vocalizations made by some fishes (e.g., cod or haddock). Masking could also indirectly occur because of repetitive impulsive signals where the repetitive sounds and reverberations over distance may create a more continuous noise exposure.

Although there is evidence of masking as a result of exposure to vessel noise, the *ANSI Sound Exposure Guideline* technical report (Popper et al., 2014) does not present numeric thresholds for this effect. Instead, relative risk factors are considered and it is assumed the probability of masking occurring is higher at near to moderate distances from the source (up to hundreds of meters) but decrease with increasing distance (Popper et al., 2014).

3.9.3.1.1.4 Physiological Stress

Section 3.0.3.7 (Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities) provides additional information on physiological stress and the framework used to analyze this potential impact. A fish must first be able to detect a sound above its hearing threshold and above the ambient noise level before a physiological stress reaction can occur. The initial response to a stimulus is a rapid release of stress hormones into the circulatory system, which may cause other responses such as elevated heart rate and blood chemistry changes. Increases in background sound have been shown to cause stress in humans and animals, which also includes the measurement of biochemical responses by fishes to acoustic stress (e.g., Goetz et al., 2015; Madaro et al., 2015; Remage-Healey et al., 2006; Smith et al., 2004b; Wysocki et al., 2007; Wysocki et al., 2006). However, results from these studies have varied. Stimuli that have been used to study physiological stress responses in fishes include predator vocalizations, non-impulsive or continuous, and impulsive noise exposures.

A stress response that has been observed in fishes includes the production of cortisol (a stress hormone) when exposed to sounds such as boat noise, tones, or predator vocalizations. Nichols et al. (2015) found that giant kelpfish (*Heterostichus rostratus*) had increased levels of cortisol with increased sound level and intermittency of boat noise playbacks. Cod exposed to a short-duration upsweep (a tone that sweeps upward across multiple frequencies) across 100 to 1,000 Hz had increases in cortisol levels, which returned to normal within one hour post-exposure (Sierra-Flores et al., 2015). Remage-Healey et al. (2006) found elevated cortisol levels in Gulf toadfish (*Opsanus beta*) exposed to low-frequency bottlenose dolphin sounds, but observed no physiological change when they exposed toadfish to low-frequency “pops” produced by snapping shrimp.

A sudden increase in sound pressure level (i.e., presentation of a sound source) or an increase in overall background noise levels can increase hormone levels and alter other metabolic rates indicative of a stress response, such as increased ventilation and oxygen consumption (Pickering, 1981; Popper & Hastings, 2009a; Radford et al., 2016; Simpson et al., 2015; Simpson et al., 2016; Smith et al., 2004a, 2004b; Spiga et al., 2017). Similarly, reef fish embryos exposed to boat noise have demonstrated changes in morphological development and increases in heart rate, another indication of a physiological stress response, although survival rates were unchanged (Fakan & McCormick, 2019; Jain-Schlaepfer et al., 2018). Although results have varied, it has been shown that chronic or long-term (days or weeks) exposures of continuous man-made sounds can lead to a reduction in embryo viability (Sierra-Flores et al., 2015) and decreased growth rates (Nedelec et al., 2015).

Mills et al. (2020) observed the hormonal effects of motorboat noise on orange-fin anemonefish (*Amphiprion chrysopterus*) over short-term (30 minute) and longer-term (48 hour) periods. Cortisol levels did not differ significantly between the periods for either sex. Testosterone levels were significantly higher in males exposed to motorboat-noise playback and 11-ketotestosterone (11-KT) levels were significantly higher in males during the short-term experiment and in both sexes during the longer-term experiment.

Kusku (2020) measured respiratory changes as secondary indicators of stress in Nile tilapia (*Oreochromis niloticus*) to determine potential effects of long-term exposure to underwater sound playback, including shipping noise. Fish exposed to noise showed as much as a two-fold increase in respiratory indicators (opercular beat rate and pectoral wing rate) after 10 minutes of sound exposure as compared to controls and pre-exposure rates. Over the next 120 days of continuous sound exposure, respiratory indicators declined steadily and returned to baseline. The authors conclude that the data support habituation of fish to chronic noise exposure.

However, not all species show these reactions. Smith et al. (2004b) found no increase in corticosteroid, a class of stress hormones, in goldfish exposed to a continuous, band-limited noise (0.1–10 kHz) with a sound pressure level of 170 dB re 1 µPa for one month. Wysocki et al. (2007) exposed rainbow trout to continuous band-limited noise with a sound pressure level of about 150 dB re 1 µPa for nine months with no observed stress effects. Growth rates and effects on the trout's immune systems were not significantly different from control animals held at a sound pressure level of 110 dB re 1 µPa. In addition, although there was a difference of 10 dB in overall background level and boat activity between test sites, reef fish, *Halichoeres bivittatus,* showed similar levels of whole-body cortisol (Staaterman et al., 2020). This suggests that boat noise, in this context, was not as stressful as handling of the fish for this particular experiment and contradicts previous conclusions that follow similar study designs.

Fishes may have physiological stress reactions to sounds that they can hear. Generally, stress responses are more likely to occur in the presence of potentially threatening sound sources, such as predator vocalizations, or the sudden onset of impulsive signals rather than from non-impulsive or continuous sources such as vessel noise or sonar. If an exposure is short, the stress responses are typically brief (a few seconds to minutes). In addition, research shows that fishes may habituate (i.e., learn to tolerate) to the noise that is being presented after multiple exposures or longer duration exposures that prove to be non-threatening. However, exposure to chronic noise sources can lead to more severe impacts over time, such as reduced growth rates which can lead to reduced survivability for an individual. It is assumed that any physiological response (e.g., hearing loss or injury) or significant behavioral response is also associated with a stress response.

3.9.3.1.1.5 Behavioral Reactions

Section 3.0.3.7 (Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities) provides additional information on behavioral reactions and the framework used to analyze this potential impact. Behavioral reactions in fishes have been observed due to a number of different types of sound sources. The majority of research has been performed using air guns (including large-scale seismic surveys), sonar, and vessel noise. Fewer observations have been made on behavioral reactions to impact pile driving noise; although fish are likely to show similar behavioral reactions to any impulsive noise within or outside the zone for hearing loss and injury.

As with masking, a fish must first be able to detect a sound above its hearing threshold and above the ambient noise level before a behavioral reaction can occur. Most fishes can only detect low-frequency sounds with the exception of a few species that can detect some mid and high frequencies (above 1 kHz).

Fish studies have identified the following behavioral reactions to sound: alteration of natural behaviors (e.g., startle or alarm), and avoidance (LGL Ltd Environmental Research Associates et al., 2008; McCauley et al., 2000; Pearson et al., 1992). In the context of this Supplemental, and to remain consistent with available behavioral reaction literature, the terms "startle," "alarm," "response," and "reaction" will be used synonymously.

In addition, observed behavioral effects to fish could include disruption to or alteration of natural activities such as swimming, schooling, feeding, breeding, and migrating. Sudden changes in sound level can cause fish to dive, rise, or change swimming direction. However, some fish either do not respond, learn to tolerate or habituate to repeated exposures, or learn to tolerate noise that seems threatening (e.g., Bruintjes et al., 2016; Currie et al., 2020; Hubert et al., 2020; Nedelec et al., 2016b; Radford et al., 2016). Research on behavioral reactions can be difficult to understand and interpret. For example, behavioral responses often times vary depending on the type of exposure and sound source present. Changes in sound intensity may be more important to a fish's behavior than the maximum sound level. Some studies show that sounds that fluctuate in level or have intermittent pulse rates tend to elicit stronger responses from fish than even stronger sounds with a continuous level (Currie et al., 2020; Neo et al., 2014; Schwarz & Greer, 1984). It has also been suggested that unpredictable sounds that last for long durations may have the largest impact on behavioral responses (de Jong et al., 2020). Interpreting behavioral responses can also be difficult due to species-specific behavioral tendencies, motivational state (e.g., feeding or mating), an individual's previous experience, how resilient a species is to changes in their environment, and whether or not the fish are able to avoid the source (e.g., caged versus free-swimming subjects). Results from caged studies may not provide a clear understanding of how free-swimming fishes may react to the same or similar sound exposures (Hawkins et al., 2015).

Behavioral Reactions due to Impulsive Sound Sources

It is assumed that most species would react similarly to impulsive sources such as weapons noise and explosions. However, it is important to note that most data on behavioral reactions to impulsive sources is collected from studies using air guns and impact pile driving, sources that do not occur in the Study Area. Reactions include startle or alarm responses and increased swim speeds at the onset of impulsive sounds (Fewtrell & McCauley, 2012; Pearson et al., 1992; Roberts et al., 2016a; Spiga et al., 2017). Data on fish behavioral reactions exposed to impulsive sound sources is mostly limited to studies using caged fishes and seismic air guns (Løkkeborg et al., 2012). Several species of rockfish (*Sebastes* species) in a caged environment exhibited startle or alarm reactions to seismic air gun pulses between peak-to-peak sound pressure levels of 180 dB re 1 µPa and 205 dB re 1 µPa (Pearson et al., 1992). More subtle behavioral changes were noted at lower sound pressure levels, including decreased swim speeds. At the presentation of the sound, some species of rockfish settled to the bottom of the experimental enclosure and reduced swim speed. Trevally (*Pseudocaranx dentex*) and pink snapper (*Pagrus auratus*) also exhibited alert responses as well as changes in swim depth, speed, and schooling behaviors when exposed to air gun noise (Fewtrell & McCauley, 2012). Both trevally and pink snapper swam faster and closer to the bottom of the cage at the onset of the exposure. However, trevally swam in tightly cohesive groups at the bottom of the test cages while pink snapper exhibited much looser group cohesion. These behavioral responses were seen during sound exposure levels as low as 147 up to 161 dB re 1 µPa^2-s but habituation occurred in all cases, either within a few minutes or within 30 minutes after the final air gun shot (Fewtrell & McCauley, 2012; Pearson et al., 1992).

Some studies have shown a lack of behavioral reactions to air gun noise. Herring exposed to an approaching air gun survey (from 27 to 2 km over six hours), resulting in single pulse sound exposure levels of 125 to 155 dB re 1 µPa^2-s, did not react by changing direction or swim speed (Pena et al., 2013). Although these levels are similar to those tested in other studies which exhibited responses (Fewtrell & McCauley, 2012), the distance of the exposure to the test enclosure, the slow onset of the sound source, and a strong motivation for feeding may have affected the observed response (Pena et al., 2013). In another study, Wardle et al. (2001) observed marine fish on an inshore reef before, during, and after an air gun survey at varying distances. The air guns were calibrated at a peak level of 210 dB re 1 µPa at 16 m and 195 dB re 1 µPa at 109 m from the source. Other than observed startle responses and small changes in the position of pollack, when the air gun was located within close proximity to the test site (within 10 m), they found no substantial or permanent changes in the behavior of the fish on the reef throughout the course of the study. Behavioral responses to impulsive sources are more likely to occur within near and intermediate (tens to hundreds of meters) distances from the source as opposed to far distances (thousands of meters) (Popper et al., 2014).

Unlike the previous studies, Slotte et al. (2004) used fishing sonar (38 kHz echo sounder) to monitor behavior and depth of blue whiting (*Micromesistius poutassou*) and Norwegian spring herring (*Clupea harengus L.*) spawning schools exposed to air gun signals. They reported that fishes in the area of the air guns appeared to go to greater depths after the air gun exposure compared to their vertical position prior to the air gun usage. Moreover, the abundance of animals 30–50 km away from the air guns increased during seismic activity, suggesting that migrating fish left the zone of seismic activity and did not re-enter the area until the activity ceased. It is unlikely that either species was able to detect the fishing sonar. However, it should be noted that these behavior patterns may have also been influenced by other variables such as motivation for feeding, migration, or other environmental factors (e.g., temperature, salinity, etc.) (Slotte et al., 2004).

Bruce et al. (2018) attached acoustic and accelerometer tags to swell sharks (*Cephaloscyllium laticeps)*, gummy sharks (*Mustelus antarcticus)*, and tiger flathead (*Neoplatycephalus richardsoni*) in order to monitor their behavior during seismic surveys. Although tagging was successful and provided a large sample size for two out of the three species, most tagged individuals moved out of range of the experimental site where autonomous acoustic receivers were placed or sporadically returned to the monitoring site throughout the duration of the survey. This made it difficult to correlate displacement from the area with the actual survey. In addition to the analysis of fish behavior, modeled predicted catch rates within the experimental site were compared to actual catch per unit effort data collected from local fisheries. Of the nine species analyzed, only three of them showed reductions in catch rates following the seismic survey. Contrary to past findings and assumptions, catch rates for six species actually increased after the survey. Although these findings are interesting and, in some ways, may contradict prior conclusions, there are some improvements that should be made to similar studies in the future to better understand the true effects of seismic surveys on fish behavior and catch rates.

Alterations in natural behavior patterns due to exposure to pile driving noise have not been studied as thoroughly, but reactions noted thus far are similar to those seen in response to seismic surveys. These changes in behavior include startle responses, changes in depth (in both caged and free-swimming subjects), increased swim speeds, changes in ventilation rates, changes in attention and anti-predator behaviors, and directional avoidance (e.g., Hawkins et al., 2014; Mueller-Blenkle et al., 2010; Neo et al., 2015; Roberts et al., 2016a; Spiga et al., 2017). The severity of response varied greatly by species and received sound pressure level of the exposure. For example, some minor behavioral reactions such as startle responses were observed during caged studies with a sound pressure level as low as 140 dB re 1 µPa (Neo et al., 2014). However, only some free-swimming fishes avoided pile driving noise at even higher sound pressure levels between 152 and 157 dB re 1 µPa (Iafrate et al., 2016). In addition, Roberts et al. (2016a) observed that although multiple species of free swimming fish responded to simulated pile driving recordings, not all responded consistently. In some cases, only one fish would respond while the others continued feeding from a baited remote underwater video. In other instances, various individual fish would respond to different strikes. The repetition rate of pulses during an exposure may also have an effect on what behaviors were noted and how quickly these behaviors recovered as opposed to the overall sound pressure or exposure level (Neo et al., 2014). Neo et al. (2014) observed slower recovery times in fishes exposed to intermittent sounds (similar to pile driving) compared to continuous exposures.

As summarized in the *ANSI Sound Exposure Guideline* technical report (Popper et al., 2014), species may react differently to the same sound source depending on a number of variables, such as the animal's life stage or behavioral state (e.g., feeding, mating). Without specific data, it is assumed that fishes react similarly to all impulsive sounds outside the zone for hearing loss and injury. Observations of fish reactions to large-scale air gun surveys are informative, but not necessarily directly applicable to analyzing impacts from the short-term, intermittent use of all impulsive sources. It is assumed that fish have a high probability of reacting to an impulsive sound source within near and intermediate distances (tens to hundreds of meters), and a decreasing probability of reaction at increasing distances (Popper et al., 2014).

Behavioral Reactions due to Sonar and Other Transducers

Behavioral reactions to sonar have been studied both in caged and free-swimming fish, although results can often-times be difficult to interpret depending on the species tested and the study environment. Jørgensen et al. (2005) showed that caged cod and spotted wolf fish (*Anarhichas minor*) lacked any response to simulated sonar between 1 and 8 kHz. However, within the same study, reactions were seen in juvenile herring. It is likely that the sonar signals were inaudible to the cod and wolf fish (species that lack notable hearing specializations), but audible to herring (a species that has hearing capabilities in the frequency ranges tested).

Doksæter et al. (2009; 2012) and Sivle et al. (2014; 2012) studied the reactions of both wild and captive Atlantic herring to the Royal Netherlands Navy's experimental mid-frequency active sonar ranging from 1 to 7 kHz. The behavior of the fish was monitored in each study either using upward looking echosounders (for wild herring) or audio and video monitoring systems (for captive herring). The source levels used within each study varied across all studies and exposures with a maximum received sound pressure level of 181 dB re 1 µPa and maximum cumulative sound exposure level of 184 dB re 1 $\mu Pa^2 \cdot s$. No avoidance or escape reactions were observed when herring were exposed to any sonar sources. Instead, significant reactions were noted at lower received sound levels of different non-sonar sound types. For example, dive responses (i.e., escape reactions) were observed when herring were exposed to killer whale feeding sounds at received sound pressure levels of approximately 150 dB re 1 µPa (Sivle et al., 2012). Startle responses were seen when the cages for captive herring were hit with a wooden stick and with the ignition of an outboard boat engine at a distance of one meter from the test pen (Doksaeter et al., 2012). It is possible that the herring were not disturbed by the sonar, were more motivated to continue other behaviors such as feeding, or did not associate the sound as a threatening stimulus. Based on these results (Doksaeter et al., 2009; Doksaeter et al., 2012; Sivle et al., 2012), Sivle et al. (2014) created a model in order to report on the possible population-level effects on Atlantic herring from active naval sonar. The authors concluded that the use of naval sonar poses little risk to populations of herring regardless of season, even when the herring populations are aggregated and directly exposed to sonar.

There is evidence that elasmobranchs (cartilaginous fish including sharks and rays) also respond to human-generated sounds. A number of researchers conducted experiments in which they played back sounds (e.g., pulsed tones below 1 kHz) and attracted a number of different shark species to the sound source (e.g., Casper et al., 2012a; Myrberg et al., 1976; Myrberg et al., 1969; Myrberg et al., 1972; Nelson & Johnson, 1972). The results of these studies showed that sharks were attracted to irregularly pulsed low-frequency sounds (below several hundred Hz), in the same frequency range of sounds that might be produced by struggling prey. However, abrupt and irregularly pulsed human-generated noise (0.2-10 kHz, with most energy below 1 kHz) resulted in withdrawal responses of certain shark species (Chapuis et al., 2019). Sharks are not known to be attracted to continuous signals or higher frequencies that they presumably cannot hear (Casper & Mann, 2006; Casper & Mann, 2009).

Only a few species of marine fishes can detect sonars above 1 kHz (see Section 3.9.2.1, Hearing and Vocalization), meaning that most fishes would not detect most mid-, high-, or very high-frequency Navy sonars. The few marine species that can detect above 1 kHz and have some hearing specializations may be able to better detect the sound and would therefore be more likely to react. However, researchers have found little reaction by adult fish in the wild to sonars within the animals' hearing range (Doksaeter et al., 2009; Doksaeter et al., 2012; Sivle et al., 2012). The *ANSI Sound Exposure Guideline* technical report (Popper et al., 2014) suggests that fish able to hear sonars would have a low probability of reacting to the source within near or intermediate distances (within tens to hundreds of meters) and a decreasing probability of reacting at increasing distances.

Behavioral Reactions due to Vessel Noise

Vessel traffic also contributes to the amount of noise in the ocean and has the potential to affect fishes. Several studies have demonstrated and reviewed avoidance responses by fishes (e.g., herring and cod) to the low-frequency sounds of vessels (De Robertis & Handegard, 2013; Engås et al., 1995; Handegard et al., 2003). Misund (1997) found fish ahead of a ship that showed avoidance reactions did so at ranges of 50 to 150 m. When the vessel passed over them, some species of fish responded with sudden escape responses that included lateral avoidance or downward compression of the school.

As mentioned above, behavioral reactions are quite variable depending on a number of factors such as (but not limited to) the type of fish, its life history stage, behavior, time of day, location, the sound source (e.g., type of vessel or motor vs. playback of broadband sounds), and the sound propagation characteristics of the water column (Popper et al., 2014; Schwarz & Greer, 1984). Reactions to playbacks of continuous noise or passing vessels generally include basic startle and avoidance responses, as well as evidence of distraction and increased decision-making errors. Other observed responses include increased group cohesion; increased distractions or evidence of modified attention; changes in vertical distribution in the water column, swim speeds, distance traveled, and feeding efficacy such as reduced foraging attempts and increased mistakes (i.e., lowered discrimination between food and non-food items) (e.g., Bracciali et al., 2012; De Robertis & Handegard, 2013; Handegard et al., 2015; McCormick et al., 2019; Nedelec et al., 2017a; Nedelec et al., 2015; Neo et al., 2015; Payne et al., 2015; Purser & Radford, 2011; Roberts et al., 2016a; Sabet et al., 2016; Simpson et al., 2015; Simpson et al., 2016; Voellmy et al., 2014a; Voellmy et al., 2014b). In addition, Butler et al. (2020) observed changes in aggressive and reproductive behaviors in African cichlids exposed to broadband playbacks in a small aquarium such as changes in visual displays and signaling to potential mates and competitors, alterations in territorial interactions, and a decrease in successful courtship behaviors. Mills et al. (2020) observed the behavioral effects of motorboat noise on orange-fin anemonefish (*Amphiprion chrysopterus*) over short-term (30 minute) and longer-term (48 hour) periods. Significant behavioral effects included increased hiding, reduction in distance from anemone, and increased aggressive behavior toward heterospecifics over both time periods.

Behavioral responses may also be dependent on the type of vessel exposed to a fish. For example, juvenile damselfish (*Pomacentrus wardi*) exposed to sound from a two-stroke engine resulted in startle responses, reduction in boldness (increased time spent hiding, less time exhibiting exploratory behaviors) and space use (maximum distance ventured from shelter or traveled within the test enclosure), as well as slower and more conservative reactions to visual stimuli analogous to a potential predator. However, damselfish exposed to sound from a four-stroke engine generally displayed similar responses as control fish exposed to ambient noise (e.g., little or no change in boldness) (McCormick et al., 2018; McCormick et al., 2019). Although the two sound sources were very similar, the vessels powered by the four-stroke engine were of lower intensity compared to vessels powered by the two-stroke engine, which may explain the overall reduced response to this engine type.

Vessel noise has also led to changes in anti-predator response, but these responses vary by species. During exposures to vessel noise, juvenile Ambon damselfish (*Pomacentrus amboinensis*) and European eels showed slower reaction times and lacked startle responses to predatory attacks, and subsequently showed signs of distraction and increased their risk of predation during both simulated and actual predation experiments (Simpson et al., 2015; Simpson et al., 2016). Furthermore, juvenile Ambon damselfish showed a reduction in learned anti-predator behaviors, likely as a result of distraction, which could lead to an increased risk to survival (Ferrari et al., 2018). Spiny chromis (*Acanthochromis polyacanthus*) exposed to chronic boat noise playbacks for up to 12 consecutive days spent less time feeding and interacting with offspring, and displayed increased defensive acts. In addition, offspring survival rates were also lower at nests exposed to chronic boat noise playbacks versus those exposed to ambient playbacks (Nedelec et al., 2017b). This suggests that chronic or long-term exposures could have more severe consequences than brief exposures.

In contrast, larval Atlantic cod showed a stronger anti-predator response and were more difficult to capture during simulated predator attacks (Nedelec et al., 2015). There are also observations of a general lack of response to shipping and pile driving playback noise by grey mullet (*Chelon labrosus*) and the two spotted goby (*Gobiusculus flavescens*) (Roberts et al., 2016b), as well as no effect of boat noise or presence on round goby (*Neogobius melanostomus*) calling behaviors (Higgs & Humphrey, 2019). Mensinger et al. (2018) found that Australian snapper (*Pagrus auratus*) located in a protected area showed no change in feeding behavior or avoidance during boat passes, whereas snapper in areas where fishing occurs startled and ceased feeding behaviors during boat presence. This supports that location and past experience also have an influence on whether fishes react.

Although behavioral responses such as those listed above were often noted during the onset of most sound presentations, most behaviors did not last long and animals quickly returned to baseline behavior patterns. In fact, in one study, when given the chance to move from a noisy tank (with sound pressure levels reaching 120–140 dB re 1 µPa) to a quieter tank (sound pressure levels of 110 dB re 1 µPa), there was no evidence of avoidance. The fish did not seem to prefer the quieter environment and continued to swim between the two tanks comparable to control sessions (Neo et al., 2015). However, many of these reactions are difficult to extrapolate to real-world conditions due to the captive environment in which testing occurred.

To investigate potential avoidance on a larger scale, Ivanova et al. (2020) tagged Arctic cod and recorded movement and behavior during exposure to noise produced by cargo and cruise ship traffic. Overall, cod increased their horizontal movement outside of their estimated home range when vessels were either present or moving, compared to periods where vessels were absent, indicating periods of potential avoidance. In addition, changes in feeding, travel, and search behaviors were observed when comparing each sound condition. Future studies should continue to investigate whether these observed effects are prolonged or how quickly fish may return to their home range and baseline behaviors.

Most fish species should be able to detect vessel noise due to its low-frequency content and their hearing capabilities (see Section 3.9.2.1, Hearing and Vocalization). The *ANSI Sound Exposure Guideline* technical report (Popper et al., 2014) suggests that fishes have a high to moderate probability of reacting to nearby vessel noise (i.e., within tens of meters) with decreasing probability of reactions with increasing distance from the source (hundreds or more meters).

3.9.3.1.1.6 Long-Term Consequences

Section 3.0.3.7 (Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities) provides additional information on potential pathways for long-term consequences. Mortality removes an individual fish from the population and injury reduces the fitness of an individual. Few studies have been conducted on any long-term consequences from repeated hearing loss, stress, or behavioral reactions in fishes due to exposure to loud sounds (Hawkins et al., 2015; Popper & Hastings, 2009a; Popper et al., 2014). Repeated exposures of an individual to multiple sound-producing activities over a season, year, or life stage could cause reactions with costs that can accumulate over time to cause long-term consequences for the individual. These long-term consequences may affect the survivability of the individual, or if impacting enough individuals may have population-level effects, including alteration from migration paths, avoidance of important habitat, or even cessation of foraging or reproductive behavior (Hawkins et al., 2015). Conversely, some animals habituate to or become tolerant of repeated exposures over time, learning to ignore a stimulus that in the past has not accompanied any overt threat. In fact, Sivle et al. (2016) predicted that exposures to sonar at the maximum levels tested would only result in short-term disturbance and would not likely affect the overall population in sensitive fishes such as Atlantic herring.

3.9.3.1.2 Impacts from Sonar and Other Transducers

The overall use of sonar and other transducers for training and testing would be similar to what was analyzed in the 2015 NWTT Final EIS/OEIS for some activities and would increase for other activities (see Tables 2.5-1, 2.5-2, and 3.0-2 for details). Although individual activities may vary some from those previously analyzed, and some new systems using new technologies will be tested under Alternative 1 and 2, the overall determinations presented in the 2015 NWTT Final EIS/OEIS remain valid.

Sonar and other transducers proposed for use are transient in most locations because activities that involve sonar and other transducers take place at different locations and many platforms are generally moving throughout the Study Area. A few activities involving sonar and other transducers occur in inshore waters (within bays and estuaries), including at pierside locations. Sonar and other transducers emit sound waves into the water to detect objects, safely navigate, and communicate. General categories and characteristics of these systems and the number of hours these sonars will be operated are described in Section 3.0.3.1.1 (Sonar and Other Transducers). The activities that use sonar and other transducers are described in Appendix A (Navy Activities Descriptions).

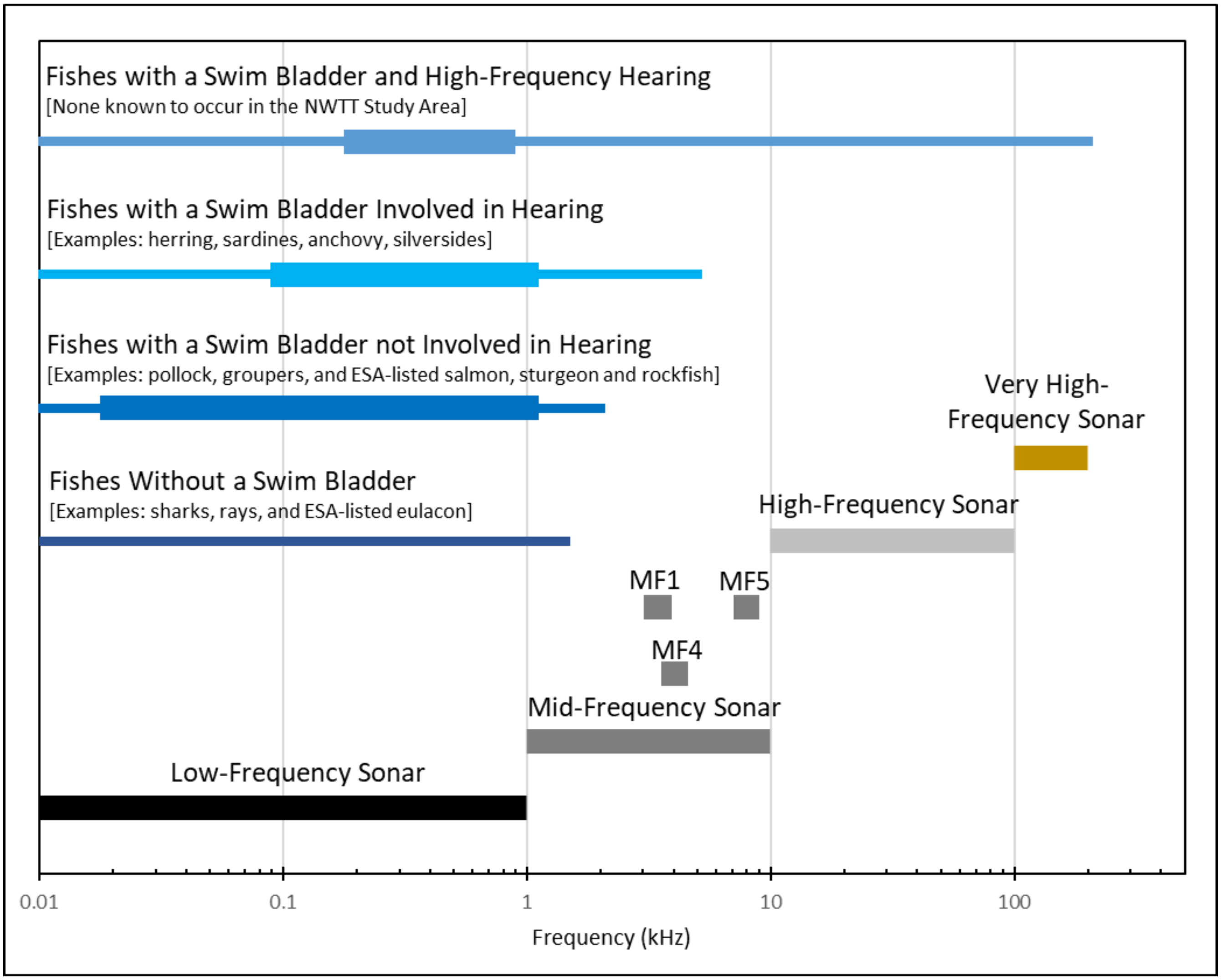
As described under Section 3.9.3.1.1.1 (Injury – Injury due to Sonar and Other Transducers), direct injury from sonar and other transducers is highly unlikely because injury has not been documented in fish exposed to sonar (Halvorsen et al., 2013; Halvorsen et al., 2012c; Popper et al., 2007) and therefore is not considered further in this analysis.

Fishes are not equally sensitive to noise at all frequencies. Fishes must first be able to hear a sound in order to be affected by it. As discussed in Section 3.9.2.1 (Hearing and Vocalization), many marine fish species tested to date hear primarily below 1 kHz. For the purposes of this analysis, fish species were grouped into one of four fish hearing groups based on either their known hearing ranges (i.e., audiograms) or physiological features that may be linked to overall hearing capabilities (i.e., swim bladder with connection to, or in close proximity to, the inner ear). Figure 3.9-6 provides a general summary of hearing threshold data from available literature (e.g., Casper & Mann, 2006; Deng et al., 2013; Kéver et al., 2014; Mann et al., 2001; Ramcharitar et al., 2006) to demonstrate the potential overall range of frequency detection for each hearing group.

Due to data limitations, these estimated hearing ranges may be overly conservative in that they may extend beyond what some species within a given fish hearing group may actually detect. For example, although most sharks are most sensitive to lower frequencies, well below 1 kHz, the bull shark has been tested and can detect frequencies up to 1.5 kHz (Kritzler & Wood, 1961; Myrberg, 2001) and therefore represents the uppermost known limit of frequency detection for this hearing group. These upper bounds of each fish hearing groups' frequency range are outside of the range of best sensitivity for the majority of fishes within that group. As a result, fishes within each group would only be able to detect those upper frequencies at close distances to the source, and from sources with relatively high source levels.

Figure 3.9-6 is not a composite audiogram but rather displays the basic overlap in potential frequency content for each hearing group with Navy defined sonar classes (i.e., low-, mid-, high- and very high-frequency) as discussed under Section 3.0.3.1.1 (Sonar and Other Transducers – Classification of Sonar and Other Transducers).

Systems within the low-frequency sonar class present the greatest potential for overlap with fish hearing. Some mid-frequency sonars and other transducers may also overlap some species' hearing ranges, but to a lesser extent than low-frequency sonars. For example, the only hearing groups that have the potential to detect mid-frequency sources within bins MF1, MF4 and MF5 are fishes with a swim bladder involved in hearing and with high-frequency hearing. It is anticipated that most marine fishes would not hear, or be affected by, mid-frequency Navy sonars or other transducers with operating frequencies greater than about 1–4 kHz. Only a few fish species (i.e., fish with a swim bladder and high-frequency hearing specializations) can detect, and therefore be potentially affected by, high- and very high-frequency sonars and other transducers.



Notes: Thin blue lines represent the estimated minimum and maximum range of frequency detection for the hearing group. All hearing groups are assumed to hear down to 0.01 kHz regardless of available data. Thicker portions of each blue line represent the estimated minimum and maximum range of best sensitivity for that group. Currently, no data are available to estimate the range of best sensitivity for fishes without a swim bladder. Although each sonar class is represented graphically by the horizontal black, grey and brown bars, not all sources within each class would operate at all the displayed frequencies. Example mid-frequency classes are provided to further demonstrate this. kHz = kilohertz, MF1 = 3.5 kHz, MF4 = 4 kHz, MF5 = 8 kHz.

Figure 3.9-6: Fish Hearing Group and Navy Sonar Bin Frequency Ranges

The most probable impacts from exposure to sonar and other transducers are TTS (for more detail see Section 3.9.3.1.1.2, Hearing Loss), masking (for more detail see Section 3.9.3.1.1.3, Masking), physiological stress (for more detail see Section 3.9.3.1.1.4, Physiological Stress), and behavioral reactions (for more detail see Section 3.9.3.1.1.5, Behavioral Reactions). Analysis of these effects are provided below.

3.9.3.1.2.1 Methods for Analyzing Impacts from Sonar and Other Transducers

The Navy performed a quantitative analysis to estimate the range to TTS for fishes exposed to sonar and other transducers used during Navy training and testing activities. Inputs to the quantitative analysis included sound propagation modeling in the Navy Acoustic Effects Model to the sound exposure criteria and thresholds presented below to predict ranges to effects. Although ranges to effect are predicted, density data for fish species within the Study Area are not available; therefore, it is not possible to estimate the total number of individuals that may be affected by sound produced by sonar and other transducers.

Criteria and thresholds to estimate impacts from sonar and other transducers are presented below in Table 3.9-3. Thresholds for hearing loss are typically reported in cumulative sound exposure level so as to account for the duration of the exposure. Therefore, thresholds reported in the *ANSI Sound Exposure Guideline* technical report (Popper et al., 2014) that were presented in other metrics were converted to sound exposure level based on the signal duration reported in the original studies (see Halvorsen et al., 2013; Halvorsen et al., 2012c; Kane et al., 2010; Popper et al., 2007). General research findings from these studies can be reviewed in Section 3.9.3.1.1.2 (Hearing Loss).

Table 3.9-3: Sound Exposure Criteria for TTS from Sonar

Fish Hearing Group	TTS from Low-Frequency Sonar (SEL_{cum})	TTS from Mid-Frequency Sonar (SEL_{cum})
Fishes without a swim bladder	NC	NC
Fishes with a swim bladder not involved in hearing	> 210	NC
Fishes with a swim bladder involved in hearing	210	220
Fishes with a swim bladder and high-frequency hearing	210	220

Notes: TTS = Temporary Threshold Shift, SEL_{cum} = Cumulative sound exposure level (decibel referenced to 1 micropascal squared seconds [dB re 1 μPa^2-s]), NC = effects from exposure to sonar is considered to be unlikely, therefore no criteria are reported, > indicates that the given effect would occur above the reported threshold.

For mid-frequency sonars, fishes with a swim bladder involved in hearing have shown signs of hearing loss because of mid-frequency sonar exposure at a maximum received sound pressure level of 210 dB re 1 µPa for a total duration of 15 seconds. To account for the total duration of the exposure, the threshold for TTS is a cumulative sound exposure level of 220 dB re 1 μPa^2-s (Halvorsen et al., 2012c; Kane et al., 2010). The same threshold is used for fishes with a swim bladder and high frequency hearing as a conservative measure although fishes in this hearing group have not been tested for the same impact. TTS has not been observed in fishes with a swim bladder that is not involved in hearing exposed to mid-frequency sonar. Fishes within this hearing group do not sense pressure well and typically cannot hear at frequencies above 1 kHz (Halvorsen et al., 2012c; Popper et al., 2014). Therefore, no criteria were proposed for fishes with a swim bladder that is not involved in hearing from exposure to mid-frequency sonars as it is considered unlikely for TTS to occur. Fishes without a swim bladder are even less susceptible to noise exposure; therefore, TTS is unlikely to occur, and no criteria are proposed for this group either.

For low-frequency sonar, as described in Section 3.9.3.1.1.2 (Hearing Loss), exposure of fishes with a swim bladder has resulted in TTS (Halvorsen et al., 2013; Kane et al., 2010; Popper et al., 2007). Specifically, fishes with a swim bladder not involved in hearing showed signs of hearing loss after exposure to a maximum received sound pressure level of 193 dB re 1 µPa for 324 and 648 seconds (cumulative sound exposure level of 218 and 220 dB re 1 µPa^2-s, respectively) (Kane et al., 2010; Popper et al., 2007). In addition, exposure of fishes with a swim bladder involved in hearing to low-frequency sonar at a sound pressure level of 195 dB re 1 µPa for 324 seconds (cumulative sound exposure level of 215 dB re 1 µPa^2-s) resulted in TTS (Halvorsen et al., 2013). Although the results were variable, it can be assumed that TTS may occur in fishes within the same hearing groups at similar exposure levels. As a conservative measure, the threshold for TTS from exposure to low-frequency sonar for all fish hearing groups with a swim bladder was rounded down to a cumulative sound exposure level of 210 dB re 1 µPa^2-s.

Criteria for high- and very-high-frequency sonar were not available in the *ANSI Sound Exposure Guideline* technical report (Popper et al., 2014); however, only species with a swim bladder involved in hearing and with high-frequency specializations, such as shad, could potentially be affected. The majority of fish species within the Study Area are unlikely to be able to detect these sounds. There is little data available on hearing loss from exposure of fishes to these high-frequency sonars. Due to the lack of available data, and as a conservative measure, effects to these hearing groups from high-frequency sonars would utilize the lowest threshold available for other hearing groups (a cumulative sound exposure level of 210 dB re 1 µPa^2-s), but effects would largely be analyzed qualitatively.

3.9.3.1.2.2 Impact Ranges for Sonar and Other Transducers

The following section provides ranges to specific effects from sonar and other transducers. Ranges are calculated using criteria from Table 3.9-4 and the Navy Acoustic Effects Model. Only ranges to TTS were predicted based on available data. Sonar durations of 1, 30, 60 and 120 seconds were used to calculate the ranges below. However, despite the variation in exposure duration, ranges were almost identical across these durations and therefore were combined and summarized by bin in the table below. General source levels, durations, and other characteristics of these systems are described in Section 3.0.3.1.1 (Sonar and Other Transducers).

3.9.3.1.2.3 Impacts from Sonar and Other Transducers Under Alternative 1

Impacts from Sonar and Other Transducers Under Alternative 1 for Training Activities

Sonar and other transducers emit sound waves into the water to detect objects, safely navigate, and communicate. Use of sonar and other transducers would typically be transient and temporary. General categories and characteristics of sonar systems and the number of hours these sonars would be operated during training under Alternative 1 are described in Section 3.0.3.1.1 (Sonar and Other Transducers). Activities using sonars and other transducers would be conducted as described in Chapter 2 (Description of Proposed Action and Alternatives) and Appendix A (Navy Activities Descriptions). Overall use of sonar and other transducers in this Supplement EIS/OEIS compared with the totals analyzed in the 2015 NWTT Final EIS/OEIS are described in Tables 3.0-2 and 3.0-3.

Only a few species of shad within the Clupeidae family, subfamily Alosinae, are known to be able to detect high-frequency sonar and other transducers (greater than 10 kHz) and are considered a part of the fish hearing group for species with a swim bladder that have high-frequency hearing. However, these species are not present in the NWTT Study Area. Other marine fishes would probably not detect these high-frequency sounds and therefore would not experience masking, physiological stress, or behavioral disturbance.

Table 3.9-4: Ranges to Temporary Threshold Shift from Four Representative Sonar Bins

Fish Hearing Group	*Range to Effects (meters)*			
	Sonar Bin LF4 Low-frequency	*Sonar Bin MF1 Hull-mounted surface ship sonars (e.g., AN/SQS-53C and AN/SQS-61)*	*Sonar Bin MF4 Helicopter-deployed dipping sonars (e.g., AN/AQS-22)*	*Sonar Bin MF5 Active acoustic sonobuoys (e.g., DICASS)*
Fishes without a swim bladder	NR	NR	NR	NR
Fishes with a swim bladder not involved in hearing	0	NR	NR	NR
Fishes with a swim bladder involved in hearing	0	6 (0–11)	0	0
Fishes with a swim bladder and high frequency hearing	0	6 (0–11)	0	0

Notes: Ranges to TTS represent modeled predictions in different areas and seasons within the Study Area. The average range to TTS is provided as well as the minimum to the maximum range to TTS in parenthesis. Where only one number is provided the average, minimum, and maximum ranges to TTS are the same.
LF = low-frequency, MF = mid-frequency, NR = no criteria are available and therefore no range to effects are estimated.

Under Alternative 1, training activities would fluctuate each year to account for the natural variation of training cycles and deployment schedules. Most anti-submarine warfare activities involving submarines or submarine targets occur in waters greater than 600 feet [ft.] (approximately 180 m) deep and would typically be used beyond 12 NM from shore. Exceptions include sonar maintenance and system checks while transiting to or from port. Some unit-level anti-submarine warfare training requirements would be conducted using synthetic means (e.g., simulators) or would be completed through other training exercises. However, training activities using low- and some mid-frequency sonars within most marine and anadromous fishes hearing range (< 2 kHz) would not fluctuate between years. Overall, use of sources in this frequency range are less common during training activities than testing activities, and occur less often than sources with higher frequency content. Although training activities using sonar and other transducers could occur throughout the Study Area, low-and some mid-frequency sonars within the hearing range of most fish only occur in the Offshore Area.

As discussed above, most marine fish species are not expected to detect sounds in the mid-frequency range (above a few kHz) of most operational sonars. The fish species that are known to detect mid-frequencies (i.e., those with swim bladders, including some sciaenids [drum], most clupeids [herring, shad], and potentially deep-water fish such as myctophids [lanternfish]) do not have their best sensitivities in the range of the operational sonars. Thus, fishes may only detect the most powerful systems, such as hull-mounted sonar, within a few kilometers; and most other, less powerful mid-frequency sonar systems, for a kilometer or less. Fishes with a swim bladder involved in hearing and with high-frequency hearing are more susceptible to hearing loss due to exposure to mid-frequency sonars. However, the maximum estimated range to TTS for these fish hearing groups is equal to or less than 10 m for only the most powerful sonar bins. Fishes within these hearing groups would have to be very close to the source and the source levels would have to be relatively high in order to experience this effect.

Most mid-frequency active sonars used in the Study Area would not have the potential to substantially mask key environmental sounds or produce sustained physiological stress or behavioral reactions due to the limited time of exposure resulting from the moving sound sources and variable duty cycles. However, it is important to note that some mid-frequency sonars have a high duty cycle or are operated continuously. This may increase the risk of masking, but only for important biological sounds that overlap with the frequency of the sonar being operated. Furthermore, although some species may be able to produce sound at higher frequencies (greater than 1 kHz), vocal marine fishes, such as sciaenids, largely communicate below the range of mid-frequency levels used by most sonars. Any such effects would be temporary and infrequent as a vessel operating mid-frequency sonar transits an area. As such, mid-frequency sonar use is unlikely to impact individuals. Long-term consequences for fish populations due to exposure to mid-frequency sonar and other transducers are not expected.

All marine fish species can likely detect low-frequency sonars and other transducers. However, low-frequency active sonar use is rare during training activities and most low-frequency active operations are conducted in deeper waters, usually beyond the continental shelf break. The majority of fish species, including those that are the most highly vocal, exist on the continental shelf and within nearshore, estuarine areas. However, some species may still be present where low-frequency sonar and other transducers are used. Most low-frequency sonar sources do not have a high enough source level to cause TTS. Although highly unlikely, if TTS did occur, it may reduce the detection of biologically significant sounds but would likely recover within a few minutes to days.

The majority of fish species exposed to sonar and other transducers within near (tens of meters) to far (thousands of meters) distances of the source would be more likely to experience; mild physiological stress; brief periods of masking; behavioral reactions such as startle or avoidance responses, although risk would be low even close to the source; or no reaction. However, based on the information provided in the *ANSI Sound Exposure Guideline* technical report (Popper et al., 2014), the relative risk of these effects at any distance are expected to be low. Due to the transient nature of most sonar operations, overall effects would be localized and infrequent, only lasting a few seconds or minutes. Based on the low level and short duration of potential exposure to low-frequency sonar and other transducers, long-term consequences for fish populations are not expected.

As discussed previously in Section 3.9.2.1 (Hearing and Vocalization) and as shown in Figure 3.9-6, all ESA-listed fish species that occur in the Study Area are capable of detecting sound produced by low- and some mid-frequency (< 2kHz) sonars and other transducers. Pacific eulachon do not have a swim bladder and cannot detect frequencies above 1 kHz. ESA-listed salmon species, rockfish, and green sturgeon have a swim bladder not involved in hearing and may be able to detect some mid-frequency sources below 2 kHz, but they are not particularly sensitive to these frequencies. Therefore, impacts from mid-, high- or very high-frequency sonar and other transducers are not expected for any ESA-listed and proposed species.

All ESA-listed salmon species are present in the Offshore Area throughout some portion of the year. In addition, the ESA-listed Puget Sound Chinook salmon ESU, Hood Canal summer-run chum salmon ESU, Puget Sound DPS of Steelhead, and Coastal-Puget Sound DPS of bull trout also occur in the Inland

Waters. Puget Sound/Georgia Basin DPS of bocaccio and yelloweye rockfish only occur in the Inland Waters. Training activities that use sonar and other transducers with frequency content at or below 2 kHz are not operated in the Inland Waters, therefore fishes that occur in the Inland Waters would not be exposed to these sources. Green sturgeon and Pacific eulachon occur throughout the Study Area and could be exposed to low-frequency sonar in the Offshore Area. There are no low- or mid-frequency (< 2kHz) sources operated in Western Behm Canal during training activities, therefore ESA-listed species that occur there would not be impacted.

Impacts on ESA-listed fishes, if they occur, would be similar to impacts on fishes in general. However, due to the short-term, infrequent and localized nature of these activities, ESA-listed fishes are unlikely to be exposed multiple times within a short period. In addition, physiological and behavioral reactions would be expected to be brief (seconds to minutes) and infrequent based on the low probability of co-occurrence between training activities and these species. Although individuals may be impacted, long-term consequences for populations would not be expected.

Designated critical habitat for the Puget Sound Chinook salmon ESU, Hood Canal Summer-run chum salmon ESU, the Coastal-Puget Sound DPS of bull trout, the Puget Sound/Georgia Basin DPS of bocaccio and yelloweye rockfish, and the Southern DPS of green sturgeon overlap the Study Area in the Inland Waters. In addition, designated critical habitat for bull trout and green sturgeon occur in the nearshore coastal areas of the Study Area. However, most of the physical and biological features for the anadromous ESA-listed species are generally not applicable to the Study Area (e.g., features associated with freshwater riverine habitat). While activities could occur in close proximity to designated critical habitat, no adverse effects to any physical or biological features (e.g., water quality, habitat structure, prey availability, or unobstructed passageways) are anticipated from exposure to sonar and other transducers.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of sonar and other transducers during training activities, as described under Alternative 1, may affect ESA-listed salmonids (all ESUs and DPSs) including bull trout (Coastal Puget Sound DPS), Pacific eulachon (Southern DPS), and green sturgeon (Southern DPS). The Navy has consulted with NMFS and USFWS as required by Section 7(a)(2) of the ESA. The use of sonar and other transducers would have no effect on ESA-listed bocaccio rockfish (Puget Sound/Georgia Basin DPS), yelloweye rockfish (Puget Sound/Georgia Basin DPS), or on designated critical habitat for Chinook (Puget Sound ESU), chum (Hood Canal summer-run ESU), bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), yelloweye rockfish (Puget Sound/Georgia Basin DPS), and green sturgeon (Southern DPS).

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of sonar and other transducers associated with training activities, as described under Alternative 1, may affect EFH species within the Study Area.

Impacts from Sonar and Other Transducers Under Alternative 1 for Testing Activities

General categories and characteristics of sonar systems and the number of hours these sonars would be operated during testing under Alternative 1 are described in Section 3.0.3.1.1 (Sonar and Other Transducers). Activities using sonars and other transducers would be conducted as described in Chapter 2 (Description of Proposed Action and Alternatives) and Appendix A (Navy Activities

Descriptions). Overall use of sonar and other transducers in this Supplemental compared with the totals analyzed in the 2015 NWTT Final EIS/OEIS are described in Tables 2.5-1 and 2.5-2.

Testing activities using sonar and other transducers would occur throughout the Study Area, with the majority of use occurring in the Inland Waters. Low-frequency sources are operated more frequently under testing activities than under training activities, including low- and some mid-frequency sonars (< 2kHz) that operate within most fish hearing ranges. In addition, some new systems using new technologies will be tested under Alternative 1 compared to systems analyzed in the 2015 NWTT Final EIS/OEIS. Although the general impacts from sonar and other transducers under testing would be similar to those described under training, there would be more impacts under testing activities as all marine fishes can detect low frequency sources.

Hearing loss in fishes from exposure to sonar and other transducers is unlikely. Although unlikely, if TTS did occur, it would occur within tens of meters of the source and only in select hearing groups. The majority of fish species exposed to sonar and other transducers within near (tens of meters) to far (thousands of meters) distances of the source would be more likely to experience; mild physiological stress; brief periods of masking; behavioral reactions such as startle or avoidance responses, although risk would be low even close to the source; or no reaction. However, based on the information provided in the *ANSI Sound Exposure Guideline* technical report (Popper et al., 2014), the relative risk of these effects at any distance are expected to be low. Long-term consequences for individual fish are unlikely in most cases because acoustic exposures are intermittent, transient and unlikely to repeat over short periods. Since long-term consequences for most individuals are unlikely, long-term consequences for populations are not expected.

As discussed previously in Section 3.9.2.1 (Hearing and Vocalization) and as shown in Figure 3.9-6, all ESA-listed fish species that occur in the Study Area are capable of detecting sound produced by low- and some mid-frequency (< 2kHz) sonars and other transducers. Pacific eulachon do not have a swim bladder and cannot detect frequencies above 1 kHz. ESA-listed salmon species, rockfish, and green sturgeon have a swim bladder not involved in hearing and may be able to detect some mid-frequency sources below 2 kHz, but they are not particularly sensitive to these frequencies. Therefore, impacts from mid-, high- or very high-frequency sonar and other transducers are not expected for any ESA-listed and proposed species.

All ESA-listed salmon species are present in the Offshore Area throughout the year. In addition, the ESA-listed Puget Sound Chinook salmon ESU, Hood Canal summer-run chum salmon ESU, Puget Sound DPS of steelhead, and Coastal-Puget Sound DPS of bull trout also occur in the Inland Waters. The only species that are present in Western Behm Canal include the Puget Sound ESU, Upper Columbia River spring-run ESU, Lower Columbia River ESU, Upper Willamette River ESU, Snake River spring-summer ESU, and Snake River fall-run Chinook salmon ESUs, as well as the Lower Columbia and Oregon Coast coho salmon ESU. Puget Sound/Georgia Basin DPS of bocaccio rockfish and yelloweye rockfish only occur in the Inland Waters and would only be exposed to sources in this portion of the Study Area. Green sturgeon and Pacific eulachon occur throughout the Study Area.

Impacts on ESA-listed fishes, if they occur, would be similar to impacts on fishes in general. However, due to the short-term, infrequent and localized nature of these activities, ESA-listed fishes are unlikely to be exposed multiple times within a short period. In addition, physiological and behavioral reactions would be expected to be brief (seconds to minutes) and infrequent based on the low probability of co-occurrence between training activities and these species. Although individuals may be impacted, long-term consequences for populations would not be expected.

Designated critical habitat for the Puget Sound Chinook salmon ESU, Hood Canal summer-run chum salmon ESU, the Coastal-Puget Sound DPS of bull trout, the Puget Sound/Georgia Basin DPS of bocaccio and yelloweye rockfish, and the Southern DPS of green sturgeon overlap the Study Area in the Inland Waters. In addition, designated critical habitat for bull trout and green sturgeon occur in the nearshore coastal areas of the Study Area. However, most of the physical and biological features for the anadromous ESA-listed species are generally not applicable to the Study Area (e.g., features associated with freshwater riverine habitat). While activities could occur in close proximity to designated critical habitat, no adverse effects to any physical or biological features (e.g., water quality, habitat structure, prey availability, or unobstructed passageways) are anticipated from exposure to sonar and other transducers.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of sonar and other transducers during testing activities, as described under Alternative 1, may affect ESA-listed salmonids (all ESUs and DPSs) including bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), yelloweye rockfish (Puget Sound/Georgia Basin DPS), Pacific eulachon (Southern DPS), and green sturgeon (Southern DPS). The Navy has consulted with NMFS and USFWS as required by Section 7(a)(2) of the ESA. The use of sonar and other transducers during testing activities would have no effect on designated critical habitat for Chinook (Puget Sound ESU), chum (Hood Canal summer-run ESU), bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), yelloweye rockfish (Puget Sound/Georgia Basin DPS) and green sturgeon (Southern DPS).

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of sonar and other transducers associated with testing activities, as described under Alternative 1, may affect EFH species within the Study Area.

3.9.3.1.2.4 Impacts from Sonar and Other Transducers Under Alternative 2

Impacts from Sonar and Other Transducers Under Alternative 2 for Training Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Section 3.0.3.1.1 (Sonar and Other Transducers), and Appendix A (Navy Activities Descriptions), training activities under Alternative 2 reflects the maximum number of activities that could occur within a given year. This would result in an increase in sonar use compared to Alternative 1, however the use of sonars and other transducers equal to or less than 2 kHz would remain the same between Alternative 1 and 2. The locations and general types of predicted impacts would be similar to those described above in Section 3.9.3.1.2.3 (Impacts from Sonar and Other Transducers Under Alternative 1 – Impacts from Sonar and Other Transducers Under Alternative 1 for Training Activities). The hours of use of sonars and other transducers in this Supplemental compared with the totals analyzed in the 2015 NWTT Final EIS/OEIS are described in Tables 2.5-1 and 2.5-2.

Pursuant to the ESA, the use of sonar and other transducers during training activities, as described under Alternative 2, may affect ESA-listed salmonids (all ESUs and DPSs) including bull trout (Coastal Puget Sound DPS), Pacific eulachon (Southern DPS), and green sturgeon (Southern DPS). The Navy has consulted with NMFS and USFWS as required by Section 7(a)(2) of the ESA. The use of sonar and other transducers would have no effect on ESA-listed bocaccio rockfish (Puget Sound/Georgia Basin DPS), yelloweye rockfish (Puget Sound/Georgia Basin DPS), or on designated critical habitat for Chinook (Puget Sound ESU), chum (Hood Canal summer-run ESU), bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), yelloweye rockfish (Puget Sound/Georgia Basin DPS), and green sturgeon (Southern DPS).

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of sonar and other transducers associated with training activities, as described under Alternative 2, may affect EFH species within the Study Area.

Impacts from Sonar and Other Transducers Under Alternative 2 for Testing Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Section 3.0.3.1.1 (Sonar and Other Transducers), and Appendix A (Navy Activities Descriptions), testing activities under Alternative 2 reflects the maximum number of activities that could occur within a given year. This would result in an increase in sonar use compared to Alternative 1, including sonars and other transducers equal to or less than 2 kHz. However, the locations and general types of predicted impacts would be similar to those described above in Section 3.9.3.1.2.3 (Impacts from Sonar and Other Transducers Under Alternative 1 – Impacts from Sonar and Other Transducers Under Alternative 1 for Testing Activities). The hours of use of sonars and other transducers in this Supplemental compared with the totals analyzed in the 2015 NWTT Final EIS/OEIS are described in Tables 2.5-1 and 2.5-2.

Pursuant to the ESA, the use of sonar and other transducers during testing activities, as described under Alternative 2, may affect ESA-listed salmonids (all ESUs and DPSs) including bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), yelloweye rockfish (Puget Sound/Georgia Basin DPS), Pacific eulachon (Southern DPS), and green sturgeon (Southern DPS). The Navy has consulted with NMFS and USFWS as required by Section 7(a)(2) of the ESA. The use of sonar and other transducers during testing activities would have no effect on designated critical habitat for Chinook (Puget Sound ESU), chum (Hood Canal summer-run ESU), bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), yelloweye rockfish (Puget Sound/Georgia Basin DPS) and green sturgeon (Southern DPS).

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of sonar and other transducers associated with testing activities, as described under Alternative 2, may affect EFH species within the Study Area.

3.9.3.1.2.5 Impacts from Sonar and Other Transducers Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Acoustic stressors, as listed above, would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer acoustic stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for acoustic impacts on individual fishes, but would not measurably improve the overall distribution or abundance of fishes.

3.9.3.1.3 Impacts from Vessel Noise

Fishes may be exposed to noise from vessel movement. A detailed description of the acoustic characteristics and typical sound levels of vessel noise are in Section 3.0.3.1.2 (Vessel Noise). Vessel movements involve transits to and from ports to various locations within the Study Area, including commercial ship traffic as well as recreational vessels in addition to U.S. Navy vessels. Many ongoing and proposed training and testing activities within the Study Area involve maneuvers by various types of surface ships, boats, and submarines (collectively referred to as vessels). Activities may vary slightly from those previously analyzed in the 2015 NWTT Final EIS/OEIS, but the overall determinations presented remain valid. Increases and decreases shown in Tables 2.5-1 and 2.5-2 for proposed activities under Alternative 1 and 2 do not appreciably change the impact conclusions presented in the 2015 NWTT Final EIS/OEIS.

Under the No Action Alternative, proposed training and testing activities would not occur. Acoustic stressors, as listed above, would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer vessel-associated acoustic stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for acoustic impacts on individual fishes, but would not measurably improve the overall distribution or abundance of fishes.

Pursuant to the ESA, vessel noise produced during training and testing activities, as described under Alternatives 1 and 2, may affect ESA-listed salmonids (all ESUs and DPSs) including bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), yelloweye rockfish (Puget Sound/Georgia Basin DPS), Pacific eulachon (Southern DPS), and green sturgeon (Southern DPS). The Navy has consulted with NMFS and USFWS as required by Section 7(a)(2) of the ESA. Vessel noise produced during training and testing activities would have no effect on designated critical habitat for Chinook (Puget Sound ESU), chum (Hood Canal summer-run ESU), bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), yelloweye rockfish (Puget Sound/Georgia Basin DPS) and green sturgeon (Southern DPS).

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, vessel noise produced during training and testing activities, as described under Alternative 1 and Alternative 2, may affect EFH species within the Study Area.

3.9.3.1.4 Impacts from Aircraft Noise

Fishes that occur near or at the waters' surface may be exposed to aircraft noise, although this is considered to be unlikely. Fixed, rotary-wing, and tilt-rotor aircraft are used during a variety of training and testing activities throughout the Study Area. Tilt-rotor impacts would be similar to fixed-wing or helicopter impacts depending which mode the aircraft is in. Most of these sounds would be concentrated around airbases and fixed ranges within the range complex. Aircraft noise could also occur in the waters immediately surrounding aircraft carriers at sea during takeoff and landing. 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 (helicopters) produce low-frequency sound and vibration (Pepper et al., 2003). A detailed description of aircraft noise as a stressor is in Section 3.0.3.1.3 (Aircraft Noise).

Activities may vary slightly from those previously analyzed in the 2015 NWTT Final EIS/OEIS. The analysis of impacts from aircraft noise in this Supplemental will supplant the 2015 NWTT Final EIS/OEIS for fishes, and may result in changes to estimated impacts for some species since the 2015 NWTT Final EIS/OEIS.

3.9.3.1.4.1 Methods for Analyzing Impacts from Aircraft Noise

The amount of sound entering the ocean from aircraft would be very limited in duration, sound level, and affected area. Due to the low level of sound that could enter the water from aircraft, hearing loss is not further considered as a potential effect. Potential impacts considered are masking of other biologically relevant sounds, physiological stress, and changes in behavior. Reactions by fishes to these specific stressors have not been recorded however, fishes would be expected to react to aircraft noise as they would react to other transient sounds (e.g., vessel noise).

For this analysis, the Navy assumes that some fish at or near the water surface may exhibit startle reactions to certain aircraft noise if aircraft altitude is low. This could mean a hovering helicopter, for which the sight of the aircraft and water turbulence could also cause a response, or a low-flying or super-sonic aircraft generating enough noise to be briefly detectable underwater or at the air-water interface. Because any fixed-wing aircraft noise would be brief, the risk of masking any sounds relevant to fishes is very low. The *ANSI Sound Exposure Guidelines* for fishes did not consider this acoustic stressor (Popper et al., 2014).

3.9.3.1.4.2 Impacts from Aircraft Noise Under Alternative 1

Impacts from Aircraft Noise Under Alternative 1 for Training Activities

Fishes may be exposed to aircraft-generated noise throughout the Study Area. Characteristics of aircraft noise are described in Section 3.0.3.1.3 (Aircraft Noise). Activities with aircraft would be conducted as described in Chapter 2 (Description of Proposed Action and Alternatives) and Appendix A (Navy Activities Descriptions). Aircraft training activities would usually occur adjacent to Navy installations and in Special Use Airspace within the Study Area.

Under Alternative 1, activities may vary slightly from those previously analyzed in the 2015 NWTT Final EIS/OEIS. Increases and decreases are shown in Tables 2.5-1 and 2.5-2 for proposed activities under Alternative 1 and 2.

In most cases, exposure of fishes to fixed-wing aircraft presence and noise would be brief as the aircraft quickly passes overhead. Fishes would have to be at or near the surface at the time of an overflight to be exposed to appreciable sound levels. Due to the low sound levels in water, it is unlikely that fishes would respond to most fixed-wing aircraft or transiting helicopters. Because most overflight exposure 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.

Daytime and nighttime activities involving helicopters may occur for extended periods of time, up to a couple of hours in some areas. During these activities, helicopters would typically transit throughout an area but could also hover over the water. Longer event durations and periods of time where helicopters hover may increase the potential for behavioral reactions, startle reactions, masking, and physiological stress. Low-altitude flights of helicopters during some activities, which often occur under 100 ft. altitude, may elicit a stronger startle response due to the proximity of a helicopter to the water; the slower airspeed and longer exposure duration; and the downdraft created by a helicopter's rotor.

If fish were to respond to aircraft noise, only short-term behavioral or physiological reactions (e.g., avoidance and increased heart rate) would be expected. Therefore, long-term consequences for individuals would be unlikely and long-term consequences for populations are not expected.

As discussed previously in Section 3.9.2.1 (Hearing and Vocalization), all ESA-listed fish species that occur in the Study Area are capable of detecting aircraft noise and could be exposed throughout the Study Area. However, due to the small area within which sound could potentially enter the water and the extremely brief window the sound could be present, exposures of fishes to aircraft noise would be extremely rare and, in the event that they did occur, would be very brief (seconds).

Designated critical habitat for the Puget Sound Chinook salmon ESU, Hood Canal summer-run chum salmon ESU, the Coastal-Puget Sound DPS of bull trout, the Puget Sound/Georgia Basin DPS of bocaccio and yelloweye rockfish, and the Southern DPS of green sturgeon overlap the Study Area in the Inland Waters. In addition, designated critical habitat for bull trout and green sturgeon occur in the nearshore coastal areas of the Study Area. However, most of the physical and biological features for the anadromous ESA-listed species are generally not applicable to the Study Area (e.g., features associated with freshwater riverine habitat). While activities could occur in close proximity to designated critical habitat, no adverse effects to any physical or biological features (e.g., water quality, habitat structure, prey availability, or unobstructed passageways) are anticipated from exposure to aircraft noise.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, aircraft noise produced during training activities, as described under Alternative 1, may affect ESA-listed salmonids (all ESUs and DPSs) including bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), yelloweye rockfish (Puget Sound/Georgia Basin DPS), Pacific eulachon (Southern DPS), and green sturgeon (Southern DPS). The Navy has consulted with NMFS and USFWS as required by Section 7(a)(2) of the ESA. Aircraft noise produced during training activities would have no effect on designated critical habitat for Chinook (Puget Sound ESU), chum (Hood Canal summer-run ESU), bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), yelloweye rockfish (Puget Sound/Georgia Basin DPS), and green sturgeon (Southern DPS).

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, aircraft noise produced during training activities, as described under Alternative 1, may affect EFH species within the Study Area.

<u>Impacts from Aircraft Noise Under Alternative 1 for Testing Activities</u>

Characteristics of aircraft noise are described in Section 3.0.3.1.3 (Aircraft Noise). Activities with aircraft would be conducted as described in Chapter 2 (Description of Proposed Action and Alternatives) and Appendix A (Navy Activities Descriptions). Aircraft testing activities would usually occur adjacent to Navy installations and in special use airspace within the Study Area. Under Alternative 2, activities may vary slightly from those previously analyzed in the 2015 NWTT Final EIS/OEIS. Increases and decreases are shown in Tables 2.5-1 and 2.5-2 for proposed activities under Alternative 1 and 2.

Proposed testing activities under Alternative 1 that involve aircraft differ in number and location from training activities under Alternative 1; however, the types and severity of impacts would not be discernible from those described above in Section 3.9.3.1.4.2 (Impacts from Aircraft Noise Under Alternative 1 – Impacts from Aircraft Noise Under Alternative 1 for Training Activities).

Pursuant to the ESA, aircraft noise produced during testing activities, as described under Alternative 1, may affect ESA-listed salmonids (all ESUs and DPSs) including bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), yelloweye rockfish (Puget Sound/Georgia Basin DPS), Pacific eulachon (Southern DPS), and green sturgeon (Southern DPS). The Navy has consulted with NMFS and USFWS as required by Section 7(a)(2) of the ESA. Aircraft noise produced during testing activities would have no effect on designated critical habitat for Chinook (Puget Sound ESU), chum (Hood Canal summer-run ESU), bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), yelloweye rockfish (Puget Sound/Georgia Basin DPS), and green sturgeon (Southern DPS).

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, aircraft noise produced during testing activities, as described under Alternative 1, may affect EFH species within the Study Area.

3.9.3.1.4.3 Impacts from Aircraft Noise Under Alternative 2

<u>Impacts from Aircraft Noise Under Alternative 2 for Training Activities</u>

As discussed in Chapter 2 (Description of Proposed Action and Alternatives), and Section 3.0.3.1.3 (Aircraft Noise), training activities under Alternative 2 include a minor increase in the number of events that involve aircraft as compared to Alternative 1; however, the training locations, types of aircraft, and severity of predicted impacts would not be discernible from those described above in Section 3.9.3.1.4.2 (Impacts from Aircraft Noise Under Alternative 1 – Impacts from Aircraft Noise Under Alternative 1 for Training Activities).

Pursuant to the ESA, aircraft noise produced during training activities, as described under Alternative 2, may affect ESA-listed salmonids (all ESUs and DPSs) including bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), yelloweye rockfish (Puget Sound/Georgia Basin DPS), Pacific eulachon (Southern DPS), and green sturgeon (Southern DPS). The Navy has consulted with NMFS and USFWS as required by Section 7(a)(2) of the ESA. Aircraft noise produced during training activities would have no effect on designated critical habitat for Chinook (Puget Sound ESU), chum (Hood Canal summer-run ESU), bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), yelloweye rockfish (Puget Sound/Georgia Basin DPS), and green sturgeon (Southern DPS).

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, aircraft noise produced during training activities, as described under Alternative 2, may affect EFH species within the Study Area.

<u>Impacts from Aircraft Noise Under Alternative 2 for Testing Activities</u>

As discussed in Chapter 2 (Description of Proposed Action and Alternatives), and Section 3.0.3.1.3 (Aircraft Noise), testing activities under Alternative 2 include a minor increase in the number of events that involve aircraft as compared to Alternative 1; however, the training locations, types of aircraft, and severity of predicted impacts would not be discernible from those described above in Section 3.9.3.1.4.2 (Impacts from Aircraft Noise Under Alternative 1 – Impacts from Aircraft Noise under Alternative 1 for Training Activities).

Pursuant to the ESA, aircraft noise produced during testing activities, as described under Alternative 2, may affect ESA-listed salmonids (all ESUs and DPSs) including bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), yelloweye rockfish (Puget Sound/Georgia Basin DPS), Pacific eulachon (Southern DPS), and green sturgeon (Southern DPS). The Navy has consulted with NMFS and USFWS as required by Section 7(a)(2) of the ESA. Aircraft noise produced during testing activities would have no effect on designated critical habitat for Chinook (Puget Sound ESU), chum (Hood Canal summer-run ESU), bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), yelloweye rockfish (Puget Sound/Georgia Basin DPS), and green sturgeon (Southern DPS).

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, aircraft noise produced during testing activities, as described under Alternative 2, may affect EFH species within the Study Area.

3.9.3.1.4.4 Impacts from Aircraft Noise Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Acoustic stressors, as listed above, would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer acoustic stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for acoustic impacts on individual fishes, but would not measurably improve the overall distribution or abundance of fishes.

3.9.3.1.5 Impacts from Weapon Noise

Fishes may be exposed to sounds caused by the firing of weapons, objects in flight, and impact of non-explosive munitions on the water's surface, which are described in Section 3.0.3.1.4 (Weapons Noise). In general, these are impulsive sounds (such as those discussed under Section 3.0.3.2, Explosive Stressors) generated in close vicinity to or at the water surface, with the exception of items that are launched underwater. 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 flying through the air. 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 and rapidly fades as the missile or target travels downrange. Due to the transient nature of most activities that produce weapon noise, overall effects would be localized and infrequent, only lasting a few seconds or minutes. Reactions by fishes to these specific stressors have not been recorded however, fishes would be expected to react to weapon noise as they would react to other transient impulsive sounds.

The Coastal-Puget Sound DPS of bull trout occur in the nearshore coastal areas of the Offshore Area. Exposure to weapons noise in the Offshore Area would be limited to the Quinault Range Site. However, within 50 nautical miles (NM) and 20 NM from shore in the Marine Species Coastal Mitigation Area, the Navy will not conduct explosive and non-explosive large-caliber gunnery training activities, respectively.

Within 12 NM from shore in the Marine Species Coastal Mitigation Area, the Navy will not conduct non-explosive small- and medium-caliber gunnery training activities. These mitigation areas would eliminate the potential that ESA-listed bull trout would be exposed to activities that produce weapons noise; therefore, there would be no effect on ESA-listed bull trout.

Activities may vary slightly from those previously analyzed in the 2015 NWTT Final EIS/OEIS, but the overall determinations presented remain valid. Increases and decreases shown in Tables 2.5-1 and 2.5-2 for activities proposed under Alternative 1 and 2 do not appreciably change the impact conclusions presented in the 2015 NWTT Final EIS/OEIS.

Under the No Action Alternative, proposed training and testing activities would not occur. Acoustic stressors, as listed above, would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer acoustic stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for acoustic impacts on individual fishes, but would not measurably improve the overall distribution or abundance of fishes.

Pursuant to the ESA, weapon noise produced during training and testing activities, as described under Alternatives 1 and 2, may affect ESA-listed salmonids (all ESUs and DPSs) including bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), yelloweye rockfish (Puget Sound/Georgia Basin DPS), Pacific eulachon (Southern DPS), and green sturgeon (Southern DPS). The Navy has consulted with NMFS and USFWS as required by Section 7(a)(2) of the ESA. Vessel noise produced during training and testing activities would have no effect on designated critical habitat for Chinook (Puget Sound ESU), chum (Hood Canal summer-run ESU), bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), yelloweye rockfish (Puget Sound/Georgia Basin DPS) and green sturgeon (Southern DPS).

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, weapon noise produced during training and testing activities, as described under Alternative 1 and Alternative 2, may affect EFH species within the Study Area.

3.9.3.2 Explosive Stressors

Explosions in the water or near the water surface can introduce loud, impulsive, broadband sounds into the marine environment. However, unlike other acoustic stressors, explosives release energy at a high rate, producing a shock wave that can be injurious and even deadly. Therefore, explosive impacts on fishes are discussed separately from other acoustic stressors, even though the analysis of explosive impacts will in part rely on data for fish impacts due to impulsive sound exposure where appropriate.

Explosives are usually described by their net explosive weight, which accounts for the weight and type of explosive material. Additional explanation of the acoustic and explosive terms and sound energy concepts used in this section is found in Appendix D (Acoustic and Explosive Concepts).

This section begins with a summary of relevant data regarding explosive impacts on fishes in Section 3.9.3.2.1 (Background). The ways in which an explosive exposure could result in immediate effects or lead to long-term consequences for an animal are explained in Section 3.0.3.7 (Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities), and this section follows that framework.

Due to the availability of new literature, adjusted sound exposure criteria, and new acoustic effects modeling, the analysis provided in Section 3.9.3.2.2 (Impacts from Explosives) of this Supplemental will supplant the 2015 NWTT Final EIS/OEIS for fishes.

3.9.3.2.1 Background

The effects of explosions on fishes have been studied and reviewed by numerous authors (Keevin & Hempen, 1997; O'Keeffe, 1984; O'Keeffe & Young, 1984; Popper et al., 2014). A summary of the literature related to each type of effect forms the basis for analyzing the potential effects from Navy activities. The sections below include a survey and synthesis of best-available-science published in peer-reviewed journals, technical reports, and other scientific sources pertinent to impacts on fishes potentially resulting from Navy training and testing activities. Fishes could be exposed to a range of impacts depending on the explosive source and context of the exposure. In addition to acoustic impacts including temporary or permanent hearing loss, auditory masking, physiological stress, or changes in behavior, potential impacts from an explosive exposure can include non-lethal injury and mortality.

3.9.3.2.1.1 Injury

Injury refers to the direct effects on the tissues or organs of a fish. The blast wave from an in-water explosion is lethal to fishes at close range, causing massive organ and tissue damage (Keevin & Hempen, 1997). At greater distance from the detonation point, the extent of mortality or injury depends on a number of factors including fish size, body shape, depth, physical condition of the fish, and perhaps most importantly, the presence of a swim bladder (Keevin & Hempen, 1997; Wright, 1982; Yelverton & Richmond, 1981; Yelverton et al., 1975). At the same distance from the source, larger fishes are generally less susceptible to death or injury, elongated forms that are round in cross-section are less at risk than deep-bodied forms, and fishes oriented sideways to the blast suffer the greatest impact (Edds-Walton & Finneran, 2006; O'Keeffe, 1984; O'Keeffe & Young, 1984; Wiley et al., 1981; Yelverton et al., 1975). Species with a swim bladder are much more susceptible to blast injury from explosives than fishes without them (Gaspin, 1975; Gaspin et al., 1976; Goertner et al., 1994).

If a fish is close to an explosive detonation, the exposure to rapidly changing high pressure levels can cause barotrauma. Barotrauma is injury due to a sudden difference in pressure between an air space inside the body and the surrounding water and tissues. Rapid compression followed by rapid expansion of airspaces, such as the swim bladder, can damage surrounding tissues and result in the rupture of the airspace itself. The swim bladder is the primary site of damage from explosives (Wright, 1982; Yelverton et al., 1975). Gas-filled swim bladders resonate at different frequencies than surrounding tissue and can be torn by rapid oscillation between high- and low-pressure waves (Goertner, 1978). Swim bladders are a characteristic of most bony fishes with the notable exception of flatfishes (e.g., halibut). Sharks and rays are examples of cartilaginous fishes without a swim bladder. Small airspaces, such as micro-bubbles that may be present in gill structures, could also be susceptible to oscillation when exposed to the rapid pressure increases caused by an explosion. This may have caused the bleeding observed on gill structures of some fish exposed to explosions (Goertner et al., 1994). Sudden very high pressures can also cause damage at tissue interfaces due to the way pressure waves travel differently through tissues with different densities. Rapidly oscillating pressure waves might rupture the kidney, liver, spleen, and sinus and cause venous hemorrhaging (Keevin & Hempen, 1997).

Several studies have exposed fish to explosives and examined various metrics in relation to injury susceptibility. Sverdrup (1994) exposed Atlantic salmon (1 to 1.5 kg [2 to 3 lb.]) in a laboratory setting to repeated shock pressures of around 2 megapascals (300 pounds per square inch [psi]) without any immediate or delayed mortality after a week. Hubbs and Rechnitzer (1952) showed that fish with swim bladders exposed to explosive shock fronts (the near-instantaneous rise to peak pressure) were more susceptible to injury when several feet below the water surface than near the bottom. When near the surface, the fish began to exhibit injuries around peak pressure exposures of 40 to 70 psi. However, near the bottom (all water depths were less than 100 ft.) fish exposed to pressures over twice as high exhibited no sign of injury. Yelverton et al. (1975) similarly found that peak pressure was not correlated to injury susceptibility; instead, injury susceptibility of swim bladder fish at shallow depths (10 ft. or less) was correlated to the metric of positive impulse (pascal seconds [Pa-s]), which takes into account both the positive peak pressure, the duration of the positive pressure exposure, and the fish mass, with smaller fish being more susceptible.

Dahl et al. (2020) reported the effects of underwater explosions on one species of Clupeiform fish, Pacific sardines (*Sardinops sagax*), with a physostomous swim bladder (an open swim bladder with direct connection to the gut via pneumatic duct). Fish were stationed at various distances prior to each explosion, in addition to a control group that was not exposed. Necropsies following explosions observed significant injuries, including fat hematoma, kidney rupture, swim bladder rupture, and reproductive blood vessel rupture. While most significant injuries were consistently present at close range (<50 m), there were inconsistent findings at the 50–125 m range, suggesting possible acoustic refraction effects, including waveform paths that were bottom reflected, surface reflected, or a combination of both. Ranges at which injuries were observed within the present study are similar to those estimated by the Navy's Acoustic Effects Model for fishes with a swim bladder for detonations modeled in Southern California (where the study took place, for ranges see U.S. Department of the Navy, 2018b). The Navy continues to fund similar projects, including survival studies and those examining other types of fish (such as physoclists, species with a closed swim bladder), as they are crucial to consider before extrapolating findings to other fish species.

Gaspin et al. (1976) exposed multiple species of fish with a swim bladder, placed at varying depths, to explosive blasts of varying size and depth. Goertner (1978) and Wiley (1981) developed a swim bladder oscillation model, which showed that the severity of injury observed in those tests could be correlated to the extent of swim bladder expansion and contraction predicted to have been induced by exposure to the explosive blasts. Per this model, the degree of swim bladder oscillation is affected by ambient pressure (i.e., depth of fish), peak pressure of the explosive, duration of the pressure exposure, and exposure to surface rarefaction (negative pressure) waves. The maximum potential for injury is predicted to occur where the surface reflected rarefaction (negative) pressure wave arrives coincident with the moment of maximum compression of the swim bladder caused by exposure to the direct positive blast pressure wave, resulting in a subsequent maximum expansion of the swim bladder. Goertner (1978) and Wiley et al. (1981) found that their swim bladder oscillation model explained the injury data in the Yelverton et al. (1975) exposure study and their impulse parameter was applicable only to fishes at shallow enough depths to experience less than one swim bladder oscillation before being exposed to the following surface rarefaction wave.

O'Keeffe (1984) provides calculations and contour plots that allow estimation of the range to potential effects of in-water explosions on fish possessing swim bladders using the damage prediction model developed by Goertner (1978). O'Keeffe's (1984) parameters include the charge weight, depth of burst, and the size and depth of the fish, but the estimated ranges do not take into account unique propagation environments that could reduce or increase the range to effect. The 10 percent mortality range shown below in Table 3.9-5 is the maximum horizontal range predicted by O'Keeffe (1984) for

10 percent of fish suffering injuries that are expected to not be survivable (e.g., damaged swim bladder or severe hemorrhaging). Fish at greater depths and near the surface are predicted to be less likely to be injured because geometries of the exposures would limit the amplitude of swim bladder oscillations. In contrast, detonations at or near the surface (i.e., similar to most Navy activities that utilize bombs and missiles) would result in energy loss at the water-air interface, resulting in lower overall ranges to effect than those predicted here.

In contrast to fishes with swim bladders, fishes without swim bladders have been shown to be more resilient to explosives (Gaspin, 1975; Gaspin et al., 1976; Goertner et al., 1994). For example, some small (average 116 mm length; approximately 1 oz.) hogchokers (*Trinectes maculatus*) exposed less than 5 ft. from a 10 lb. pentolite charge immediately survived the exposure with slight to moderate injuries, and only a small number of fish were immediately killed; however, most of the fish at this close range did suffer moderate to severe injuries, typically of the gills or around the otolithic structures (Goertner et al., 1994).

Studies that have documented caged fishes killed during planned underwater explosions indicate that most fish that die do so within one to four hours, and almost all die within a day (Yelverton et al., 1975). Mortality in free-swimming (uncaged) fishes may be higher due to increased susceptibility to predation. Fitch and Young (1948) found that the type of free-swimming fish killed changed when blasting was repeated at the same location within 24 hours of previous blasting. They observed that most fish killed on the second day were scavengers, presumably attracted by the victims of the previous day's blasts.

Fitch and Young (1948) also investigated whether a significant portion of fish killed would have sunk and not been observed at the surface. Comparisons of the numbers of fish observed dead at the surface and at the bottom in the same affected area after an explosion showed that fish found dead on the bottom comprised less than 10 percent of the total observed mortality. Gitschlag et al. (2000) conducted a more detailed study of both floating fishes and those that were sinking or lying on the bottom after explosive removal of nine oil platforms in the northern Gulf of Mexico. Results were highly variable. They found that 3 to 87 percent (46 percent average) of the red snapper killed during a blast might float to the surface. Currents, winds, and predation by seabirds or other fishes may be some of the reasons that the magnitude of fish mortality may not have been accurately captured.

There have been few studies of the impact of underwater explosives on early life stages of fish (eggs, larvae, juveniles). Fitch and Young (1948) reported mortality of larval anchovies exposed to underwater blasts off California. Nix and Chapman (1985) found that anchovy and smelt larvae died following the detonation of buried charges. Similar to adult fishes, the presence of a swim bladder contributes to shock wave-induced internal damage in larval and juvenile fish (Settle et al., 2002). Explosive shock wave injury to internal organs of larval pinfish and spot exposed at shallow depths was documented by Settle et al. (2002) and Govoni et al. (2003; 2008) at impulse levels similar to those predicted by Yelverton et al. (1975) for very small fish. Settle et al. (2002) provides the lowest measured received level that injuries have been observed in larval fish. Researchers (Faulkner et al., 2006; Faulkner et al., 2008; Jensen, 2003) have suggested that egg mortality may be correlated with peak particle velocity exposure (i.e., the localized movement or shaking of water particles, as opposed to the velocity of the blast wave), although sufficient data from direct explosive exposures is not available.

Rapid pressure changes could cause mechanical damage to sensitive ear structures due to differential movements of the otolithic structures. Bleeding near otolithic structures was the most commonly observed injury in non-swim bladder fish exposed to a close explosive charge (Goertner et al., 1994).

Table 3.9-5: Range to 10% Mortality from In-Water Explosions for Fishes with a Swim Bladder

Weight of Pentolite (lb.) [NEW, lb.][1]	*Depth of Explosion (ft.) [m]*	*10% Mortality Maximum Range (ft.) [m]*		
		1 oz. Fish	*1 lb. Fish*	*30 lb. Fish*
10 [13]	10 [3]	530 [162]	315 [96]	165 [50]
	50 [15]	705 [214]	425 [130]	260 [79]
	200 [61]	905 [276]	505 [154]	290 [88]
100 [130]	10 [3]	985 [300]	600 [183]	330 [101]
	50 [15]	1,235 [376]	865 [264]	590 [180]
	200 [61]	1,340 [408]	1,225 [373]	725 [221]
1,000 [1,300]	10 [3]	1,465 [447]	1,130 [344]	630 [192]
	50 [15]	2,255 [687]	1,655 [504]	1,130 [344]
	200 [61]	2,870 [875]	2,390 [728]	1,555 [474]
10,000 [13,000]	10 [3]	2,490 [759]	1,920 [585]	1,155 [352]
	50 [15]	4,090 [1,247]	2,885 [879]	2,350 [716]
	200 [61]	5,555 [1,693]	4,153 [1,266]	3,090 [942]

[1] Explosive weights of pentolite converted to net explosive weight using the peak pressure parameters in Swisdak (1978). lb. = pounds, NEW = net explosive weight, m = meter, oz. = ounce.
Data from O'Keeffe (1984)

As summarized by the *ANSI Sound Exposure Guideline* technical report (Popper et al., 2014), exposure to explosive energy poses the greatest potential threat for injury and mortality in marine fishes. Fishes with a swim bladder are more susceptible to injury than fishes without a swim bladder. The susceptibility also probably varies with size and depth of both the detonation and the fish. Fish larvae or juvenile fish may be more susceptible to injury from exposure to explosives.

3.9.3.2.1.2 Hearing Loss

There are no direct measurements of hearing loss in fishes due to exposure to explosive sources. The sound resulting from an explosive detonation is considered an impulsive sound and shares important qualities (i.e., short duration and fast rise time) with other impulsive sounds such as those produced by air guns. PTS in fish has not been known to occur in species tested to date and any hearing loss in 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).

As reviewed in the *ANSI Sound Exposure Guideline* technical report (Popper et al., 2014), fishes without a swim bladder, or fishes with a swim bladder not involved in hearing, would be less susceptible to hearing loss (i.e., TTS), even at higher level exposures. Fish with a swim bladder involved in hearing may be susceptible to TTS within very close ranges to an explosive. General research findings regarding TTS in fishes as well as findings specific to exposure to other impulsive sound sources are discussed in Section 3.9.3.1.1.2 (Hearing Loss).

3.9.3.2.1.3 Masking

Masking refers to the presence of a noise that interferes with a fish's ability to hear biologically important sounds including those produced by prey, predators, or other fish in the same species (Myrberg, 1980; Popper et al., 2003). This can take place whenever the noise level heard by a fish exceeds the level of a biologically relevant sound. As discussed in Section 3.0.3.7 (Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities) masking only occurs in the presence of the masking noise and does not persist after the cessation of the noise. Masking may lead to a change in vocalizations or a change in behavior (e.g., cessation of foraging, leaving an area).

There are no direct observations of masking in fishes due to exposure to explosives. The *ANSI Sound Exposure Guideline* technical report (Popper et al., 2014) highlights a lack of data that exist for masking by explosives but suggests that the intermittent nature of explosions would result in very limited probability of any masking effects and if masking were to occur it would only occur during the duration of the sound. General research findings regarding masking in fishes due to exposure to sound are discussed in detail in Section 3.9.3.1.1.3 (Masking). Potential masking from explosives is likely to be similar to masking studied for other impulsive sounds such as air guns.

3.9.3.2.1.4 Physiological Stress

Fishes naturally experience stress within their environment and as part of their life histories. The stress response is a suite of physiological changes that are meant to help an organism mitigate the impact of a stressor. However, if the magnitude and duration of the stress response is too great or too long, then it can have negative consequences to the organism (e.g., decreased immune function, decreased reproduction). Section 3.0.3.7 (Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities) provides additional information on physiological stress and the framework used to analyze this potential impact.

Research on physiological stress in fishes due to exposure to explosive sources is limited. Sverdrup et al. (1994) studied levels of stress hormones in Atlantic salmon after exposure to multiple detonations in a laboratory setting. Increases in cortisol and adrenaline were observed following the exposure, with adrenaline values returning to within normal range within 24 hours. General research findings regarding physiological stress in fishes due to exposure to acoustic sources are discussed in detail in Section 3.9.3.1.1.4 (Physiological Stress). Generally, stress responses are more likely to occur in the presence of potentially threatening sound sources such as predator vocalizations or the sudden onset of impulsive signals. Stress responses may be brief (a few seconds to minutes) if the exposure is short or if fishes habituate or learn to tolerate the noise. It is assumed that any physiological response (e.g., hearing loss or injury) or significant behavioral response is also associated with a stress response.

3.9.3.2.1.5 Behavioral Reactions

As discussed in Section 3.0.3.7 (Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities), any stimuli in the environment can cause a behavioral response in fishes, including sound and energy produced by explosions. Alterations in natural behavior patterns due to exposure to explosions have not been studied as thoroughly, but reactions are likely to be similar to reactions studied for other impulsive sounds such as those produced by air guns (e.g., startle response, changes in swim speed and depth). Impulsive signals, particularly at close range, have a rapid rise time and higher instantaneous peak pressure than other signal types, making them more likely to cause startle or avoidance responses. General research findings regarding behavioral reactions from fishes due to exposure to impulsive sounds, such as those associated with explosions, are discussed in detail in Section 3.9.3.1.1.5 (Behavioral Reactions).

As summarized by the *ANSI Sound Exposure Guideline* technical report (Popper et al., 2014), species may react differently to the same sound source depending on a number of variables, such as the animal's life stage or behavioral state (e.g., feeding, mating). Without data that are more specific it is assumed that fishes with similar hearing capabilities react similarly to all impulsive sounds outside or within the zone for hearing loss and injury. Observations of fish reactions to large-scale air gun surveys are informative, but not necessarily directly applicable to analyzing impacts from the short-term, intermittent use of all impulsive sources. Fish have a higher probability of reacting when closer to an impulsive sound source (within tens of meters), and a decreasing probability of reaction at increasing distances (Popper et al., 2014).

3.9.3.2.1.6 Long-Term Consequences

Long-term consequences to a population are determined by examining changes in the population growth rate. For additional information on the determination of long-term consequences, see Section 3.0.3.7 (Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities). Physical effects from explosive sources that could lead to a reduction in the population growth rate include mortality or injury, which could remove animals from the reproductive pool, and temporary hearing impairment or chronic masking, which could affect navigation, foraging, predator avoidance, or communication. The long-term consequences due to individual behavioral reactions, masking and short-term instances of physiological stress are especially difficult to predict because individual experience over time can create complex contingencies, especially for fish species that live for multiple seasons or years. For example, a lost reproductive opportunity could be a measurable cost to the individual; however, short-term costs may be recouped during the life of an otherwise healthy individual. These factors are taken into consideration when assessing risk of long-term consequences.

3.9.3.2.2 Impacts from Explosives

This section analyzes the impacts on fishes due to in-water and in-air explosives that would be used during Navy training and testing activities, synthesizing the background information presented above.

As discussed above, sound and energy from underwater explosions are capable of causing mortality, injury, temporary hearing loss, masking, physiological stress, or a behavioral response, depending on the level and duration of exposure. The death of an animal would eliminate future reproductive potential, which is considered in the analysis of potential long-term consequences to the population. 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 affect its ability to reproduce. Temporary threshold shift can also impair an animal's abilities, although the individual may recover quickly with little significant effect.

Although activities may vary from those previously analyzed, the overall determinations presented in the 2015 NWTT Final EIS/OEIS remain valid, but have been improved upon under this current Final Supplemental.

3.9.3.2.2.1 Methods for Analyzing Impacts from Explosives

The Navy performed a quantitative analysis to estimate ranges to effect for fishes exposed to underwater explosives during Navy training and testing activities. Inputs to the quantitative analysis included sound propagation modeling in the Navy's Acoustic Effects Model to the sound exposure criteria and thresholds presented below. Density data for fish species within the Study Area are not currently available; therefore, it is not possible to estimate the total number of individuals that may be affected by explosive activities.

Criteria and Thresholds used to Estimate Impacts on Fishes from Explosives

Mortality and Injury from Explosives

Criteria and thresholds to estimate impacts from sound and energy produced by explosive activities are presented below in Table 3.9-6. In order to estimate the longest range at which a fish may be killed or mortally injured, the Navy based the threshold for mortal injury on the lowest pressure that caused mortalities in the study by Hubbs and Rechnitzer (1952), consistent with the recommendation in the *ANSI Sound Exposure Guideline* technical report (Popper et al., 2014). As described in Section 3.9.3.2.1.1 (Injury), this threshold likely over-estimates the potential for mortal injury. The potential for mortal injury has been shown to be correlated to fish size, depth, and geometry of exposure, which are not accounted for by using a peak pressure threshold. However, until fish mortality models are developed that can reasonably consider these factors across multiple environments, use of the peak pressure threshold allows for a conservative estimate of maximum impact ranges.

Table 3.9-6: Sound Exposure Criteria for Mortality and Injury from Explosives

Fish Hearing Group	*Onset of Mortality*	*Onset of Injury*
	SPL_{peak}	*SPL_{peak}*
Fishes without a swim bladder	229	220
Fishes with a swim bladder not involved in hearing	229	220
Fishes with a swim bladder involved in hearing	229	220
Fishes with a swim bladder and high-frequency hearing	229	220

Note: SPL_{peak} = Peak sound pressure level.

Due to the lack of detailed data for onset of injury in fishes exposed to explosives, thresholds from impact pile driving exposures (Halvorsen et al., 2012a; Halvorsen et al., 2011, 2012b) were used as a proxy for the analysis in the Atlantic Fleet Training and Testing Final EIS/OEIS (U.S. Department of the Navy, 2018a). Upon re-evaluation during consultation with NMFS, both Navy and NMFS agreed that pile driving thresholds are too conservative and not appropriate to use in the analysis of explosive effects on fishes. Therefore, injury criteria have been revised as follows.

Thresholds for the onset of injury from exposure to an explosion are not currently available and recommendations in the *ANSI Sound Exposure Guideline* technical report (Popper et al., 2014) only provide qualitative criteria for consideration. Therefore, available data from existing explosive studies were reviewed to provide a conservative estimate for a threshold to the onset of injury (Gaspin, 1975; Gaspin et al., 1976; Hubbs & Rechnitzer, 1952; Settle et al., 2002; Yelverton et al., 1975).

It is important to note that some of the available literature is not peer-reviewed and may have some caveats to consider when reviewing the data (e.g., issues with controls, limited details on injuries observed, etc.) but this information may still provide a better understanding of where injurious effects would begin to occur specific to explosive activities. The lowest threshold at which injuries were observed in each study were recorded and compared for consideration in selecting criteria. As a conservative measure, the absolute lowest peak sound pressure level recorded that resulted in injury, observed in exposures of larval fishes to explosions (Settle et al., 2002), was selected to represent the threshold to injury.

The injury threshold is consistent across all fish regardless of hearing groups due to the lack of rigorous data for multiple species. As discussed throughout Section 3.9.3.2.1.1 (Injury), it is important to note that these thresholds may be overly conservative, as there is evidence that fishes exposed to higher thresholds than those in Table 3.9-6 have shown no signs of injury (depending on variables such as the weight of the fish, size of the explosion, and depth of the cage (Gaspin, 1975; Gaspin et al., 1976; Hubbs & Rechnitzer, 1952; Settle et al., 2002; Yelverton et al., 1975). It is likely that adult fishes and fishes without a swim bladder would be less susceptible to injury than more sensitive hearing groups (i.e., fishes with a swim bladder) and larval fish.

The number of fish killed by an in-water explosion would depend on the population density near the blast, as well as factors discussed throughout Section 3.9.3.2.1.1 (Injury) such as net explosive weight, depth of the explosion, and fish size. For example, if an explosion occurred in the middle of a dense school of fish, a large number of fish could be killed. However, the probability of this occurring is low based on the patchy distribution of dense schooling fish. Stunning from pressure waves could also temporarily immobilize fish, making them more susceptible to predation.

Fragments produced by exploding munitions at or near the surface may present a high-speed strike hazard for an animal at or near the surface. In water, however, fragmentation velocities decrease rapidly due to drag (Swisdak & Montanaro, 1992). Because blast waves propagate efficiently through water, the range to injury from the blast wave would likely extend beyond the range of fragmentation risk.

Hearing Loss from Explosives

Criteria and thresholds to estimate TTS from sound produced by explosive activities are presented below in Table 3.9-7. Direct (measured) TTS data from explosives are not available. Criteria used to define TTS from explosives is derived from data on fishes exposed to seismic air gun signals (Popper et al., 2005) as summarized in the *ANSI Sound Exposure Guideline* technical report (Popper et al., 2014). TTS has not been documented in fishes without a swim bladder from exposure to other impulsive sources (pile driving and air guns). Although it is possible that fishes without a swim bladder could receive TTS from exposure to explosives, fishes without a swim bladder are typically less susceptible to hearing impairment than fishes with a swim bladder. If TTS occurs in fishes without a swim bladder, it would likely occur within the range of injury; therefore, no thresholds for TTS are proposed. General research findings regarding hearing loss in fishes as well as findings specific to exposure to other impulsive sound sources are discussed in Section 3.9.3.1.1.2 (Hearing Loss).

Table 3.9-7: Sound Exposure Criteria for Hearing Loss from Explosives

Fish Hearing Group	*TTS (SEL_{cum})*
Fishes with a swim bladder not involved in hearing	> 186
Fishes with a swim bladder involved in hearing	186
Fishes with a swim bladder and high-frequency hearing	186

Notes: TTS = Temporary Threshold Shift, SEL_{cum} = Cumulative sound exposure level (decibel referenced to 1 micropascal squared seconds [dB re 1 μPa^2-s]), > indicates that the given effect would occur above the reported threshold.

As discussed in Section 3.9.3.1.1.2 (Hearing Loss), exposure to sound produced from seismic air guns at a cumulative sound exposure level of 186 dB re 1 μPa^2-s has resulted in TTS in fishes with a swim bladder involved in hearing (Popper et al., 2005). TTS has not occurred in fishes with a swim bladder not involved in hearing and would likely occur above the given threshold in Table 3.9-7.

3.9.3.2.2.2 Impact Ranges for Explosives

The following section provides estimated range to effects for fishes exposed to sound and energy produced by explosives. Ranges are calculated using criteria from Table 3.9-8 and Table 3.9-9 and the Navy Acoustic Effects Model. Most detonations conducted during Navy activities would occur at or near the surface. The Navy Acoustic Effects Model cannot account for the highly non-linear effects of cavitation and surface blow off; therefore, some estimated ranges may be overly conservative. In addition, ranges are conservatively calculated using the maximum net explosive weight within any given bin, even if a specific activity uses a smaller charge size. For example, explosive ordnance disposal activities in the Inland Waters use charges much smaller than 0.1 lb. although ranges in the table below were estimated using a charge size of 0.1 lb. Fishes within these ranges would be predicted to receive the associated effect. Ranges may vary greatly depending on factors such as the cluster size (the number of rounds fired [or buoys dropped] within a very short duration), location, depth, and season of the event.

Table 3.9-8 provides range to mortality and injury for all fishes regardless of hearing group. Only one table (Table 3.9-9) is provided for range to TTS for all fishes with a swim bladder. As discussed in the section above, TTS has not been documented in fishes without a swim bladder and therefore no criteria or range to effect are proposed.

Table 3.9-8: Range to Mortality and Injury for All Fishes from Explosives

***Bin*[1]**	***Range to Effects (meters)***	
	Onset of Mortality	***Onset of Injury***
	229 SPL_{peak}	***220 SPL_{peak}***
E0[2] Inland Waters (Hood Canal)	49 (35–75)	125 (90–220)
E0[2] Inland Waters (Crescent Harbor)	35 (35–45)	100 (95–150)
E1	50 (45–50)	124 (120–140)
E2	64 (60–65)	163 (150–170)
E3 Inland Waters (Hood Canal)	162 (120–260)	358 (160–675)
E3 Inland Waters (Crescent Harbor)	129 (120–180)	400 (230–1,525)
E3 Offshore Area	111 (110–120)	322 (270–600)
E4	150 (140–370)	466 (350–1,025)
E5	177 (170–180)	447 (430–460)
E7	424 (320–1,025)	1,142 (775–2,275)
E8	644 (380–1,275)	1,708 (950–3,275)

Table 3.9-8: Range to Mortality and Injury for All Fishes from Explosives (continued)

Bin[1]	Range to Effects (meters)	
	Onset of Mortality	Onset of Injury
	229 SPL_{peak}	220 SPL_{peak}
E10	644 (625–650)	1,478 (1,275–1,525)
E11	1,287 (725–3,025)	3,913 (2,025–7,275)

[1]Bin (net explosive weight, lb.): E0 (< 0.1), E1 (0.1 – 0.25), E2 (> 0.25 – 0.5), E3 (> 0.5 – 2.5), E4 (> 2.5 – 5), E5 (> 5 – 10), E7 (> 20 – 60), E8 (> 60 – 100), E10 (> 250 – 500), E11 (> 500 – 650)
[2]Estimated ranges for E0 are consistent with measurements from a series of monitoring events during training activities that used explosives in the Inland Waters (Hart, 2012; U. S. Department of the Navy, 2015; U.S. Department of the Navy, 2009, 2013, 2014, 2015a, 2015b, 2015c).
Notes: NEW = net explosive weight, SPL_{peak} = Peak sound pressure level.
Range to effects represent modeled predictions in different areas and seasons within the Action Area. Bin E0 and E3 are the only bins used in the Inland Waters. Bin E3 is used in both the Inland Waters and Offshore Area, therefore ranges to effect are shown for both the Inland Waters and the Offshore Area for this bin. All other range to effects were calculated in the Offshore Area where these bins would be used. Each cell contains the estimated average, minimum, and maximum range to the specified effect.

Table 3.9-9: Range to TTS for Fishes with a Swim Bladder from Explosives

Bin[1]	Cluster Size	Range to Effects (meters)
		TTS
		SEL_{cum}
E0[2] Inland Waters (Hood Canal)	1	< 59 (50–85)
E0[2] Inland Waters (Crescent Harbor)	1	< 48 (45–50)
E1	1	< 53 (45–55)
E2	1	< 58 (55–60)
E3 Inland Waters (Hood Canal)	1	<259 (160–440)
E3 Inland Waters (Crescent Harbor)	1	<250 (200–600)
E3 Offshore Area	1	< 150 (140–160)

Table 3.9-9: Range to TTS for Fishes with a Swim Bladder from Explosives (continued)

Bin[1]	Cluster Size	Range to Effects (meters)
		TTS
		SEL_{cum}
E4	2	< 340 (270–750)
E5	1	< 158 (150–200)
	8	< 394 (380–430)
E7	1	< 974 (675–1,775)
E8	1	< 1,110 (725–1,775)
E10	1	< 570 (550–650)
E11	1	< 2,693 (1,525–5,025)

[1]Bin (net explosive weight, lb.): E0 (< 0.1), E1 (0.1–0.25), E2 (> 0.25–0.5), E3 (> 0.5–2.5), E4 (> 2.5–5), E5 (> 5–10), E7 (> 20–60), E8 (> 60–100), E10 (> 250–500), E11 (> 500–650)

[2]Estimated ranges for E0 are consistent with measurements from a series of monitoring events during training activities that used explosives in the Inland Waters (Hart, 2012; U. S. Department of the Navy, 2015; U.S. Department of the Navy, 2009, 2013, 2014, 2015a, 2015b, 2015c).

Notes: NEW = net explosive weight, SEL_{cum} = Cumulative sound exposure level, TTS = Temporary Threshold Shift, "<" indicates that the given effect would occur at distances less than the reported range(s).

Range to effects represent modeled predictions in different areas and seasons within the Action Area. Bin E0 and E3 are the only bins used in the Inland Waters. Bin E3 is used in both the Inland Waters and Offshore Area, therefore ranges to effect are shown for both the Inland Waters and the Offshore Area for this bin. All other range to effects were calculated in the Offshore Area where these bins would be used. Each cell contains the estimated average, minimum, and maximum range to the specified effect.

3.9.3.2.2.3 Impacts from Explosives Under Alternative 1

Impacts from Explosives Under Alternative 1 for Training Activities

Activities using explosives would be conducted as described in Chapter 2 (Description of Proposed Action and Alternatives) and Appendix A (Navy Activities Descriptions). General characteristics, quantities, and net explosive weights of in-water explosives used during training activities under Alternative 1 are provided in Section 3.0.3.2 (Explosive Stressors). The number of explosive sources in this Supplemental compared with the totals analyzed in the 2015 NWTT Final EIS/OEIS are described in Tables 2.5-1 and 2.5-2.

Under Alternative 1, there could be fluctuation in the amount of explosions that would occur annually, although potential impacts would be similar from year to year. Training activities involving explosives would be concentrated in the Offshore Area. The Navy's mitigation requires explosive training to occur at distances greater than 50 NM from shore in the NWTT Offshore Area. A very small amount of mine neutralization training activities would occur in the Inland Areas of the Study Area. There are no training activities that involve the use of explosives in the Western Behm Canal, therefore there would be no impacts on fishes that occur in these areas. In addition, the Navy will implement mitigation to avoid impacts from explosives on seafloor resources in mitigation areas throughout the Study Area (see Appendix K, Geographic Mitigation Assessment, for more details), which will consequently also help avoid potential impacts on fishes that shelter and feed on live hard bottom, artificial reefs, and shipwrecks. The Navy will also implement mitigation measures, including seasonal charge size restrictions and distance-from-shore requirements for explosive mine neutralization activities involving Navy divers specifically to avoid impacts on ESA-listed bull trout and salmonids in NWTT Inland Waters (see Appendix K, Geographic Mitigation Assessment, for more details).

Sound and energy from explosions could result in mortality and injury, on average, for hundreds to even thousands of meters from some of the largest explosions. Exposure to explosions could also result in temporary hearing loss in nearby fishes. The estimated range to each of these effects based on explosive bin size is provided in Table 3.9-8 and Table 3.9-9. Generally, explosives that belong to larger bins (with large net explosive weights) produce longer ranges within each effect category. However, some ranges vary depending upon a number of other factors (e.g., number of explosions in a single event, 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. Fishes that experience hearing loss could miss opportunities to detect predators or prey, or show a reduction in interspecific communication.

Some activities involve the use of multiple detonations over a short period of time and could result in repeated exposures of some individual fish. If an individual fish were repeatedly exposed to sound and energy from underwater explosions within a short period of time that lead to severe alterations in natural behavioral patterns or physiological stress, these impacts could lead to long-term consequences for the individual such as reduced survival, growth, or reproductive capacity. If detonations occurred close together (within a few seconds), there could be the potential for masking to occur but this would likely happen at farther distances from the source where individual detonations might sound more continuous. However, training 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 not likely and most behavioral effects are expected to be short-term (seconds or minutes) and localized. 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.

As discussed previously in Section 3.9.2.1 (Hearing and Vocalization), all ESA-listed fish species that occur in the Study Area are capable of detecting sound produced by explosives. All ESA-listed salmon species are present in the Offshore Area throughout the year. Adult and juvenile Chinook and chum salmon generally occur in coastal areas along the continental shelf (within approximately 20–32 NM from shore) and therefore would not be exposed to training activities that occur beyond 50 NM from shore. However, individuals from the Puget Sound, Upper Columbia River spring-run, Snake River spring/summer-run Chinook salmon ESU, and the Columbia River chum salmon ESU, are known to move farther offshore and could be exposed to explosives used during training activities. The majority of ESA-listed steelhead populations could occur beyond 50 NM from shore with the exception of the South-Central California Coast DPS and the Southern-California DPS of steelhead, which are not known to occur beyond distances of approximately 30 NM from shore. Therefore, only these two DPSs of steelhead would avoid impacts from training activities due to lack of spatial overlap. The ESA-listed Puget Sound Chinook salmon ESU, Hood Canal summer-run chum salmon ESU, Puget Sound DPS of Steelhead, and Coastal-Puget Sound DPS of bull trout also occur in the Inland Waters. Salmon of all sizes and age classes could be exposed to explosives in these described areas throughout the year depending on specific seasonal migrations. Bocaccio rockfish and yelloweye rockfish only occur in the Inland Waters. Due to their preference for rocky habitats and the extremely low level of training activities that involve the use of explosives that occur in the Inland Waters, the likelihood of exposure to explosions would be rare. Green sturgeon and Pacific eulachon occur throughout the Study Area. As discussed above, there are no explosive activities in Western Behm Canal, therefore ESA-listed species that occur there would not be impacted.

Impacts on ESA-listed fishes, if they occur, would be similar to impacts on fishes in general. However, due to the short-term, infrequent and localized nature of these activities, ESA-listed fishes are unlikely to be exposed multiple times within a short period. In addition, physiological and behavioral reactions would be expected to be brief (seconds to minutes) and infrequent based on the low probability of co-occurrence between training activities and these species. Although individuals may be impacted, long-term consequences for populations would not be expected.

Designated critical habitat for the Puget Sound Chinook salmon ESU, Hood Canal summer-run chum salmon ESU, the Coastal-Puget Sound DPS of bull trout, the Puget Sound/Georgia Basin DPS of bocaccio and yelloweye rockfish, and Southern DPS of green sturgeon overlap the Study Area in the Inland Waters. In addition, designated critical habitat for bull trout and green sturgeon occur in the nearshore coastal areas of the Study Area. However, it is unlikely that training activities involving explosives would occur in portions of the Inland Waters designated as critical habitat, nor would they occur close to shore as explosives are typically detonated 50 NM from shore. In addition, most of the physical and biological features for the anadromous ESA-listed species are generally not applicable to the Study Area (e.g., features associated with freshwater riverine habitat). While activities could occur in close proximity to designated critical habitat, no adverse effects to any physical or biological features (e.g., water quality, habitat structure, prey availability, or unobstructed passageways) are anticipated from exposure to explosives.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of explosives during training activities, as described under Alternative 1, may affect ESA-listed Chinook salmon (Puget Sound, Upper Columbia River spring-run, and Snake River spring/summer-run ESU), chum salmon (Hood Canal summer-run ESU), steelhead (Puget Sound, Upper Columbia River, Middle Columbia River, Lower Columbia River, Upper Willamette River, Snake River Basin, Northern California, California Central Valley, and Central California Coast DPS), bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), yelloweye rockfish (Puget Sound/Georgia Basin DPS), Pacific eulachon (Southern DPS), and green sturgeon (Southern DPS). In addition, the use of explosives may affect designated critical habitat for Chinook salmon (Puget Sound ESU), chum salmon (Hood Canal summer-run ESU), bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), and yelloweye rockfish (Puget Sound/Georgia Basin DPS). The Navy has consulted with NMFS and USFWS as required by Section 7(a)(2) of the ESA. The use of explosives during training activities would have no effect on ESA-listed Chinook salmon (Lower Columbia River, Upper Willamette River, Snake River fall-run, California Coastal, Central Valley spring-run, and Sacramento River winter-run ESU), coho salmon (all ESUs), chum salmon (Columbia River ESU), sockeye salmon (all ESUs), steelhead (South-Central California Coast and Southern California DP), or on designated critical habitat for green sturgeon (Southern DPS).

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of explosives associated with training activities, as described under Alternative 1, may affect EFH species within the Study Area.

Impacts from Explosives Under Alternative 1 for Testing Activities

Activities using explosives would be conducted as described in Chapter 2 (Description of Proposed Action and Alternatives) and Appendix A (Navy Activities Descriptions). General characteristics, quantities, and net explosive weights of in-water explosives used during testing activities under Alternative 1 are provided in Section 3.0.3.2 (Explosive Stressors). The number of explosive sources in this Supplemental compared with the totals analyzed in the 2015 NWTT Final EIS/OEIS are described in Tables 2.5-1 and 2.5-2.

Under Alternative 1, there could be fluctuation in the amount of explosions that would occur annually, although potential impacts would be similar from year to year. Testing activities involving explosives would only occur in the Offshore Area. Therefore, there would be no impacts on fishes that occur in the Inland Waters or Western Behm Canal. With one exception, the Navy's mitigation requires explosive testing to occur at distances greater than 50 NM from shore in the NWTT Offshore Area and explosives would occur in the same general locations and in a similar manner as previously analyzed in the 2015 NWTT Final EIS/OEIS. A new mine countermeasure and neutralization testing activity would occur closer to shore than other activities analyzed in the 2015 NWTT Final EIS/OEIS that involved the use of in-water explosives. This activity would occur greater than 3 NM from shore in the Quinault Range Site or greater than 12 NM from shore elsewhere in the Offshore Area but would not occur off the coast of California. These activities would occur approximately two times per year in water depths shallower than 1,000 ft. (typically 300 ft.). Exposure of fish to these activities would be highly dependent on the actual presence of fish populations in the Study Area at the time the activity takes place, which may be limited depending on various species migration patterns. Additionally, the areas in which this activity could occur are small compared to the overall Study Area, further reducing potential spatial overlap.

Explosives are used less frequently under testing activities than under training activities. Overall, the general impacts from explosives under testing would be similar to those described above in Section

3.9.3.2.2.3 (Impacts from Explosives Under Alternative 1 – Impacts from Explosives Under Alternative 1 for Training Activities) in the Offshore Area with the exception of impacts from the mine countermeasures and neutralization testing activity closer to shore. To avoid impacts on sanctuary resources, the Navy will not conduct explosive mine countermeasures and neutralization testing activities in the Olympic Coast National Marine Sanctuary Mitigation Area. In addition, the Navy will implement mitigation to avoid impacts from explosives on seafloor resources in mitigation areas throughout the Study Area (see Appendix K, Geographic Mitigation Assessment, for more details), which will consequently also help avoid potential impacts on fishes that shelter and feed on live hard bottom, artificial reefs, and shipwrecks. The Navy also developed several new mitigation measures for this Supplemental EIS/OEIS for the purpose of avoiding or reducing potential impacts from explosive mine countermeasure and neutralization testing on ESA-listed fishes, including requirements to (1) conduct explosive mine countermeasure and neutralization testing from July 1 through September 30 to the maximum extent practical when operating within 20 NM from shore, (2) conduct a maximum of one explosive Mine Countermeasure and Neutralization Testing event from October 1 through June 30 within 20 NM from shore in the Marine Species Mitigation Area (not to exceed the use of 20 explosives from bin E4 and 3 explosives from bin E7 annually, and not to exceed the use of 60 explosives from bin E4 and 9 explosives from bin E7 over seven years), (3) not conduct explosive Mine Countermeasure and Neutralization Testing event within a new mitigation area known as the Juan de Fuca Eddy Marine Species Mitigation Area, and (4) not use explosives in bin E7 closer than 6 NM from shore in the Quinault Range Site.

As discussed previously in Section 3.9.2.1 (Hearing and Vocalization), all ESA-listed fish species that occur in the Study Area are capable of detecting sound produced by explosives. All ESA-listed salmon species are present in the Offshore Area throughout portions of the year depending on specific seasonal migrations. As a result, the majority of ESA-listed salmonid populations could overlap areas where in-water explosives occur. The notable exceptions include the South-Central California Coast and Southern California DPS of steelhead, which would only occur in the southernmost portion of the Offshore Area off the coast of California where mine countermeasures and neutralization testing activities are not conducted. In addition, the Hood Canal summer-run chum salmon ESU and the Lake Ozette sockeye salmon ESU would only occur in the northernmost portion of the Offshore Area within the Olympic Coast National Marine Sanctuary and the Strait of Juan de Fuca. Because the Navy will not conduct explosive Mine Countermeasure and Neutralization Testing activities within the Olympic Coast National Marine Sanctuary Mitigation Area or Juan de Fuca Eddy Marine Species Mitigation Area (see Appendix K, Geographic Mitigation Assessment, for more details), these two ESUs would not be affected by in-water explosive testing activities. Bocaccio rockfish and yelloweye rockfish only occur in the Inland Waters, and thus would not be affected by explosive testing activities. Green sturgeon and Pacific eulachon occur throughout the Study Area. As discussed above, there are no explosive testing activities in the Inland Waters or Western Behm Canal, therefore ESA-listed species that occur in these portions of the Study Area would not be impacted.

Impacts on ESA-listed fishes, if they occur, would be similar to impacts on fishes in general. However, due to the short-term, infrequent and localized nature of these activities, ESA-listed fishes are unlikely to be exposed multiple times within a short period. There is still the possibility that repeated exposures could occur during successive detonations that are close in proximity to one another. However, unless ESA-listed fishes are close enough to be seriously injured or killed, the effect of a repeated exposure would not affect the overall fitness of an individual. Most reactions, even to multiple detonations, would result in brief startle responses or avoidance of the area where the detonation occurred. Even temporary displacement from important habitats is not expected to affect the fitness of any individual because similar habitat is likely to be available in close proximity. Physiological and behavioral reactions would be expected to be brief (seconds to minutes) and infrequent based on the low probability of co-occurrence between testing activities and these species. Although individuals may be impacted, long-term consequences for populations would not be expected.

Designated critical habitat for the Puget Sound Chinook salmon ESU, Hood Canal summer-run chum salmon ESU, the Coastal-Puget Sound DPS of Bull trout, the Puget Sound/Georgia Basin DPS of bocaccio and yelloweye rockfish, and Southern DPS of green sturgeon overlap the Study Area in the Inland Waters. In addition, designated critical habitat for bull trout and green sturgeon occur in the nearshore coastal areas of the Offshore Area. Since explosives testing does not take place in Inland Waters, these critical habitats would not be affected. In addition, most of the physical and biological features for the anadromous ESA-listed species are generally not applicable to the Study Area (e.g., features associated with freshwater riverine habitat). While activities could occur in close proximity to designated critical habitat, no adverse effects to any physical or biological features (e.g., water quality, habitat structure, prey availability, or unobstructed passageways) are anticipated from exposure to explosives.

Although green sturgeon critical habitat largely occurs in the nearshore coastal areas of the Study Area and most testing activities would occur beyond 50 NM from shore, some mine countermeasure testing activities would occur closer to shore and would therefore overlap a portion green sturgeon critical habitat. Most of the defined physical and biological features would not be affected by explosives (e.g., water flow and water quality). However, the use of explosives within the critical habitat may affect a small number of prey items.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of explosives during testing activities, as described under Alternative 1, may affect ESA-listed Chinook salmon (all ESUs), coho salmon (all ESUs), chum salmon (Columbia River ESU), sockeye salmon (Snake River ESU), steelhead (Puget Sound, Upper Columbia River, Middle Columbia River, Lower Columbia River, Upper Willamette River, Snake River Basin, Northern California, California Central Valley, and Central California Coast DPS), bull trout (Coastal Puget Sound DPS), Pacific eulachon (Southern DPS), green sturgeon (Southern DPS), and designated critical habitat for green sturgeon (Southern DPS). The Navy has consulted with NMFS and USFWS as required by Section 7(a)(2) of the ESA. The use of explosives during testing activities would have no effect on ESA-listed chum salmon (Hood Canal summer-run ESU), sockeye salmon (Lake Ozette ESU)], steelhead (South-Central California Coast and Southern California DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), yelloweye rockfish (Puget Sound/Georgia Basin DPS), or on designated critical habitat for Chinook salmon (Puget Sound ESU), chum salmon (Hood Canal ESU), bocaccio rockfish (Puget Sound/Georgia Basin DPS), yelloweye rockfish (Puget Sound/Georgia Basin DPS), or bull trout (Coastal Puget Sound DPS).

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of explosives associated with testing activities, as described under Alternative 1, may affect EFH species within the Study Area.

3.9.3.2.2.4 Impacts from Explosives Under Alternative 2

Impacts from Explosives Under Alternative 2 for Training Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Section 3.0.3.2 (Explosive Stressors), and Appendix A (Navy Activities Descriptions), training activities under Alternative 2 reflects the maximum number of training activities that could occur within a given year. This would result in an increase of explosive use compared to Alternative 1. The locations and general types of predicted impacts would be similar to those described above in Section 3.9.3.2.2.3 (Impacts from Explosives Under Alternative 1 – Impacts from Explosives Under Alternative 1 for Training Activities). The number of explosive sources in this Supplemental compared with the totals analyzed in the 2015 NWTT Final EIS/OEIS are described in Tables 2.5-1 and 2.5-2.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of explosives during training activities, as described under Alternative 2, may affect ESA-listed Chinook salmon (Puget Sound, Upper Columbia River Spring-Run, and Snake River Spring/Summer-Run ESU), chum salmon (Hood Canal Summer-Run ESU), steelhead (Puget Sound, Upper Columbia River, Middle Columbia River, Lower Columbia River, Upper Willamette River, Snake River Basin, Northern California, California Central Valley, and Central California Coast DPS), bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), yelloweye rockfish (Puget Sound/Georgia Basin DPS), Pacific eulachon (Southern DPS), and green sturgeon (Southern DPS). In addition, the use of explosives may affect designated critical habitat for Chinook salmon (Puget Sound ESU), chum salmon (Hood Canal summer-run ESU), bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), and yelloweye rockfish (Puget Sound/Georgia Basin DPS). The Navy has consulted with NMFS and USFWS as required by Section 7(a)(2) of the ESA. The use of explosives during training activities would have no effect on ESA-listed Chinook salmon (Lower Columbia River, Upper Willamette River, Snake River fall-run, California Coastal, Central Valley spring-run, and Sacramento River winter-run ESU), coho salmon (all ESUs), chum salmon (Columbia River ESU), sockeye salmon (all ESUs), steelhead (South-Central California Coast and Southern California DP), or on designated critical habitat for green sturgeon (Southern DPS).

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of explosives associated with training activities, as described under Alternative 2, may affect EFH species within the Study Area.

Impacts from Explosives Under Alternative 2 for Testing Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Section 3.0.3.2 (Explosive Stressors), and Appendix A (Navy Activities Descriptions), testing activities under Alternative 2 reflects the maximum number of testing activities that could occur within a given year. This would result in the same amount of explosive use compared to Alternative 1 for testing activities. The locations and general types of predicted impacts would be similar to those described above in Section 3.9.3.2.2.3 (Impacts from Explosives Under Alternative 1 – Impacts from Explosives Under Alternative 1 for Testing Activities). The number of explosive sources in this Supplemental compared with the totals analyzed in the 2015 NWTT Final EIS/OEIS are described in Tables 2.5-1 and 2.5-2.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon are not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of explosives during testing activities, as described under Alternative 2, may affect ESA-listed Chinook salmon (all ESUs), coho salmon (all ESUs), chum salmon (Columbia River ESU), sockeye salmon (Snake River ESU), steelhead (Puget Sound, Upper Columbia River, Middle Columbia River, Lower Columbia River, Upper Willamette River, Snake River Basin, Northern California, California Central Valley, and Central California Coast DPS), bull trout (Coastal Puget Sound DPS), Pacific eulachon (Southern DPS), green sturgeon (Southern DPS), and designated critical habitat for green sturgeon (Southern DPS). The Navy has consulted with NMFS and USFWS as required by Section 7(a)(2) of the ESA. The use of explosives during testing activities would have no effect on ESA-listed chum salmon (Hood Canal Summer-Run ESU), sockeye salmon (Lake Ozette ESU)], steelhead (South-Central California Coast and Southern California DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), yelloweye rockfish (Puget Sound/Georgia Basin DPS), or on designated critical habitat for Chinook salmon (Puget Sound ESU), chum salmon (Hood Canal ESU), bocaccio rockfish (Puget Sound/Georgia Basin DPS), yelloweye rockfish (Puget Sound/Georgia Basin DPS), or bull trout (Coastal Puget Sound DPS).

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of explosives associated with testing activities, as described under Alternative 2, may affect EFH species within the Study Area.

3.9.3.2.2.5 Impacts from Explosives Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Explosive stressors, as listed above, would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer explosive stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for explosive impacts on individual fishes, but would not measurably improve the overall distribution or abundance of fishes.

3.9.3.3 Energy Stressors

The energy stressors that may impact fishes include in-water electromagnetic devices and high-energy lasers. Only one new energy stressor (high-energy lasers) used in testing activities differs from the energy stressors that were previously analyzed in the 2015 NWTT Final EIS/OEIS. Use of low-energy lasers was analyzed and dismissed as an energy stressor in the 2015 NWTT Final EIS/OEIS in Section 3.0.5.3.2.2 (Lasers). However, at that time high-energy laser weapons were not part of the proposed action for the Study Area.

As discussed in Section 3.0.3.3.2.2 (High-Energy Lasers), high-energy lasers can be divided into high-energy laser weapons and laser-based optical communication systems. High-energy laser weapons are designed to disable surface targets, rendering them immobile. High-energy lasers lose a significant amount of energy within only a few centimeters (cm) from the surface. Laser-based optical communication systems penetrate the water and at least 1.7 percent of a laser beam is scattered and reflected at the surface. Once it is underwater, the light will lose power at an exponential rate due to scattering and absorption (Ulrich, 2004). A minimum of 86 percent of light will be lost over 10 m for blue-green wavelengths; significantly more would be lost for other wavelength lasers. The primary concern for both high-energy laser weapons and laser-based communication systems is the potential for a fish to be struck with the laser beam at or near the water's surface, where extended exposure could result in injury or death. Fish could be exposed to a laser only if the beam missed the target. Should the laser strike the sea surface, individual fish at or near the surface could be exposed. The potential for exposure to a high-energy laser beam decreases as the water depth increases. Most fish are unlikely to be exposed to laser activities because they primarily occur more than a few meters below the sea surface.

3.9.3.3.1 Impacts from In-Water Electromagnetic Devices

3.9.3.3.1.1 Impacts from In-Water Electromagnetic Devices Under Alternative 1

Impacts from In-Water Electromagnetic Devices Under Alternative 1 for Training Activities

Under Alternative 1, the number of proposed training activities involving the use of in-water electromagnetic devices would remain the same (Table 3.0-9) as those proposed in the 2015 NWTT Final EIS/OEIS. The activities would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts on fishes would be the same. As stated in the 2015 NWTT Final EIS/OEIS, the impact of in-water electromagnetic devices on fishes would be inconsequential because (1) the range of impact (i.e., greater than earth's magnetic field) is small (i.e., 13 ft. [3.9 m] from the source), (2) the electromagnetic components of these activities are limited to simulating the electromagnetic signature of a vessel as it passes through the water, and (3) the electromagnetic signal is temporally variable and would cover only a small spatial range during each activity in the Study Area.

Some fishes could have a detectable response to electromagnetic exposure, but any impacts would be temporary and would not impact an individual's growth, survival, annual reproductive success, or lifetime reproductive success (i.e., fitness). Fitness refers to changes in an individual's growth, survival, annual reproductive success, or lifetime reproductive success. Electromagnetic exposure of eggs and larvae of sensitive bony fishes would be low relative to their total ichthyoplankton biomass (Able and Fahay 1998). Therefore, potential impacts on recruitment are not be expected.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of in-water electromagnetic devices during training activities, as described under Alternative 1, may affect ESA-listed salmonid species, green sturgeon (Southern DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), and yelloweye rockfish (Puget Sound/Georgia Basin DPS). The Navy has consulted with NMFS and USFWS, as required by section 7(a)(2) of the ESA. The use of in-water electromagnetic devices would have no effect on bull trout (Coastal Puget Sound DPS) and no effect on critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal summer-run ESU), green sturgeon, bull trout, bocaccio rockfish, and yelloweye rockfish.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of in-water electromagnetic devices associated with training activities, as described under Alternative 1, may affect EFH species within the Study Area.

Impacts from In-Water Electromagnetic Devices Under Alternative 1 for Testing Activities

No in-water electromagnetic devices are proposed for testing activities under Alternative 1.

3.9.3.3.1.2 Impacts from In-Water Electromagnetic Devices Under Alternative 2

Impacts from In-Water Electromagnetic Devices Under Alternative 2 for Training Activities

Under Alternative 2, the number of proposed training activities involving the use of in-water electromagnetic devices would remain the same as Alternative 1 (Table 3.0-9) and those proposed in the

2015 NWTT Final EIS/OEIS. The activities would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts on fishes would be the same as those described above for Alternative 1 and presented in the 2015 NWTT Final EIS/OEIS. As described above for Alternative 1, marine fishes may be exposed to in-water electromagnetic devices during training activities. As stated in the 2015 NWTT Final EIS/OEIS, in-water electromagnetic devices would not cause any potential risk to fishes because (1) the range of impact (i.e., greater than earth's magnetic field) is small (i.e., 13 ft. [3.9 m] from the source), (2) the electromagnetic components of these activities are limited to simulating the electromagnetic signature of a vessel as it passes through the water, and (3) the electromagnetic signal is temporally variable and would cover only a small spatial range during each activity in the Study Area.

Some fishes could have a detectable response to electromagnetic exposure, but any impacts would be temporary and would not impact an individual's growth, survival, annual reproductive success, or lifetime reproductive success (i.e., fitness). Fitness refers to changes in an individual's growth, survival, annual reproductive success, or lifetime reproductive success. Electromagnetic exposure of eggs and larvae of sensitive bony fishes would be low relative to their total ichthyoplankton biomass (Able and Fahay 1998). Therefore, potential impacts on recruitment are not be expected.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of in-water electromagnetic devices during training activities, as described under Alternative 2, may affect ESA-listed salmonid species, green sturgeon (Southern DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), and yelloweye rockfish (Puget Sound/Georgia Basin DPS). The use of in-water electromagnetic devices would have no effect on bull trout (Coastal Puget Sound DPS) and no effect on critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal summer-run ESU), green sturgeon, bull trout, bocaccio rockfish and yelloweye rockfish.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of in-water electromagnetic devices associated with training activities, as described under Alternative 1, may affect EFH species within the Study Area.

Impacts from In-Water Electromagnetic Devices Under Alternative 2 for Testing Activities

No in-water electromagnetic devices are proposed for testing activities under Alternative 2.

3.9.3.3.1.3 Impacts from In-Water Electromagnetic Devices Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Energy stressors, as listed above, would not be introduced into the marine environment. In-water electromagnetic devices as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer energy stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for energy impacts on individual fish, but would not measurably improve the status of fish populations or subpopulations.

3.9.3.3.2 Impacts from High-Energy Lasers

High-Energy Lasers were not proposed for use in the 2015 NWTT Final EIS/OEIS.

As discussed in Section 3.0.3.3.2.2 (High-Energy Lasers), high-energy laser weapons testing activities involve evaluating the effectiveness of a high-energy laser deployed from a surface ship or helicopter to create small but critical failures in potential targets from short ranges.

This section analyzes the potential impacts of high-energy laser weapons on marine fishes. The primary concern for high-energy weapons testing is the potential for a fish to be struck by a high-energy laser beam at or near the water's surface, which could result in injury or death, resulting from traumatic burns from the beam. Fish could be exposed to a laser only if the beam missed the target. Should the laser strike the sea surface, individual fish at or near the surface could be exposed. The potential for exposure to a high-energy laser beam decreases as the water depth increases. Most fish are unlikely to be exposed to laser activities because they primarily occur more than a few meters below the sea surface.

3.9.3.3.2.1 Impacts from High-Energy Lasers Under Alternative 1

<u>Impacts from High-Energy Lasers Under Alternative 1 for Training Activities</u>

No high-energy lasers are proposed for training activities under Alternative 1.

<u>Impacts from High-Energy Lasers Under Alternative 1 for Testing Activities</u>

As discussed in Section 3.0.3.3.2.2 (High-Energy Lasers) and shown in Table 3.0-10, under Alternative 1 there would be up to 55 testing activities per year involving the use of high-energy lasers. One of those 55 activities is a test of a laser-based optical communication system, which was discussed in Section 3.0.3.3.2.2 and dismissed from further evaluation. The remaining 54 annual testing activities would involve the use of high-energy laser weapons in the Offshore portion of the Study Area. Fish species may be exposed to high-energy lasers. Fishes are unlikely to be exposed to high-energy lasers based on (1) the relatively low number of events (54 per year throughout the entire Study Area), (2) the very localized potential impact area of the laser beam, (3) the temporary duration of potential impact (seconds), (4) the low probability of fish at or near the surface at the exact time and place a laser misses its target, and (5) the low probability of a laser missing its target.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of high-energy laser weapons during testing activities, as described under Alternative 1, may affect ESA-listed salmonid species, green sturgeon (Southern DPS), and Pacific eulachon. The Navy has consulted with NMFS and USFWS, as required by section 7(a)(2) of the ESA. The use of high-energy laser weapons would have no effect on bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS) and yelloweye rockfish (Puget Sound/Georgia Basin DPS), and would have no effect on critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal summer-run ESU), green sturgeon, bull trout, bocaccio rockfish, and yelloweye rockfish.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of high-energy lasers associated with testing activities, as described under Alternative 1, may affect EFH species within the Study Area.

3.9.3.3.2.2 Impacts from High-Energy Lasers under Alternative 2

Impacts from High-Energy Lasers Under Alternative 2 for Training Activities

No high-energy lasers are proposed for training activities under Alternative 2.

Impacts from High-Energy Lasers Under Alternative 2 for Testing Activities

As shown in Table 3.0-10, a total 54 testing activities involving the use of high-energy laser weapons are proposed to be conducted in the Offshore Area under Alternative 2, the same as under Alternative 1. As stated above, this represents a new activity not covered in the 2015 NWTT Final EIS/OEIS. Therefore, the impacts would be the same as described under Alternative 1.

Pursuant to the ESA, the use of high-energy laser weapons during testing activities, as described under Alternative 2, may affect ESA-listed salmonid species, green sturgeon (Southern DPS), and Pacific eulachon. The use of high-energy laser weapons would have no effect on bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS) and yelloweye rockfish (Puget Sound/Georgia Basin DPS), and would have no effect on critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal summer-run ESU), green sturgeon, bull trout, bocaccio rockfish, and yelloweye rockfish.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of high-energy lasers associated with testing activities, as described under Alternative 2, may affect EFH species within the Study Area.

3.9.3.3.2.3 Impacts from High-Energy Lasers Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Energy stressors, as listed above, would not be introduced into the marine environment. Therefore, existing environmental conditions would remain unchanged after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer energy stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for energy impacts on individual fish, but would not measurably improve the status of fish populations or subpopulations.

3.9.3.4 Physical Disturbance and Strike Stressors

The physical disturbance and strike stressors that may impact marine fishes include (1) vessels and in-water devices, (2) military expended materials, and (3) seafloor devices. These stressors remain the same as analyzed in the 2015 NWTT Final EIS/OEIS.

3.9.3.4.1 Impacts from Vessels and In-Water Devices

As stated in the 2015 NWTT Final EIS/OEIS, with few exceptions, activities involving vessels and in-water devices are not intended to contact the seafloor. There is minimal potential strike impact other than bottom-crawling unmanned underwater vehicles. Physical disturbance and strike stressors from vessels and in-water devices, military expended materials, and seafloor devices have the potential to affect all marine fish groups found within the Study Area, although some fish groups may be more susceptible to strike potential than others. In addition, the potential responses to physical strikes are varied, but include behavioral changes such as avoidance, altered swimming speed and direction, physiological stress, and physical injury or mortality.

3.9.3.4.1.1 Impacts from Vessels and In-Water Devices Under Alternative 1

Impacts from Vessels and In-Water Devices Under Alternative 1 for Training Activities

Under Alternative 1, the combined number of proposed training activities involving the movement of vessels and the use of in-water devices would increase (Table 3.0-12 and Table 3.0-13) compared to those proposed in the 2015 NWTT Final EIS/OEIS. Vessel movement would decrease slightly in the Offshore Area (from 1,156 to 1,144 annual activities) and in the Inland Waters (from 368 to 327), so there would still be a net decrease in the Study Area. The activities would occur in the same locations and in a similar manner as were analyzed previously. There is an overall increase in the use of in-water devices (Table 3.0-13), all of which are associated with small, slow-moving unmanned underwater vehicles. Because the increases are to activities in which the in-water devices are small and slow moving, the impacts on fishes would be similar. The proposed increase of approximately 100 in-water devices would not change that conclusion. As stated in the 2015 NWTT Final EIS/OEIS, the risk of a strike from vessels and in-water devices used in training and testing activities on an individual fish would be extremely low because (1) most fish can detect and avoid vessel and in-water device movements, and (2) the types of fish that are likely to be exposed to vessel and in-water device strike are limited and occur in low concentrations where vessels and in-water devices are used. Potential impacts of exposure to vessels and in-water devices are not expected to result in substantial changes to an individual's behavior, fitness, or species recruitment, and are not expected to result in population-level impacts. Therefore, impacts on fish or fish populations would be negligible.

Similar to most other fish species described above, ESA-listed fish species would be able to sense pressure changes in the water column and swim quickly, and are likely to escape collision with vessels and in-water devices.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of vessels and in-water devices during training activities, as described under Alternative 1, may affect ESA-listed salmonid species, green sturgeon (Southern DPS), Pacific eulachon, bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), and yelloweye rockfish (Puget Sound/Georgia Basin DPS),and may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal summer-run ESU), green sturgeon, bull trout, bocaccio rockfish, and yelloweye rockfish. The Navy has consulted with NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of vessels and in-water devices associated with training activities, as described under Alternative 1, may affect EFH species within the Study Area.

Impacts from Vessels and In-Water Devices Under Alternative 1 for Testing Activities

Under Alternative 1, the combined number of proposed testing activities involving the movement of vessels and the use of in-water devices (Table 3.0-12 and Table 3.0-13) would increase compared to those proposed in the 2015 NWTT Final EIS/OEIS. Vessel movement would increase in the Offshore Area (from 181 to 283 annual activities), and increases slightly in the Inland Waters (from 916 to 918) and Western Behm Canal (60 to 63).

There is also an overall increase in the use of in-water devices during testing activities in the Study Area (Table 3.0-13), all of which are associated with small, slow-moving, and unmanned underwater vehicles. The number of testing activities increases in the Offshore Areas (156 to 215), Inland Waters (576 to 664), and in the western Behm Canal (8 to 19). The proposed increase of in-water devices would not change the conclusion presented in the 2015 NWTT Final EIS/OEIS. The activities would occur in the same locations and in a similar manner as were analyzed previously. In spite of these increases, and as described in the 2015 NWTT Final EIS/OEIS, these vessel and in-water device activities remain unlikely to result in a strike to any marine fish. The proposed increase of vessel and in-water device activities would not change that conclusion. As stated in the 2015 NWTT Final EIS/OEIS, the risk of a strike from vessels and in-water devices used in training and testing activities on an individual fish would be extremely low because (1) most fish can detect and avoid vessel and in-water device movements, and (2) the types of fish that are likely to be exposed to vessel and in-water device strike are limited and occur in low concentrations where vessels and in-water devices are used. Potential impacts of exposure to vessels and in-water devices are not expected to result in substantial changes to an individual's behavior, fitness, or species recruitment, and are not expected to result in population-level impacts. Therefore, impacts on fish or fish populations would be negligible.

Similar to most other fish species described above, ESA-listed fish species would be able to sense pressure changes in the water column and swim quickly, and are likely to escape collision with vessels and in-water devices.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon are not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of vessels and in-water devices during testing activities, as described under Alternative 1, may affect ESA-listed salmonid species, green sturgeon (Southern DPS), Pacific eulachon, bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), and yelloweye rockfish (Puget Sound/Georgia Basin DPS), and may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal summer-run ESU), green sturgeon, bull trout, bocaccio rockfish, and yelloweye rockfish. The Navy has consulted with NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of vessels and in-water devices associated with testing activities, as described under Alternative 1, may affect EFH species within the Study Area.

3.9.3.4.1.2 Impacts from Vessels and In-Water Devices Under Alternative 2

Impacts from Vessels and In-Water Devices Under Alternative 2 for Training Activities

Under Alternative 2, the combined number of proposed training activities involving the movement of vessels and the use of in-water devices would be slightly greater than Alternative 1 (Table 3.0-12 and Table 3.0-13) and greater than those proposed in the 2015 NWTT Final EIS/OEIS. Vessel movement would increase in the Study Area compared to Alternative 1 (1,471 for Alternative 1 compared to 1,658 for Alternative 2), and increases (1,524 to 1,658) compared to levels presented in the 2015 NWTT Final EIS/OEIS (Table 3.0-12).

There would also be a slight total increase in the use of in-water devices compared to Alternative 1 (600 for Alternative 1 compared to 620) and an increase from levels presented in the 2015 NWTT Final EIS/OEIS (496 to 620) (Table 3.0-13). All of the increased in-water device activities are associated with small, slow-moving unmanned underwater vehicles. Because the increases are to activities in which the in-water devices are unlikely to have an impact on marine fishes (small, slow-moving in-water devices), the impacts on fishes would be similar. The proposed increase of in-water devices would not change that conclusion. The activities would occur in the same locations and in a similar manner as were analyzed previously. Under Alternative 2, the risk of a strike from vessels and in-water devices used in training and testing activities on an individual fish would be extremely low because (1) most fish can detect and avoid vessel and in-water device movements, and (2) the types of fish that are likely to be exposed to vessel and in-water device strike are limited and occur in low concentrations where vessels and in-water devices are used. Potential impacts of exposure to vessels and in-water devices are not expected to result in substantial changes to an individual's behavior, fitness, or species recruitment, and are not expected to result in population-level impacts. Therefore, impacts on fish or fish populations would be negligible.

Similar to most other fish species described above, ESA-listed fish species would be able to sense pressure changes in the water column and swim quickly, and are likely to escape collision with vessels and in-water devices.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of vessels and in-water devices during training activities, as described under Alternative 2, may affect ESA-listed salmonid species, green sturgeon (Southern DPS), Pacific eulachon, bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), and yelloweye rockfish (Puget Sound/Georgia Basin DPS), and may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal summer-run ESU), green sturgeon, bull trout, bocaccio rockfish, and yelloweye rockfish.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of vessels and in-water devices associated with training activities, as described under Alternative 2, may affect EFH species within the Study Area.

Impacts from Vessels and In-Water Devices Under Alternative 2 for Testing Activities

Under Alternative 2, the combined number of proposed testing activities involving the movement of vessels and the use of in-water devices would increase compared to Alternative 1 (Table 3.0-12 and Table 3.0-13) and those proposed in the 2015 NWTT Final EIS/OEIS. Vessel movement would increase slightly in the Offshore Area compared to Alternative 1 (from 283 to 295) and would increase compared to numbers presented in the 2015 NWTT Final EIS/OEIS (from 181 to 295). Vessel movements would increase in the Inland Waters compared to Alternative 1 (from 918 to 1,028) and would increase compared to numbers presented in the 2015 NWTT final EIS/OEIS (from 916 to 1,028). Similarly, vessel movement would increase in the Western Behm Canal (from 63 to 77) compared to Alternative 1 and would increase from 60 to 77 compared to the 2015 NWTT Final EIS/OEIS, resulting in a net increase in the Study Area.

There would also be a slight increase in the use of in-water devices compared to Alternative 1 (898 for Alternative 1 compared to 932) and an increase from levels presented in the 2015 NWTT final EIS/OEIS (740 to 932) (Table 3.0-13). The activities would occur in the same locations and in a similar manner as were analyzed previously. In spite of these increases, and as described in the 2015 NWTT Final EIS/OEIS, these vessel and in-water device activities remain unlikely to result in a strike to any marine fish. The proposed increase of vessel and in-water device activities would not change that conclusion. As stated in the 2015 NWTT Final EIS/OEIS and above under Alternative 1, the impact of vessels and in-water devices on marine fishes would remain inconsequential because (1) most fish can detect and avoid vessel and in-water device movements, and (2) the types of fish that are likely to be exposed to vessel and in-water device strike are limited and occur in low concentrations where vessels and in-water devices are used. Potential impacts of exposure to vessels and in-water devices are not expected to result in substantial changes to an individual's behavior, fitness, or species recruitment, and are not expected to result in population-level impacts.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of vessels and in-water devices during testing activities, as described under Alternative 2, may affect ESA-listed salmonid species, green sturgeon (Southern DPS), Pacific eulachon, bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), and yelloweye rockfish (Puget Sound/Georgia Basin DPS), and may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal summer-run ESU), green sturgeon, bull trout, bocaccio rockfish, and yelloweye rockfish.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of vessels and in-water devices associated with testing activities, as described under Alternative 2, may affect EFH species within the Study Area.

3.9.3.4.1.3 Impacts from Vessels and In-Water Devices Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Physical disturbance and strike stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer physical disturbance and strike stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for physical disturbance and strike impacts on individual fish, but would not measurably improve the status of fish populations or subpopulations.

3.9.3.4.2 Impacts from Military Expended Materials

Military expended materials include non-explosive practice munitions (Table 3.0-14), other military materials (Table 3.0-15), high explosives that may result in fragments (Table 3.0-16), and targets (Table 3.0-17).

3.9.3.4.2.1 Impacts from Military Expended Materials Under Alternative 1

Impacts from Military Expended Materials Under Alternative 1 for Training Activities

Under Alternative 1, the number of military materials that would be expended during training activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from (Tables 3.0-14 through 3.0-16) are combined, the number of items proposed to be expended under Alternative 1 decreases compared to ongoing activities. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts on fishes would be expected to be the same as stated in the 2015 NWTT Final EIS/OEIS and would be inconsequential for the same reasons described above for vessels and in-water devices.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of military expended materials during training activities, as described under Alternative 1, may affect ESA-listed salmonid species, green sturgeon (Southern DPS), Pacific eulachon, bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), and yelloweye rockfish (Puget Sound/Georgia Basin DPS), and may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal summer-run ESU), green sturgeon, bull trout, bocaccio rockfish, and yelloweye rockfish. The Navy has consulted with NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended materials associated with training activities, as described under Alternative 1, may affect EFH species within the Study Area.

Impacts from Military Expended Materials Under Alternative 1 for Testing Activities

Under Alternative 1, the number of military materials that would be expended during testing activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from (Tables 3.0-14 through 3.0-16) are combined, the number of items proposed to be expended under Alternative 1 increases slightly compared to ongoing activities. Although there are a few new activities such as mine countermeasure and neutralization testing and kinetic energy weapon testing that would generate military expended materials, impacts on fishes would be expected to be the same as those described above and would be inconsequential for the same reasons described above for vessels and in-water devices.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of military expended materials during testing activities, as described under Alternative 1, may affect ESA-listed salmonid species, green sturgeon (Southern DPS), Pacific eulachon, bocaccio rockfish (Puget Sound/Georgia Basin DPS), and yelloweye rockfish (Puget Sound/Georgia Basin DPS), and may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal summer-run ESU), green sturgeon, bull trout, bocaccio rockfish, and yelloweye rockfish. The Navy has consulted with NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended materials associated with testing activities, as described under Alternative 1, may affect EFH species within the Study Area.

3.9.3.4.2.2 Impacts from Military Expended Materials Under Alternative 2

Impacts from Military Expended Materials Under Alternative 2 for Training Activities

Under Alternative 2, the number of military materials that would be expended during training activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from Table 3.0-14, Table 3.0-15, and Table 3.0-16 are combined, the number of items proposed to be expended under Alternative 2 increases compared to both Alternative 1 and ongoing activities. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts on fishes would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS, the impact of military expended materials on marine fishes would be inconsequential for the same reasons described above for vessels and in-water devices.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of military expended materials during training activities, as described under Alternative 2, may affect ESA-listed salmonid species, green sturgeon (Southern DPS), Pacific eulachon, bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), and yelloweye rockfish (Puget Sound/Georgia Basin DPS), and may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal summer-run ESU), green sturgeon, bull trout, bocaccio rockfish, and yelloweye rockfish.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended materials associated with training activities, as described under Alternative 2, may affect EFH species within the Study Area.

Impacts from Military Expended Materials Under Alternative 2 for Testing Activities

Under Alternative 2, the number of military materials that would be expended during testing activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from Tables 3.0-14 through 3.0-16 are combined, the number of items proposed to be expended under Alternative 2 increases compared to Alternative 1 and ongoing activities. Although there are a few new activities such as mine countermeasure and neutralization testing and kinetic energy weapon testing that would generate military expended materials, impacts on marine fishes would be expected to be the same as those described above and would be inconsequential for the same reasons described above for vessels and in-water devices.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of military expended materials during testing activities, as described under Alternative 2, may affect ESA-listed salmonid species, green sturgeon (Southern DPS), Pacific eulachon, bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS) and yelloweye rockfish (Puget Sound/Georgia Basin DPS), and may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal summer-run ESU), green sturgeon, bull trout, bocaccio rockfish, and yelloweye rockfish.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended materials associated with testing activities, as described under Alternative 2, may affect EFH species within the Study Area.

3.9.3.4.2.3 Impacts from Military Expended Materials Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Physical disturbance and strike stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer physical disturbance and strike stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for physical disturbance and strike impacts on individual fish, but would not measurably improve the status of fish populations or subpopulations.

3.9.3.4.3 Impacts from Seafloor Devices

3.9.3.4.3.1 Impacts from Seafloor Devices Under Alternative 1

Impacts from Seafloor Devices Under Alternative 1 for Training Activities

Under Alternative 1, the number of training activities that include the use of seafloor devices would increase from 10 to 40 compared to ongoing activities, all of which would occur in the Inland Waters (Table 3.0-18) as part of the Precision Anchoring exercise. The activity is comprised of a vessel navigating to a precise, pre-determined location and releasing the ship's anchor to the bottom. The anchor is later recovered and the activity is complete. As discussed in the 2015 NWTT Final EIS/OEIS, it would be highly unlikely that a seafloor device strikes an individual fish because they are able to detect and avoid falling objects through the water column and the dispersed nature of the activity. It is possible, although extremely unlikely, that a fish on the seafloor could be struck by a falling object such as an anchor. Under Alternative 1, training activities involving seafloor devices are not expected to yield any behavioral changes or lasting impacts on the survival, growth, recruitment, or reproduction of fish species at the population level.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of seafloor devices during training activities, as described under Alternative 1, may affect ESA-listed salmonid species, green sturgeon (Southern DPS), Pacific eulachon, bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), and yelloweye rockfish (Puget Sound/Georgia Basin DPS), and may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal summer-run ESU), green sturgeon, bull trout, bocaccio rockfish, and yelloweye rockfish. The Navy has consulted with NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of seafloor devices associated with training activities, as described under Alternative 1, may affect EFH species within the Study Area.

Impacts from Seafloor Devices Under Alternative 1 for Testing Activities

Under Alternative 1, the total number of testing activities that include the use of seafloor devices (Table 3.0-18) would increase compared to ongoing activities (from 809 to 878). The majority of the activities involve the temporary placement of mine shapes in Inland Waters. As discussed in the 2015 NWTT Final EIS/OEIS, it would be highly unlikely that a seafloor device strikes an individual fish because they are able to detect and avoid falling objects through the water column and the dispersed nature of the activity. It is possible, although extremely unlikely, that a fish on the seafloor could be struck by a falling object such as an anchor. Under Alternative 1, testing activities involving seafloor devices are not expected to yield any behavioral changes or lasting impacts on the survival, growth, recruitment, or reproduction of fish species at the population level.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of seafloor devices during testing activities, as described under Alternative 1, may affect ESA-listed salmonid species, green sturgeon (Southern DPS), Pacific eulachon, bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), and yelloweye rockfish (Puget Sound/Georgia Basin DPS), and may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal summer-run ESU), bull trout (Coastal Puget Sound DPS), green sturgeon, bull trout, bocaccio rockfish, and yelloweye rockfish. The Navy has consulted with NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended materials associated with testing activities, as described under Alternative 1, may affect EFH species within the Study Area.

3.9.3.4.3.2 Impacts from Seafloor Devices Under Alternative 2

Impacts from Seafloor Devices Under Alternative 2 for Training Activities

Under Alternative 2, the number of training activities that include the use of seafloor devices would be the same as under Alternative 1 (Table 3.0-18) and would increase compared to ongoing activities (from 10 to 40). As described above under Alternative 1, it would be highly unlikely that a seafloor device strikes an individual fish because they are able to detect and avoid falling objects through the water column and the dispersed nature of the activity. It is possible, although extremely unlikely, that a fish on the seafloor could be struck by a falling object such as an anchor. Under Alternative 2, training activities involving seafloor devices are not expected to yield any behavioral changes or lasting impacts on the survival, growth, recruitment, or reproduction of fish species at the population level.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of seafloor devices during training activities, as described under Alternative 2, may affect ESA-listed salmonid species, green sturgeon (Southern DPS), Pacific eulachon, bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), and yelloweye rockfish (Puget Sound/Georgia Basin DPS), and may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal summer-run ESU), bull trout (Coastal Puget Sound DPS), green sturgeon, bull trout, bocaccio rockfish, and yelloweye rockfish.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of seafloor devices associated with training activities, as described under Alternative 2, may affect EFH species within the Study Area.

Impacts from Seafloor Devices Under Alternative 2 for Testing Activities

Under Alternative 2, the total number of testing activities that include the use of seafloor devices would increase compared to both Alternative 1 (878 to 953) (Table 3.0-18) and ongoing activities (809 to 953). As described above under Alternative 1, it would be highly unlikely that a seafloor device strikes an individual fish because they are able to detect and avoid falling objects through the water column and the dispersed nature of the activity. It is possible, although extremely unlikely, that a fish on the seafloor could be struck by a falling object such as an anchor. Under Alternative 2, testing activities involving seafloor devices are not expected to yield any behavioral changes or lasting impacts on the survival, growth, recruitment, or reproduction of fish species at the population level.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of seafloor devices during testing activities, as described under Alternative 2, may affect ESA-listed salmonid species, green sturgeon (Southern DPS), Pacific eulachon, bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), and yelloweye rockfish (Puget Sound/Georgia Basin DPS), and may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal summer-run ESU), bull trout (Coastal Puget Sound DPS), green sturgeon, bull trout, bocaccio rockfish, and yelloweye rockfish.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended materials associated with testing activities, as described under Alternative 2, may affect EFH species within the Study Area.

3.9.3.4.3.3 Impacts from Seafloor Devices Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Physical disturbance and strike stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer physical disturbance and strike stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for physical disturbance and strike impacts on individual fish, but would not measurably improve the status of fish populations or subpopulations.

3.9.3.5 Entanglement Stressors

Entanglement stressors that may impact fishes include (1) fiber optic cables and guidance wires, and (2) decelerators/parachutes. Biodegradable polymer is a new stressor not previously analyzed, but the other two stressors remain the same as analyzed in the 2015 NWTT Final EIS/OEIS.

3.9.3.5.1 Impacts from Wires and Cables

Wires and cables include fiber optic cables, guidance wires, and sonobuoy wires (Table 3.0-19).

3.9.3.5.1.1 Impacts from Wires and Cables Under Alternative 1

Impacts from Wires and Cables Under Alternative 1 for Training Activities

Under Alternative 1, the number of wires and cables that would be expended during training activities (Table 3.0-19) is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. No fiber optic cables are used in the Study Area under training, either in the previous analysis or this Supplemental. Two guidance wires are proposed to be expended in the Offshore Area under Alternative 1, compared to none proposed in the previous analysis. No guidance wires would be expended in Inland Waters. As shown in Table 3.0-19, the expenditure of sonobuoy wires in the Offshore Area is proposed to increase slightly (from 8,928 to 9,338), and no sonobuoys are proposed to be used in the Inland Waters, where none were proposed previously. The activities that expend wires and cables would generally occur in the same locations and in a similar manner as were analyzed previously. Because the number and locations of these wires and cables is similar to those analyzed in the 2015 NWTT Final EIS/OEIS, the impacts on fishes would be expected to be the same.

As stated in the 2015 NWTT Final EIS/OEIS, while individual fish susceptible to entanglement would encounter wires and cables, including guidance wires, fiber optic cables, and sonobuoy wires during training and testing activities, the long-term consequences of entanglement are unlikely for either individuals or populations because (1) the encounter rate for wires and cables is low, (2) the types of fishes that are susceptible to these items is limited, (3) there is restricted overlap with susceptible fishes, and (4) the physical characteristics of the wires and cables reduce entanglement risk to fishes compared to monofilament used for fishing gear. Potential impacts from exposure to fiber optic cables and guidance wires are not expected to result in substantial changes to an individual's behavior, fitness, or species recruitment, and are not expected to result in population-level impacts.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of wires and cables during with training activities, as described under Alternative 1, may affect ESA-listed salmonid species, green sturgeon (Southern DPS), Pacific eulachon, bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS) and yelloweye rockfish (Puget Sound/Georgia Basin DPS), and may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal summer-run ESU), green sturgeon, bocaccio rockfish, and yelloweye rockfish. The Navy has consulted with NMFS and USFWS, as required by section 7(a)(2) of the ESA. The use of wires and cables would have no effect on critical habitat for bull trout.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of wires and cables associated with training activities, as described under Alternative 1, may affect EFH species within the Study Area.

Impacts from Wires and Cables Under Alternative 1 for Testing Activities

Under Alternative 1, the total number of wires and cables that would be expended during testing activities (Table 3.0-19) is increased compared to the number proposed for use in the 2015 NWTT Final EIS/OEIS. Fiber optic cables used in the Offshore Area would increase (20 to 36), guidance wires used in both the Offshore Area and the Inland Waters would increase (from 92 to 152 in Offshore Areas and 155 to 230 in Inland Waters), and sonobuoy wires expended would also increase (1,000 to 4,001 in Offshore Areas and 6 to 48 in Inland Waters. Even though the number of wires and cables would increase during testing activities, the locations are similar to those analyzed in the 2015 NWTT Final EIS/OEIS, and impacts on fishes would be expected to be the same.

As stated in the 2015 NWTT Final EIS/OEIS, while individual fish susceptible to entanglement would encounter wires and cables, including guidance wires, fiber optic cables, and sonobuoy wires during training and testing activities, the long-term consequences of entanglement are unlikely for either individuals or populations because (1) the encounter rate for wires and cables is low, (2) the types of fishes that are susceptible to these items is limited, (3) there is restricted overlap with susceptible fishes, and (4) the physical characteristics of the wires and cables reduce entanglement risk to fishes compared to monofilament used for fishing gear. Potential impacts from exposure to fiber optic cables and guidance wires are not expected to result in substantial changes to an individual's behavior, fitness, or species recruitment, and are not expected to result in population-level impacts.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of wires and cables during testing activities, as described under Alternative 1, may affect ESA-listed salmonid species, green sturgeon (Southern DPS), Pacific eulachon, bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS) and yelloweye rockfish (Puget Sound/Georgia Basin DPS), and may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal summer-run ESU), green sturgeon, bocaccio rockfish, and yelloweye rockfish. The Navy has consulted with NMFS and USFWS, as required by section 7(a)(2) of the ESA. The use of wires and cables would have no effect on critical habitat for bull trout.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of wires and cables associated with testing activities, as described under Alternative 1, may affect EFH species within the Study Area.

3.9.3.5.1.2 Impacts from Wires and Cables Under Alternative 2

Impacts from Wires and Cables Under Alternative 2 for Training Activities

Under Alternative 2, the total number of wires and cables that would be expended during training activities (9,380) is generally consistent with the number proposed for use under Alternative 1 (9,340) (Table 3.0-19) and in the 2015 NWTT Final EIS/OEIS (8,928). No fiber optic cables are used in the Study Area under training, either in the previous analysis or this Supplemental. Two guidance wires are proposed to be expended in the Offshore Area under Alternative 2, none were proposed in the previous analysis. As shown in Table 3.0-19, the expenditure of sonobuoy wires in the Offshore Area is proposed to increase slightly (from 9,338 to 9,380), and no sonobuoys are proposed to be used in the Inland Waters, where none were proposed previously. The activities that expend wires and cables would generally occur in the same locations and in a similar manner as were analyzed previously. Because the number and locations of these wires and cables is similar to those analyzed in the 2015 NWTT Final EIS/OEIS, the impacts on fishes would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS, the impact of wires and cables on fishes would be inconsequential for the same reasons discussed above under Alternative 1.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of wires and cables during with training activities, as described under Alternative 2 may affect ESA-listed salmonid species, green sturgeon (Southern DPS), Pacific eulachon, bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS) and yelloweye rockfish (Puget Sound/Georgia Basin DPS), and may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal summer-run ESU), green sturgeon, bocaccio rockfish, and yelloweye rockfish. The use of wires and cables would have no effect on critical habitat for bull trout.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of wires and cables associated with training activities, as described under Alternative 2, may affect EFH species within the Study Area.

Impacts from Wires and Cables Under Alternative 2 for Testing Activities

Under Alternative 2, the total number of wires and cables that would be expended during testing activities increases compared to the number proposed for use under Alternative 1 (from 4,616 to 6,862) (Table 3.0-19) and in the 2015 NWTT Final EIS/OEIS (1,395 to 6,862). Fiber optic cables used in the Offshore Area and Inland Waters would be the same as Alternative 1 and increase compared to the 2015 NWTT Final EIS/OEIS. Guidance wires used in the Offshore Area would increase compared to

Alternative 1 (from 152 to 192) and those proposed in the previous analysis (from 92 to 192). Guidance wires in Inland Waters would be the same as Alternative 1 (Table 3.0-19), but increase (from 155 to 230) compared to those proposed in the previous analysis. Sonobuoy wires expended in Offshore Areas would increase compared to Alternative 1 (from 4,001 to 6,207) and in the 2015 NWTT Final EIS/OEIS (from 1,000 to 6,207). Sonobuoy wires expended in Inland Waters would be the same as Alternative 1 (Table 3.0-19) and would increase compared to the 2015 NWTT Final EIS/OEIS (from 6 to 48). The activities that expend wires and cables would generally occur in the same locations and in a similar manner as were analyzed previously. As stated in the 2015 NWTT Final EIS/OEIS, the impact of wires and cables on fishes would be inconsequential for the same reasons discussed above under Alternative 1.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon are not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of wires and cables during testing activities, as described under Alternative 2, may affect ESA-listed salmonid species, green sturgeon (Southern DPS), Pacific eulachon, bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS) and yelloweye rockfish (Puget Sound/Georgia Basin DPS), and may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal summer-run ESU), green sturgeon, bocaccio rockfish, and yelloweye rockfish. The use of wires and cables would have no effect on critical habitat for bull trout.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of wires and cables associated with testing activities, as described under Alternative 2, may affect EFH species within the Study Area.

3.9.3.5.1.3 Impacts from Wires and Cables Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Entanglement stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer entanglement stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for entanglement impacts on individual fish, but would not measurably improve the status of fish populations or subpopulations.

3.9.3.5.2 Impacts from Decelerators/Parachutes

Decelerators/parachutes include small, medium, large, and extra-large decelerator parachutes (Table 3.0-20).

3.9.3.5.2.1 Impacts from Decelerators/Parachutes Under Alternative 1

Impacts from Decelerators/Parachutes Under Alternative 1 for Training Activities

Under Alternative 1, the total number of decelerators/parachutes that would be expended during training activities increases (9,097 to 9,456) compared to the number proposed for use in the 2015 NWTT Final EIS/OEIS. As shown in Table 3.0-20, the expenditure of small size decelerators/parachutes in the Offshore Area is proposed to increase (8,928 to 9,354), and no small decelerators/parachutes are proposed to be used in the Inland Waters, where none were proposed previously. The number of medium decelerators/parachutes in the Offshore Area decreases from 24 to 4, and the number of large decelerators/parachutes in the Offshore Area decreases from 145 to 98 (Table 3.0-20). The activities that expend decelerators/parachutes would generally occur in the same locations and in a similar manner as were analyzed previously. Because the number and locations of these decelerators/parachutes is similar to those analyzed in the 2015 NWTT Final EIS/OEIS, the impacts on fishes would be expected to be the same.

As described in the 2015 NWTT Final EIS/OEIS, it would be very unlikely that fishes would encounter and become entangled in any decelerators/parachutes or sonobuoy accessories. This is mainly due to the size of the range complexes and the resulting widely scattered decelerators/parachutes. If a few individual fish were to encounter and become entangled in a decelerator/parachute, the growth, survival, annual reproductive success, or lifetime reproductive success of the population as a whole would not be impacted directly or indirectly.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of decelerators/parachutes during with training activities, as described under Alternative 2, may affect ESA-listed salmonid species, green sturgeon (Southern DPS), Pacific eulachon, bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS) and yelloweye rockfish (Puget Sound/Georgia Basin DPS), and may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal summer-run ESU), green sturgeon, bocaccio rockfish, and yelloweye rockfish. The Navy has consulted with NMFS and USFWS, as required by section 7(a)(2) of the ESA. The use of decelerators/parachutes would have no effect on critical habitat for bull trout.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of decelerators/parachutes associated with training activities, as described under Alternative 2, may affect EFH species within the Study Area.

Impacts from Decelerators/Parachutes Under Alternative 1 for Testing Activities

Under Alternative 1, the total number of decelerators/parachutes that would be expended during testing activities increases (1,181 to 1,887) compared to the number proposed for use in the 2015 NWTT Final EIS/OEIS. As shown in Table 3.0-20, the expenditure of small size decelerators/parachutes in the Offshore Area increases (1,068 to 1,711), and increases from 113 to 176 in the Inland Waters. No other sizes of decelerators/parachutes are proposed during testing activities. The activities that expend decelerators/parachutes would generally occur in the same locations and in a similar manner as were analyzed previously. Even though the number of decelerators/parachutes would increase during testing activities, the locations are similar to those analyzed in the 2015 NWTT Final EIS/OEIS, and impacts on fishes would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS, the impact of decelerators/parachutes on fishes would be inconsequential for the same reasons presented above for wires and cables.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of decelerators/parachutes during testing activities, as described under Alternative 1, may affect ESA-listed salmonid species, green sturgeon (Southern DPS), Pacific eulachon, bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS) and yelloweye rockfish (Puget Sound/Georgia Basin DPS), and may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal summer-run ESU), green sturgeon, bocaccio rockfish, and yelloweye rockfish. The Navy has consulted with NMFS and USFWS, as required by section 7(a)(2) of the ESA. The use of decelerators/parachutes would have no effect on critical habitat for bull trout.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of decelerators/parachutes associated with testing activities, as described under Alternative 1, may affect EFH species within the Study Area.

3.9.3.5.2.2 Impacts from Decelerators/Parachutes Under Alternative 2

Impacts from Decelerators/Parachutes Under Alternative 2 for Training Activities

Under Alternative 2, the total number of decelerators/parachutes that would be expended during training activities increases compared to the number proposed for use under Alternative 1 (from 9,456 to 9,563) (Table 3.0-20) and in the 2015 NWTT Final EIS/OEIS (9,097 to 9,563). As shown in Table 3.0-20, the expenditure of small size decelerators/parachutes in the Offshore Area is proposed to increase (9,354 to 9,394), and no small decelerators/parachutes are proposed to be used in the Inland Waters, where none were proposed previously. The number of medium decelerators/parachutes in the Offshore Area increases from 4 to 24 compared to Alternative 1 and is the same as the 2015 NWTT Final EIS/OEIS. The number of large decelerators/parachutes in the Offshore Area increases from 98 to 145 (Table 3.0-20) compared to Alternative 1 and is the same as the 2015 NWTT Final EIS/OEIS. The activities that expend decelerators/parachutes would generally occur in the same locations and in a similar manner as were analyzed previously. Because the number and locations of these decelerators/parachutes is similar to those analyzed in the 2015 NWTT Final EIS/OEIS, the impacts on fishes would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS, the impact of decelerators/parachutes on fishes would be inconsequential for the same reasons detailed above under Alternative 1.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of decelerators/parachutes during training activities, as described under Alternative 2, may affect ESA-listed salmonid species, green sturgeon (Southern DPS), Pacific eulachon, bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS) and yelloweye rockfish (Puget Sound/Georgia Basin DPS), and may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal summer-run ESU), green sturgeon, bocaccio rockfish, and yelloweye rockfish. The use of decelerators/parachutes would have no effect on critical habitat for bull trout.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of decelerators/parachutes associated with training activities, as described under Alternative 2, may affect EFH species within the Study Area.

Impacts from Decelerators/Parachutes Under Alternative 2 for Testing Activities

Under Alternative 2, the total number of decelerators/parachutes that would be expended during testing activities increases compared to the number proposed for use under Alternative 1 (from 1,887 to 1,895) (Table 3.0-20) and in the 2015 NWTT Final EIS/OEIS (1,181 to 1,991). As shown in Table 3.0-20, the expenditure of small decelerators/parachutes would be the same in the Offshore Area compared to Alternative 1 and increase compared to the 2015 NWTT Final EIS/OEIS (from 1,068 to 1,711). The expenditure of small decelerators/parachutes in Inland Waters would increase compared to both Alternative 1 (176to 184) and the previous analysis (113 to 232). The activities that expend decelerators/parachutes would generally occur in the same locations and in a similar manner as were analyzed previously. Even though the number of decelerators/parachutes would increase during testing activities, the locations are similar to those analyzed in the 2015 NWTT Final EIS/OEIS, and impacts on fishes would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS, the impact of decelerators/parachutes on fishes would be inconsequential for the same reasons presented above for wires and cables.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of decelerators/parachutes during testing activities, as described under Alternative 2, may affect ESA-listed salmonid species, green sturgeon (Southern DPS), Pacific eulachon, bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS) and yelloweye rockfish (Puget Sound/Georgia Basin DPS), and may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal summer-run ESU), green sturgeon, bocaccio rockfish, and yelloweye rockfish. The use of decelerators/parachutes would have no effect on critical habitat for bull trout.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of decelerators/parachutes associated with testing activities, as described under Alternative 2, may affect EFH species within the Study Area.

3.9.3.5.2.3 Impacts from Decelerators/Parachutes Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Entanglement stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer entanglement stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for entanglement impacts on individual fish, but would not measurably improve the status of fish populations or subpopulations.

3.9.3.5.3 Impacts from Biodegradable Polymer

Biodegradable polymers were not proposed for use in the 2015 NWTT Final EIS/OEIS, and for this Supplemental would be used only during proposed testing activities, not during training activities. For a discussion of where biodegradable polymers are used and how many activities would occur under each alternative, see Section 3.0.3.5.3 (Biodegradable Polymer). The biodegradable polymers that the Navy uses are designed to temporarily interact with the propeller(s) of a target craft, rendering it ineffective. A biodegradable polymer is a high molecular weight polymer that degrades to smaller compounds as a result of microorganisms and enzymes. The rate of biodegradation could vary from hours to years and the type of small molecules formed during degradation can range from complex to simple products, depending on whether the polymers are natural or synthetic (Karlsson & Albertsson, 1998). Based on the constituents of the biodegradable polymer the Navy proposes to use, it is anticipated that the material will break down into small pieces within a few days to weeks. This will break down further and dissolve into the water column within weeks to a few months. The final products which are all environmentally benign will be dispersed quickly to undetectable concentrations. Unlike other entanglement stressors, biodegradable polymers only retain their strength for a relatively short period of time, therefore the potential for entanglement by a fish would be limited. Furthermore, the longer the biodegradable polymer remains in the water, the weaker it becomes making it more brittle and likely to break. A fish would have to encounter the biodegradable polymer immediately after it was expended for it to be a potential entanglement risk. If a fish were to encounter the polymer a few hours after it was expended, it is very likely that it would break easily and would no longer be an entanglement stressor.

3.9.3.5.3.1 Impacts from Biodegradable Polymer Under Alternative 1

Impacts from Biodegradable Polymer Under Alternative 1 for Training Activities

No biodegradable polymers are proposed to be used for training activities under Alternative 1.

Impacts from Biodegradable Polymer Under Alternative 1 for Testing Activities

As shown in Table 3.0-21, four testing activities involving the use of biodegradable polymers are proposed to only be conducted in the Inland Waters under Alternative 1. The impact of biodegradable polymers on fish would be inconsequential because biodegradable polymers only retain their strength for a relatively short period of time and a fish would have to encounter the biodegradable polymer immediately after it was expended for it to be a potential entanglement risk.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of biodegradable polymers during testing activities, as described under Alternative 1, may affect ESA-listed salmonid species, green sturgeon (Southern DPS), Pacific eulachon, bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS) and yelloweye rockfish (Puget Sound/Georgia Basin DPS), and may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal summer-run ESU), green sturgeon, bull trout, bocaccio rockfish, and yelloweye rockfish. The Navy has consulted with NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of biodegradable polymers associated with testing activities, as described under Alternative 1, may affect EFH species within the Study Area.

3.9.3.5.3.2 Impacts from Biodegradable Polymer Under Alternative 2

Impacts from Biodegradable Polymer Under Alternative 2 for Training Activities

No biodegradable polymers are proposed to be used for training activities under Alternative 2.

Impacts from Biodegradable Polymer Under Alternative 2 for Testing Activities

As shown in Table 3.0-21, four testing activities involving the use of biodegradable polymers are proposed to be conducted in the Inland Waters under Alternative 2, the same as Alternative 1. The impact of biodegradable polymers on fishes would be inconsequential because biodegradable polymers only retain their strength for a relatively short period of time and a fish would have to encounter the biodegradable polymer immediately after it was expended for it to be a potential entanglement risk. As detailed above and in the 2015 NWTT Final EIS/OEIS, fish are not particularly susceptible to entanglement stressors, including biodegradable polymers and would likely only be temporarily disturbed.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of biodegradable polymers during testing activities, as described under Alternative 2, may affect ESA-listed salmonid species, green sturgeon (Southern DPS), Pacific eulachon, bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS) and yelloweye rockfish (Puget Sound/Georgia Basin DPS), and may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal summer-run ESU), green sturgeon, bull trout, bocaccio rockfish, and yelloweye rockfish.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of biodegradable polymers associated with testing activities, as described under Alternative 2, may affect EFH species within the Study Area.

3.9.3.5.3.3 Impacts from Biodegradable Polymer Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Entanglement stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would remain unchanged after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer entanglement stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for entanglement impacts on individual fish, but would not measurably improve the status of fish populations or subpopulations.

3.9.3.6 Ingestion Stressors

The ingestions stressors that may impact fishes include military expended materials from munitions (non-explosive practice munitions and fragments from high-explosives) and military expended materials other than munitions (fragments from targets, chaff and flare components, decelerators/parachutes, and biodegradable polymers). Biodegradable polymer is a new stressor not previously analyzed, but the other stressors remain the same as analyzed in the 2015 NWTT Final EIS/OEIS.

3.9.3.6.1 Impacts from Military Expended Materials – Munitions

The military expends materials during training and testing in the Study Area that could become ingestion stressors, including non-explosive practice munitions (small- and medium-caliber), fragments from explosives, fragments from targets, chaff, flare casings (including plastic end caps and pistons), and small decelerators/parachutes. Metal items eaten by marine fish are generally small (such as fishhooks, bottle caps, and metal springs), suggesting that small- and medium-caliber projectiles, pistons, or end caps (from chaff canisters or flares) are more likely to be ingested. Both physical and toxicological impacts could occur as a result of consuming metal or plastic materials (Dantas et al., 2012; Davison & Asch, 2011; Possatto et al., 2011). Ingestion of plastics has been shown to increase hazardous chemicals in fish leading to liver toxicity of fishes (Rochman et al., 2013). Items of concern are those of ingestible size that either drift at or just below the surface (or in the water column) for a time or sink immediately to the seafloor. The likelihood that expended items would cause a potential impact on a given fish species depends on the size and feeding habits of the fish and the rate at which the fish encounters the item and the composition of the item. In this analysis only small- and medium-caliber munitions (or small fragments from larger munitions), chaff, small decelerators/parachutes, and end caps and pistons from flares and chaff cartridges are considered to be of ingestible size for a fish.

3.9.3.6.1.1 Impacts from Military Expended Materials – Munitions Under Alternative 1

Impacts from Military Expended Materials – Munitions Under Alternative 1 for Training Activities

Under Alternative 1, the number of military expended materials – munitions that would be used during training activities (Table 3.0-14 and Table 3.0-16) is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from munitions are combined, the number of items proposed to be expended under Alternative 1 decreases from ongoing activities. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts on fishes would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS, ingestion of military expended materials could result in sublethal or lethal effects to a small number of individuals, but the likelihood of a fish encountering an expended item is dependent on where that species feeds and the amount of material expended. Furthermore, as described in Section 3.1.4.1 (Explosives and Explosive Byproducts) and Table 3.1-7 in the 2015 NWTT Final EIS/OEIS, the majority of explosives byproducts from commonly used explosives materials that may be consumed (by fishes) are naturally occurring compounds in the marine environment. For example, 98 percent (by weight) of the explosives byproducts of royal demolition explosive (RDX) consistent of nitrogen, carbon dioxide, water, carbon monoxide, ammonia, and hydrogen. An encounter may not lead to ingestion, as a fish might "taste" an item and then expel it, in the same manner that a fish would take a lure into its mouth then spit it out, and would not consume toxic materials. Therefore, the number of fishes potentially impacted by ingestion of military expended materials such as munitions would be low and population-level effects are not expected.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of military expended materials – munitions of ingestible size during with training activities, as described under Alternative 1, may affect ESA-listed salmonid species, green sturgeon (Southern DPS), Pacific eulachon, bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), and yelloweye rockfish (Puget Sound/Georgia Basin DPS) and may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal summer-run ESU), green sturgeon, bull trout, bocaccio rockfish and yelloweye rockfish. The Navy has consulted with NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended materials – munitions of ingestible size associated with training activities, as described under Alternative 1, may affect EFH species within the Study Area.

Impacts from Military Expended Materials – Munitions Under Alternative 1 for Testing Activities

Under Alternative 1, the number of military expended materials – munitions that would be used during testing activities (Table 3.0-14 and Table 3.0-16) is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from munitions (non-explosive practice munitions and fragments from high explosives) are combined, the number of items proposed to be expended under Alternative 1 increases compared to ongoing activities. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts on fishes would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS, ingestion of military expended materials could result in sublethal or lethal effects to a small number of individuals, but the likelihood of a fish encountering an expended item is dependent on where that species feeds and the amount of material expended. Furthermore, an encounter may not lead to ingestion, as a fish might "taste" an item and then expel it, in the same manner that a fish would take a lure into its mouth then spit it out. Therefore, the number of fishes potentially impacted by ingestion of military expended materials such as munitions would be low and population-level effects are not expected.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of military expended materials – munitions of ingestible size during testing activities, as described under Alternative 1, may affect ESA-listed salmonid species, green sturgeon (Southern DPS), Pacific eulachon, bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), and yelloweye rockfish (Puget Sound/Georgia Basin DPS) and may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal summer-run ESU), green sturgeon, bull trout, bocaccio rockfish and yelloweye rockfish. The Navy has consulted with NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended materials – munitions of ingestible size associated with testing activities, as described under Alternative 1, may affect EFH species within the Study Area.

3.9.3.6.1.2 Impacts from Military Expended Materials – Munitions Under Alternative 2

Impacts from Military Expended Materials – Munitions Under Alternative 2 for Training Activities

Under Alternative 2, the number of military expended materials – munitions that would be used during training activities (Table 3.0-14 and Table 3.0-16) is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from munitions are combined, the number of items proposed to be expended under Alternative 2 increases compared to both Alternative 1 (Table 3.0-14 and Table 3.0-16) and ongoing activities. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts on fishes would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS, ingestion of military expended materials could result in sublethal or lethal effects to a small number of individuals, but the likelihood of a fish encountering an expended item is dependent on where that species feeds and the amount of material expended. Furthermore, an encounter may not lead to ingestion, as a fish might "taste" an item and then expel it, in the same manner that a fish would take a lure into its mouth then spit it out. Therefore, the number of fishes potentially impacted by ingestion of military expended materials such as munitions would be low and population-level effects are not expected.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of military expended materials – munitions of ingestible size during with training activities, as described under Alternative 2, may affect ESA-listed salmonid species, green sturgeon (Southern DPS), Pacific eulachon, bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), and yelloweye rockfish (Puget Sound/Georgia Basin DPS) and may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal summer-run ESU), green sturgeon, bull trout, bocaccio rockfish and yelloweye rockfish.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended materials – munitions of ingestible size associated with training activities, as described under Alternative 2, may affect EFH species within the Study Area.

Impacts from Military Expended Materials – Munitions Under Alternative 2 for Testing Activities

Under Alternative 2, the number of military expended materials – munitions that would be used during testing activities is generally consistent with the number proposed for use under Alternative 1 (Table 3.0-14 and Table 3.0-16) and greater than the numbers presented in in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from munitions are combined, the number of items proposed to be expended under Alternative 2 decreases compared to ongoing activities. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts on fishes would be expected to be the same as stated in the 2015 NWTT Final EIS/OEIS, ingestion of military expended materials could result in sublethal or lethal effects to a small number of individuals, but the likelihood of a fish encountering an expended item is dependent on where that species feeds and the amount of material expended. Furthermore, an encounter may not lead to ingestion, as a fish might "taste" an item and then expel it, in the same manner that a fish would take a lure into its mouth then spit it out. Therefore, the number of fishes potentially impacted by ingestion of military expended materials such as munitions would be low and population-level effects are not expected.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of military expended materials – munitions of ingestible size during testing activities, as described under Alternative 2, may affect ESA-listed salmonid species, green sturgeon (Southern DPS), Pacific eulachon, bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), and yelloweye rockfish (Puget Sound/Georgia Basin DPS) and may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal summer-run ESU), green sturgeon, bull trout, bocaccio rockfish and yelloweye rockfish.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended materials – munitions of ingestible size associated with testing activities, as described under Alternative 2, may affect EFH species within the Study Area.

3.9.3.6.1.3 Impacts from Military Expended Materials – Munitions Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Ingestion stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer ingestion stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for ingestion impacts on individual fish, but would not measurably improve the status of fish populations or subpopulations.

3.9.3.6.2 Impacts from Military Expended Materials – Other than Munitions

3.9.3.6.2.1 Impacts from Military Expended Materials – Other than Munitions Under Alternative 1

Impacts from Military Expended Materials – Other than Munitions Under Alternative 1 for Training Activities

Under Alternative 1, the number of military expended materials other than munitions that would be used during training activities (Table 3.0-17, Table 3.0-20, Table 3.0-21, and Table 3.0-22) is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials other than munitions (fragments from targets, chaff and flare components, and biodegradable polymers) are combined, the number of items proposed to be expended under Alternative 1 increases from ongoing activities. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts on fishes would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS, ingestion of military expended materials other than munitions could result in sublethal or lethal effects to a small number of individuals, but the likelihood of a fish encountering an expended item is dependent on where that species feeds and the amount of material expended. Furthermore, an encounter may not lead to ingestion, as a fish might "taste" an item and then expel it, in the same manner that a fish would take a lure into its mouth then spit it out. Therefore, the number of fishes potentially impacted by ingestion of military expended materials such as munitions would be low and population-level effects are not expected.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of military expended materials other than munitions of ingestible size during with training activities, as described under Alternative 1, may affect ESA-listed salmonid species, green sturgeon (Southern DPS), Pacific eulachon, bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), and yelloweye rockfish (Puget Sound/Georgia Basin DPS) and may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal summer-run ESU), green sturgeon, bull trout, bocaccio rockfish and yelloweye rockfish. The Navy has consulted with NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended materials other than munitions of ingestible size associated with training activities, as described under Alternative 1, may affect EFH species within the Study Area.

Impacts from Military Expended Materials – Other than Munitions Under Alternative 1 for Testing Activities

Under Alternative 1, the number of military expended materials other than munitions that would be used during testing activities (Table 3.0-17, Table 3.0-20, Table 3.0-21, and Table 3.0-22) decreases compared to the number proposed for use in the 2015 NWTT Final EIS/OEIS. Other than the addition of biodegradable polymer, which would occur four times annually in the Inland Waters, the activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Based on the constituents of the biodegradable polymer the Navy proposes to use, it is anticipated that the material will breakdown into small pieces within a few days to weeks, eventually dissolving into the water column as environmentally benign products. Being benign, if ingested, the remnants of the biodegradable polymer would pose limited risk to fishes. Even though there would be a substantial increase in the number of military expended materials other than munitions and as stated in the 2015 NWTT Final EIS/OEIS, ingestion of military expended materials other than munitions could result in sublethal or lethal effects to a small number of individuals, but the likelihood of a fish encountering an expended item is dependent on where that species feeds and the amount of material expended. Furthermore, an encounter may not lead to ingestion, as a fish might “taste” an item and then expel it, in the same manner that a fish would take a lure into its mouth then spit it out. Therefore, the number of fishes potentially impacted by ingestion of military expended materials such as munitions would be low and population-level effects are not expected.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of military expended materials other than munitions of ingestible size during testing activities, as described under Alternative 1, may affect ESA-listed salmonid species, green sturgeon (Southern DPS), Pacific eulachon, bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), and yelloweye rockfish (Puget Sound/Georgia Basin DPS), and may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal summer-run ESU), green sturgeon, bull trout, bocaccio rockfish and yelloweye rockfish. The Navy has consulted with NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended materials other than munitions of ingestible size associated with testing activities, as described under Alternative 1, may affect EFH species within the Study Area.

3.9.3.6.2.2 Impacts from Military Expended Materials – Other than Munitions Under Alternative 2

Impacts from Military Expended Materials – Other than Munitions Under Alternative 2 for Training Activities

Under Alternative 2, the number of military expended materials other than munitions that would be used during training activities is generally consistent with the number proposed for use under Alternative 1 (Table 3.0-17, Table 3.0-20, Table 3.0-21, and Table 3.0-22) and in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials other than munitions (fragments from targets, chaff and flare components, and biodegradable polymers) are combined, the number of items proposed to be expended under Alternative 2 increases slightly compared to Alternative 1 and increases compared to ongoing activities. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts on fishes would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS and above under Alternative 1, ingestion of military expended materials other than munitions could result in sublethal or lethal effects to a small number of individuals, but the likelihood of a fish encountering an expended item is dependent on where that species feeds and the amount of material expended. Furthermore, an encounter may not lead to ingestion, as a fish might “taste” an item and then expel it, in the same manner that a fish would take a lure into its mouth then spit it out. Therefore, the number of fishes potentially impacted by ingestion of military expended materials such as munitions would be low and population-level effects are not expected.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of military expended materials other than munitions of ingestible size during with training activities, as described under Alternative 2, may affect ESA-listed salmonid species, green sturgeon (Southern DPS), Pacific eulachon, bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), and yelloweye rockfish (Puget Sound/Georgia Basin DPS) and may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal summer-run ESU), green sturgeon, bull trout, bocaccio rockfish and yelloweye rockfish.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended materials other than munitions of ingestible size associated with training activities, as described under Alternative 2, may affect EFH species within the Study Area.

Impacts from Military Expended Materials – Other than Munitions Under Alternative 2 for Testing Activities

Under Alternative 2, the number of military expended materials other than munitions that would be used during testing activities is increased compared to the number proposed for use under Alternative 1 (Table 3.0-17, Table 3.0-20, Table 3.0-21, and Table 3.0-22) and decreases slightly from ongoing activities. Other than the addition of biodegradable polymer, which would occur four times annually in the Inland Waters, the activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Based on the constituents of the biodegradable polymer the Navy proposes to use, it is anticipated that the material will breakdown into small pieces within a few days to weeks, eventually dissolving into the water column as environmentally benign products. Being benign, if ingested, the remnants of the biodegradable polymer would pose limited risk to fishes. Even though there would be a substantial increase in the number of military expended materials other than munitions and as stated in the 2015 NWTT Final EIS/OEIS and above under Alternative 1, ingestion of military expended materials other than munitions could result in sublethal or lethal effects to a small number of individuals, but the likelihood of a fish encountering an expended item is dependent on where that species feeds and the amount of material expended. Furthermore, an encounter may not lead to ingestion, as a fish might "taste" an item and then expel it, in the same manner that a fish would take a lure into its mouth then spit it out. Therefore, the number of fishes potentially impacted by ingestion of military expended materials such as munitions would be low and population-level effects are not expected.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of military expended materials other than munitions of ingestible size during testing activities, as described under Alternative 2, may affect ESA-listed salmonid species, green sturgeon (Southern DPS), Pacific eulachon, bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), and yelloweye rockfish (Puget Sound/Georgia Basin DPS) and may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal summer-run ESU), green sturgeon, bull trout, bocaccio rockfish and yelloweye rockfish.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended materials other than munitions of ingestible size associated with testing activities, as described under Alternative 2, may affect EFH species within the Study Area.

3.9.3.6.2.3 Impacts from Military Expended Materials – Other than Munitions Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Ingestion stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer ingestion stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for ingestion impacts on individual fish, but would not measurably improve the status of fish populations or subpopulations.

3.9.3.7 Secondary Stressors

Stressors from training and testing activities could pose secondary or indirect impacts on fishes via habitat, sediment, and water quality. These include (1) explosives and byproducts; (2) metals; (3) chemicals; (4) other materials such as targets, chaff, and plastics; and (5) impacts on fish habitat.

While the number of training and testing activities would change under this supplement, the analysis presented in the 2015 NWTT Final EIS/OEIS, Section 3.9.3.6 (Secondary Stressors) remains valid. The changes in training and testing activities are not substantial and would not result in an overall change to existing environmental conditions or an increase in the level or intensity of secondary stressors within the Study Area.

As stated in the 2015 NWTT Final EIS/OEIS, indirect impacts of explosives and unexploded ordnance on marine fishes via water could not only cause physical impacts, but prey might also have behavioral reactions to underwater sound. For example, the sound from underwater explosions might induce startle reactions and temporary dispersal of schooling fishes if they are within close proximity. The abundances of fish and invertebrate prey species near the detonation point could be diminished for a short period of time before being repopulated by animals from adjacent waters. Secondary impacts from underwater explosions would be temporary, and no lasting impact on prey availability or the pelagic food web would be expected. Indirect impacts of underwater detonations and explosive ordnance use under the proposed action would not result in a decrease in the quantity or quality of fish populations or fish habitats in the Study Area.

Indirect impacts of explosives and unexploded ordnance to fishes via sediment is possible in the immediate vicinity of the ordnance. Degradation of explosives proceeds via several pathways is discussed in Section 3.1 (Sediments and Water Quality). Degradation products of Royal Demolition Explosive are not toxic to marine organisms at realistic exposure levels (Rosen & Lotufo, 2010). TNT and its degradation products impact developmental processes in fishes and are acutely toxic to adults at concentrations similar to real-world exposures (Halpern et al., 2008; Rosen & Lotufo, 2010). It is likely that various lifestages of fishes could be impacted by the indirect impacts of degrading explosives within a very small radius of the explosive (1–6 ft.), but these impacts are expected to be short term and localized.

Certain metals are harmful to fishes at concentrations above background levels (e.g., cadmium, chromium, lead, mercury, zinc, copper, manganese, and many others) (Wang & Rainbow, 2008). Metals are introduced into seawater and sediments as a result of Navy training and testing activities involving vessel hulks, targets, ordnance, munitions, and other military expended materials. Indirect impacts of metals to fishes via water involve concentrations that are several orders of magnitude lower than concentrations achieved via bioaccumulation in the sediments. Fishes may be exposed by contact with the metal, contact with contaminants in the sediment or water, and ingestion of contaminated sediments. Concentrations of metals in seawater are orders of magnitude lower than concentrations in marine sediments. It is extremely unlikely that fishes would be indirectly impacted by toxic metals via the water.

Several military training and testing activities introduce potentially harmful chemicals into the marine environment; principally, flares and propellants for rockets, missiles, and torpedoes. The greatest risk to fishes from flares, missile, and rocket propellants is perchlorate, which is highly soluble in water, persistent, and impacts metabolic processes in many plants and animals. Fishes may be exposed by contact with contaminated water or ingestion of contaminated sediments. Since perchlorate is highly soluble, it does not readily absorb to sediments. Therefore, missile and rocket fuel poses no risk of indirect impact on fishes via sediment. In contrast, propylene glycol dinitrate and nitrodiphenylamine, the principal toxic components of torpedo fuel (OTTO Fuel II), adsorb to sediments, have relatively low toxicity, and are readily degraded by biological processes (Sun et al., 1996; U.S. Department of the Navy, 1996a, 1996b; Walker & Kaplan, 1992). It is conceivable that various lifestages of fishes could be indirectly impacted by propellants via sediment in the immediate vicinity of the object (e.g., within a few inches), but these potential impacts would diminish rapidly as the propellant degrades.

As described in the 2015 NWTT Final EIS/OEIS, some military expended materials (e.g., decelerators/parachutes) could become remobilized after their initial contact with the sea floor (e.g., by waves or currents) and could be reintroduced as an entanglement or ingestion hazard for fishes. In some bottom types (without strong currents, hard-packed sediments, and low biological productivity), items such as projectiles might remain intact for some time before becoming degraded or broken down by natural processes. While these items remain intact sitting on the bottom, they could potentially remain ingestion hazards. These potential impacts may cease only (1) when the military expended materials are too massive to be mobilized by typical oceanographic processes, (2) if the military expended materials become encrusted by natural processes and incorporated into the seafloor, or (3) when the military expended materials become permanently buried. In this scenario, a parachute could initially sink to the seafloor, but then be transported laterally through the water column or along the seafloor, increasing the opportunity for entanglement. In the unlikely event that a fish would become entangled, injury or mortality could result. The entanglement stressor would eventually cease to pose an entanglement risk as it becomes encrusted or buried, or degrades.

Secondary stressors can also involve impacts on habitat (sediment or water quality) or prey (i.e., impacting the availability or quality of prey) that have the potential to affect fish species. Secondary stressors that may affect ESA-listed species only include those related to the use of explosives. Secondary effects on prey and habitat from the release of metals, chemicals, and other materials into the marine environment during training and testing activities are not anticipated. In addition to directly impacting ESA-listed species, underwater explosives could impact other species in the food web, including those that these species prey upon. The impacts of explosions would differ depending upon the type of prey species in the area of the blast. In addition to physical effects of an underwater blast, prey might have behavioral reactions to underwater sound. For instance, prey species might exhibit a strong startle reaction to explosions that might include swimming to the surface or scattering away from the source. This startle and flight response is the most common secondary defense among animals. The abundances of prey species near the detonation point could be diminished for a short period of time, affecting prey availability for ESA-listed species feeding in the vicinity. Any effects to prey, other than those located within the impact zone when the explosive detonates, would be temporary. Direct impacts on fishes by affecting the availability or quality of prey is low and would not be expected.

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3.10 Cultural Resources

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Northwest Training and Testing

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3.10 Cultural Resources

This section of the NWTT Supplemental Environmental Impact Statement (SEIS)/Overseas Environmental Impact Statement (OEIS) (Supplemental) provides general background information on cultural resources present in the Northwest Training and Testing (NWTT) Study Area and provides the analysis of potential impacts on those cultural resources that may result from Navy training and testing activities. Section 3.10.1 (Affected Environment) provides an introduction to the cultural resources that may be present in the NWTT Study Area. The complete analysis and summary of potential impacts of the Proposed Action on cultural resources are found in Sections 3.10.2 (Environmental Consequences). For additional information, also see the 2015 NWTT Final EIS/OEIS, Section 3.10 (Cultural Resources) (U.S. Department of the Navy, 2015).

Substantively, there is little new information since 2015 presented in this Supplemental. The proposed action and its potential to impact cultural resources are largely the same. Therefore, the steps taken to identify cultural resources and analyze impacts on them mirror those described in the 2015 NWTT Final EIS/OEIS. However, based on a reexamination of the 2015 document, additional research, and evolving interests and increasing emphasis on traditional cultural resources by local consulting partners, particularly affected tribes, cultural resources in this section have been renamed and their definitions refined. Marine Archaeological Sites are renamed Pre-Contact Archaeological Sites; Known Wrecks, Obstructions, Occurrences, or Unknowns are renamed Shipwrecks and Submerged Aircraft Wreck Sites; and Traditional Cultural Properties are now presented separately.

The key change in the planning process requiring revisiting the analysis of cultural resources, and the reason for this chapter, relates to the National Historic Preservation Act (NHPA) of 1966, as amended, and Section 106 of its implementing regulations (36 CFR § 800) as conducted in Washington State. Specifically, in careful consideration of the proposed Section 106 undertaking, the Navy consulted with the Washington State Historic Preservation Officer, tribes, and additional consulting parties to define the area of potential effects (APE) in accordance with 36 C.F.R. § 800.4(a)(1). This is a difference from the 2015 NWTT Final EIS/OEIS, in which the Section 106 process used the broad National Environmental Policy Act (NEPA) Study Area as the APE.

The Study Area and APE remain the same in Alaska and the Section 106 undertaking comprises the same activities and potential to affect historic properties as reflected in the 2015 NWTT Final EIS/OEIS. Accordingly, the Navy informed the Alaska State Historic Preservation Officer and affected tribes it was not reinitiating Section 106 consultation.

In determining the APE in Washington for this Supplemental, the Navy considered all proposed activities and their potential effects, including physical damage from anchors, disturbance from the placement and use of seafloor devices, shockwaves and vibration from explosives, auditory effects from aircraft, and settling of military expended materials (MEM), among others. With regard to aircraft noise, the highest modeled noise exposure for NWTT activities, based on the most current noise analysis, would be less than 37 decibels (dB) Day Night Average Sound Level (DNL), well below the level with the potential to affect historic properties (65 dB DNL) and therefore not included in the APE. In consideration of comments received, and the scale and nature of the proposed undertaking, the Navy identified four types of activity with the potential to affect historic properties as part of the APE definition process. The resulting APE includes areas within existing range complexes and operating areas offshore and in inland waters of Washington where historic properties could be affected by these activities and is much smaller than the NEPA Study Area.

The APE and the Study Area were the same geographical area in the 2015 NWTT Final EIS/OEIS. The Study Area in this Supplemental is the same as the Study Area in the 2015 NWTT Final EIS/OEIS. The Study Area and APE, however, are not the same in this Supplemental. This section continues to reflect the Study Area largely unchanged from that in the 2015 NWTT Final EIS/OEIS and primarily uses NEPA terms such as cultural resources, human environment, stressors, and impacts. NHPA terminology such as APE, historic properties, activities, and effects is reserved for separate paragraphs, when possible, in order to maintain distinction between NEPA and NHPA contexts. Per the NHPA, the Navy has determined that no historic properties are affected by the undertaking within the defined APE and, per NEPA, no cultural resources are impacted by stressors associated with the Proposed Action within the larger study area.

As stated in the 2015 NWTT Final EIS/OEIS, the United States is a party to The Convention Concerning the Protection of the World Cultural and Natural Heritage. Accordingly, the Department of Defense's (DoD's) cultural resources policy and environmental regulations require compliance with the terms of the Convention. The addendum (addendum section 402) to the NHPA (recodified at 54 United States Code part 307101[e], *Consideration of Undertaking on Property, International Federal Activities Affecting Historic Properties*) requires an assessment by federal agencies of project impacts on historic properties located outside the United States that are identified on the World Heritage List or on the applicable country's equivalent of the NRHP. The Olympic National Park in Washington is the only World Heritage Site in the affected environment.

3.10.1 Affected Environment

NEPA requires consideration of impacts on the "human environment" consisting of natural, built, and social environments and the relationship of people to them through culture. Compliance requirements for cultural resources are established by federal statutes (out to 12 nautical miles [NM] from shore), state law in specific circumstances, regulations, and executive orders that are presented in detail in the 2015 Northwest Training and Testing (NWTT) Final Environmental Impact Statement (EIS)/Overseas EIS (OEIS) (U.S. Department of the Navy, 2015).

Sociocultural elements, such as traditions, lifeways, religious practices, community values, spiritual wellbeing, and social institutions may be considered by some groups to be types of cultural resources, especially within tribal communities whose traditional interaction with the natural world is integral to their culture. Considering the social consequences of a proposed action is challenging and arguably better addressed within the framework of a separate and holistic social impact assessment. This supplement, however, is organized using the 2015 NWTT Final EIS/OEIS, which sought to consider cultural and historic elements of the human environment within and between the three following sections: Section 3.10 (Cultural Resources), Section 3.11 (American Indian and Alaska Native Traditional Resources), and Section 3.12 (Socioeconomic Resources and Environmental Justice). Combined, these sections seek to provide a full analysis of the potential impacts from the Proposed Action on sociocultural elements of American Indian/Alaska Native communities and American history. For the purposes of this section, discussions of impacts on cultural resources will primarily focus on physical cultural resources such as those defined in the National Historic Preservation Act (NHPA), the Archaeological Resources Protection Act, and other types described in the 2015 NWTT Final EIS/OEIS. Other resources considered by the tribes to be of cultural significance include air, water, and wildlife. These resources are discussed in Section 3.1 (Sediments and Water Quality), Section 3.2 (Air Quality), Section 3.3 (Marine Habitats), Section 3.4 (Marine Mammals), Section 3.5 (Sea Turtles), Section 3.6 (Birds), Section 3.7 (Marine Vegetation), Section 3.8 (Marine Invertebrates), and Section 3.9 (Fishes).

The Supplemental EIS/OEIS (Supplemental) must be read in conjunction with the 2015 NWTT Final EIS/OEIS and Record of Decision, which provide more detailed and in-depth information.

In this section, cultural resources are divided into three major categories:

- Pre-Contact Archaeological Sites: pre-Contact inundated sites and features
- Shipwrecks and Submerged Aircraft Wreck Sites
- Traditional Cultural Properties: historic properties associated with the cultural practices or beliefs of a living community that are rooted in that community's history and are important in maintaining the continuing cultural identity of the community.

The NWTT Study Area for this Supplemental is the same analyzed in the 2015 NWTT Final EIS/OIES (Section 2.1, Description of the Northwest Training and Testing Study Area). Within these areas, the Proposed Action is composed of Military activities in the Study Area occur (1) on the ocean surface, (2) beneath the ocean surface, and (3) in the air.

For the purposes of this NEPA analysis, the Affected Environment discussion considers potential direct impacts on and under water, and indirect impacts on water and land under the Olympic Military Operations Area (MOA) over the Olympic Peninsula. There is only one potential activity to occur on land, the use of a light truck to recover unmanned underwater vehicle "crawlers," from the surf zone at Pacific Beach, Washington. The truck would be limited to established vehicle routes on and off the beach. The use of vehicles on established roadways in Washington has previously been determined to have *de minimis* impacts and no potential to affect historic properties. Therefore, the Navy is not considering the truck route to be part of the cultural resources affected environment. The Navy performed its consultation requirements under the NHPA, and where applicable, these consultation requirements are noted below.

In accordance with the requirements of the NHPA and based on the nature and magnitude of the Section 106 undertaking, historic properties of the type considered in this chapter generally would be those on or imbedded in the seafloor. Accordingly, the Navy determined the APE to be limited to the seafloor in the Offshore Area, Inland Waters, and Western Behm Canal. Again, this represents a significant departure from the APE being identical to the Study Area in the 2015 NWTT Final EIS/OIES. In accordance with 36 Code of Federal Regulations Section 800.4(b)(1), the Navy's efforts to identify historic properties took into account past planning, research, and studies; the magnitude and nature of the undertaking; the degree of federal involvement; the nature and extent of the potential effects; and the likely nature and location of historic properties within the APE. The Navy obtained information from a variety of sources, including the following: (1) properties identified during previous planning for the ranges and associated areas within the current NWTT APE and consultations for prior NWTT undertakings; (2) the National Register of Historic Places (NRHP); (3) the Washington State Department of Archaeology and Historic Preservation Washington Information System for Architectural and Archaeological Records Data; (4) the National Oceanic and Atmospheric Administration Automated Wreck and Obstruction Information System; (5) the Bureau of Ocean Energy Management online index of shipwrecks by state; (6) Navy shipwreck and submerged aircraft documentation; (7) agencies, organizations, and individuals who expressed interest in participation in the Section 106 process; and (8) publicly available sources about tribal territories and resources, including tribal websites, and information solicited directly from the 26 consulting tribes to identify properties of traditional religious and cultural significance within the APE.

Underwater cultural resources that may be affected include pre-Contact inundated sites and historic sunken craft such as shipwrecks and submerged aircraft. Traditional cultural properties may include inundated archaeological sites, topographic features or landforms, and marine habitats (including associated plants and animals), that American Indians or other groups consider essential for the preservation of traditional culture.

Per 36 Code of Federal Regulations 800.4(a)(4) the Navy consulted with Indian tribes to identify properties of religious and cultural significance under NHPA. The Navy received this information in letters, through comments received in response to prior and current NEPA documents, and during recent meetings. In addition to soliciting information through the Section 106 process, the Navy expects to receive additional information from ongoing government-to-government consultation beyond this action/undertaking and will work with advisory and consulting parties to address challenges inherent to full consideration of these resources within the regulatory framework of NEPA, NHPA, and other applicable mandates, authorities, instructions, and guidance.

The 2015 NWTT Final EIS/OEIS analysis reflected the fact that there were no activities with the potential to directly impact cultural resources on land. For this Supplemental, the Navy conducted a Noise Study (see Appendix J, Airspace Noise Analysis for the Olympic Military Operations Area) for aircraft training activities conducted within special use airspace comprising the Olympic MOA, the Warning Area 237A (W-237A), and transit routes of flight to the MOA and back, which is a typical event. Impacts from aircraft noise on land below Navy's special use airspace are discussed in this section (see also Section 3.10.2.3, Acoustic). In this Supplemental the Affected Environment discussion is organized by resource type.

3.10.1.1 Pre-Contact Archaeological Sites: Pre-Contact Inundated Sites and Features

In the 2015 NWTT Final EIS/OEIS, as discussed in Section 3.10.2.1 (Marine Archaeological Sites), potential marine archaeological sites and features included prehistoric sites associated with early maritime migrations inundated during deglaciation and located on the continental shelf, and prehistoric and historic sites that were intentionally placed in or under water such as canoe runs; petroglyphs and pictographs; fish weirs and traps; reef net anchors; trash dumps; piers, wharves, docks, and bridges; dams; and marine railways (Stilson et al., 2003). In this Supplemental, information is presented for pre-Contact archaeology underwater within the Offshore Area, Inland Waters, and Western Behm Canal.

Coastal (i.e., those located between the low tide line to the high tide line) archaeological sites within the Offshore Area, Inland Waters, and Western Behm Canal have largely been recognized in two settings: shell middens in littoral areas and sites located in riverine areas. In general, shell middens occur just above the mean high tide line. The oldest dated coastal shell midden site in Washington is approximately 4,000 years old, but the majority are less than 3,000 years old as that is around the time when the current sea level stabilized. Shell middens may indicate sites such as villages, camp sites, or shellfish processing areas that contain organically rich dark soil with shell fragments or shells, artifacts, and fire-cracked rocks near saltwater shorelines (Stilson et al., 2003). Pre-Contact marine archaeological sites recognized by Stilson in Washington include canoe runs; petroglyphs and pictographs; fish weirs and traps; reef net anchors; and shell middens (Stilson et al., 2003).

3.10.1.1.1 Offshore Area

The Offshore Area only comes into contact with the shore at the Quinault Range Site, and there are no known terrestrial or inundated sites at this location. Based on the predictive model used in the 2015 NWTT Final EIS/OEIS (ICF International et al., 2013), the Offshore Area has an increased probability for inundated prehistoric sites in the large embayments of Grays Harbor and Willapa Bay, which were produced as rising sea level drowned large incised river valleys of the paleolandscape. Elder et al. (2019) demonstrated terrestrial coastal sites are more likely to survive in environments subject to stable or depositional geomorphic processes. This study pointed out the rarity of these types of environments for the entire Washington coastline, particularly along the Pacific Coast. Stable or depositional geomorphic processes also would have been necessary for the preservation of now-inundated sites. No subsurface sampling of marine deposits has been conducted, and no inundated prehistoric sites have been identified. Based on data sources reviewed in the 2015 NWTT Final EIS/OEIS (Section 3.10.1.3.2, Data Sources), no pre-Contact archaeological features in or under water have been identified in the Offshore Area since the review of data sources from 2015.

Olympic Peninsula

The Study Area for this Supplemental includes the Olympic MOA, which is situated over areas of the Olympic Peninsula. Though the MOA overlays federal, tribal, state, municipal, and private lands, the cultural resources found within the Olympic National Park provide a representation of those found on the Olympic Peninsula. Interwoven throughout the Olympic National Park's diverse landscape is an array of cultural and historic sites that tell the human story of the park. More than 650 archeological sites document 12,000 years of human occupation of Olympic National Park lands. Historic sites reveal clues about the 200-year history of exploration, homesteading, and community development in the Pacific Northwest (U.S. Department of the Interior, 2016). There are two sites listed on the NRHP located within the Olympic National Park; Ozette Indian Village Archeological Site and Wedding Rock Petroglyphs.

3.10.1.1.2 Inland Waters

Based on the predictive model used in the 2015 NWTT Final EIS/OEIS (ICF International et al., 2013), the Inland Waters have a lower probability for inundated prehistoric sites because of the lack of paleolandscape features (e.g., estuaries and streams) associated with concentrated resource availability. No subsurface sampling of marine deposits has been conducted, and no inundated prehistoric sites have been identified. Based on data sources reviewed in the 2015 NWTT Final EIS/OEIS (Section 3.10.1.3.2, Data Sources), no prehistoric or historic sites that were intentionally placed in or under water have been identified in the Inland Waters.

3.10.1.1.3 Western Behm Canal, Alaska

As discussed in the 2015 NWTT Final EIS/OEIS, a predictive model developed by Monteleone (2013) did not identify specific paleolandscape settings of inundated prehistoric sites associated with early maritime migrations. Although underwater surveys were conducted to test the model, no areas in the Western Behm Canal were surveyed (Monteleone, 2013). No inundated prehistoric sites have been previously identified in the Western Behm Canal. The Western Behm Canal portion of the Study Area meets the shore in many places; however, to date, pre-Contact archaeological resources have not been identified within the Western Behm Canal. Therefore, this category is not discussed further for the Western Behm Canal.

3.10.1.2 Shipwrecks and Submerged Aircraft Wreck Sites

As discussed in the 2015 NWTT Final EIS/OEIS, Section 3.10.2.2 (Known Wrecks, Obstructions, Occurrences, or Unknowns), submerged resources in the region may include shipwrecks or aircraft wreck sites. After review of the National Register Information System, National Oceanic and Atmospheric Administration Automated Wreck and Obstruction Information System, and Bureau of Ocean Energy Management's Alaskan shipwreck inventory data regarding submerged cultural resources in the region of influence (Bureau of Ocean Energy Management, 2011; National Oceanic and Atmospheric Administration, 2017; National Park Service, 2017), the information from the 2015 NWTT Final EIS/OEIS has been updated in the sections that follow and new shipwrecks or obstructions are depicted with red-orange dots in Figure 3.10-1, Figure 3.10-2, Figure 3.10-3, Figure 3.10-4, and Figure 3.10-5. Additional discoveries are made as survey methods become more sophisticated and new areas explored.

3.10.1.2.1 Offshore Area

As presented in the 2015 NWTT Final EIS/OEIS, the eastern boundary of the Offshore Area at Washington abuts the coastline and includes a 1-mile-wide surf zone of Quinault Range Site. The Offshore Area contains several Navy shipwrecks and submerged naval aircraft (Grant et al., 1996). Besides the Quinault Range Site, the Offshore Area contains wrecks such as *Prince Arthur* in 1903, the *P.J. Pirrie* in 1920, nine ships wrecked between Quillayute Rocks and Cape Alava, five at Destruction Island, and four near Hoh Head (National Oceanic and Atmospheric Administration, 1993). The documented submerged cultural resources in and near the Offshore Area are primarily associated with maritime trade, transport, and military activities, and include many shipwrecks. In particular, the Olympic coast of Washington is a ship graveyard as a result of the isolated, rocky shores; heavy ship traffic; and ferocious weather and wave action. As shown in Figure 3.10-1**,** more than a dozen wrecks have been documented in and near the Olympic Coast National Marine Sanctuary (Galasso, 2017).

In Oregon and Northern California, the Offshore Area boundary is 12 NM off the coastline. Cultural resources discovered in the international waters of the Offshore Area would not be listed in either the state registers or the NRHP. However, it is Navy policy to treat shipwrecks and other unclassified, potentially cultural, obstructions within U.S. territorial waters as though they are eligible for the NRHP within U.S. territorial waters. Known shipwrecks and obstructions off the coast of Oregon and Northern California are shown in Figure 3.10-1.

3.10.1.2.1.1 Olympic Peninsula

There are 34 sites listed on the NRHP that are located within the Olympic National Park or under the Olympic MOA on the Olympic Peninsula, including historic districts, stations, and other architectural resources. Additionally, under the MOA there are three sites (Huelsdonk Homestead, Adam House Copeland, and Smith-Mansfield House) listed in the Washington Heritage Register and three other sites (Wesseler Barn, Barn and the Fletcher, Fred Barn) listed in the Washington Heritage Barn Register.

3.10.1.2.2 Inland Waters

As presented in the 2015 NWTT Final EIS/OEIS, the Inland Waters contain an extensive collection of wrecks and submerged aircraft as shown in Figure 3.10-2, Figure 3.10-3, and Figure 3.10-4. Updated data or newly discovered shipwrecks and obstructions since the publishing of the 2015 NWTT Final EIS/OEIS are shown in red on the figures. Six known shipwrecks lie within 2 miles of the shoreline boundary of Naval Base Kitsap Bangor (Figure 3.10-4). Four shipwrecks are within or near the Naval Undersea Warfare Center Division, Keyport Range Complex, including the *Laurel*, the *Elk*, the *A.R. Robinson*, and the *R.M. Hasty*. Other shipwrecks near the Naval Undersea Warfare Center Division, Keyport Range Complex include the *Orion*, the *B.C. Company No. 4*, the *Union*, the *Curlew*, the *Nokomis*, and an unnamed vessel, among others, as shown in Figure 3.10-4 (U.S. Department of the Navy, 2010, 2015).

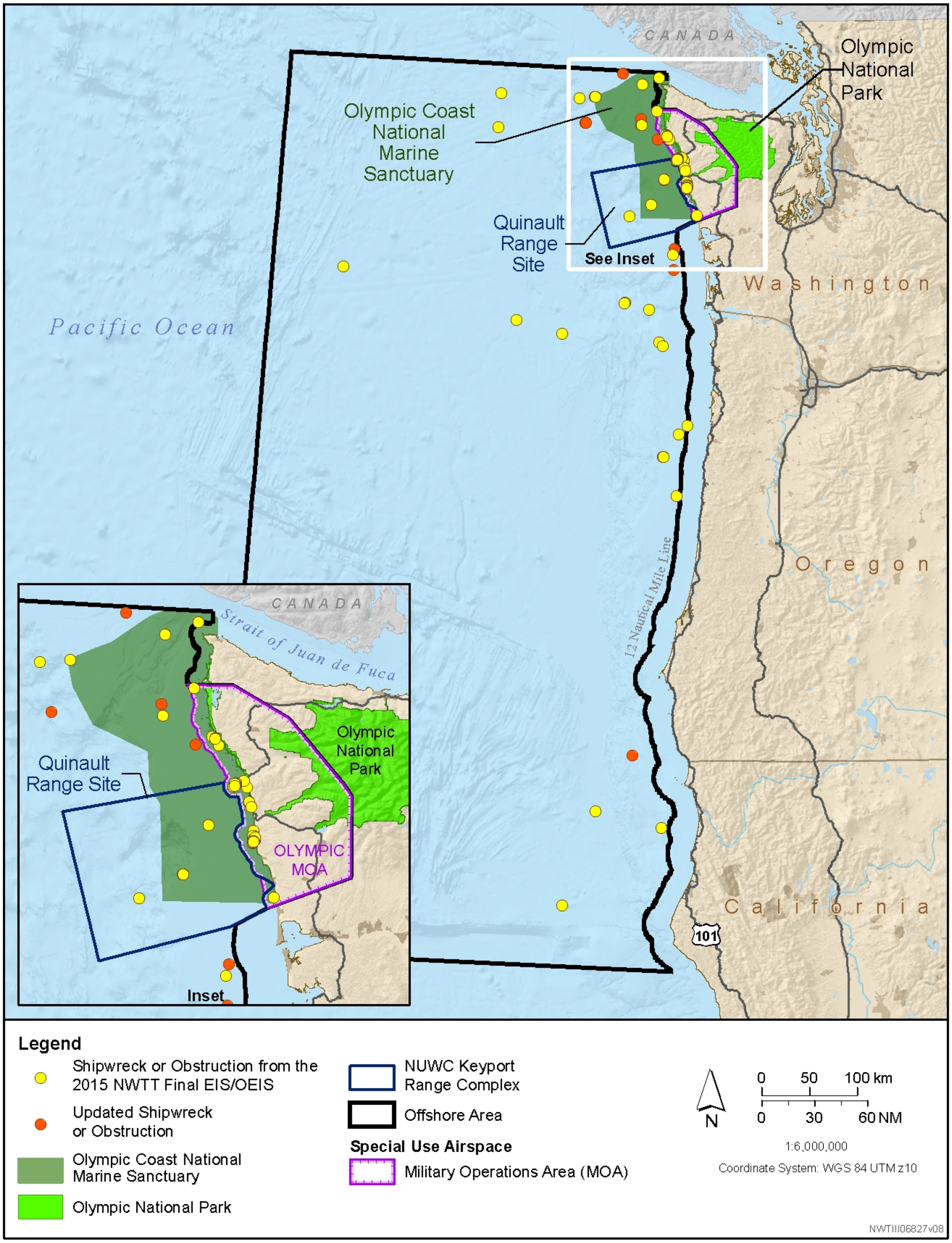

Figure 3.10-1: Known Shipwrecks and Obstructions in the Offshore Area

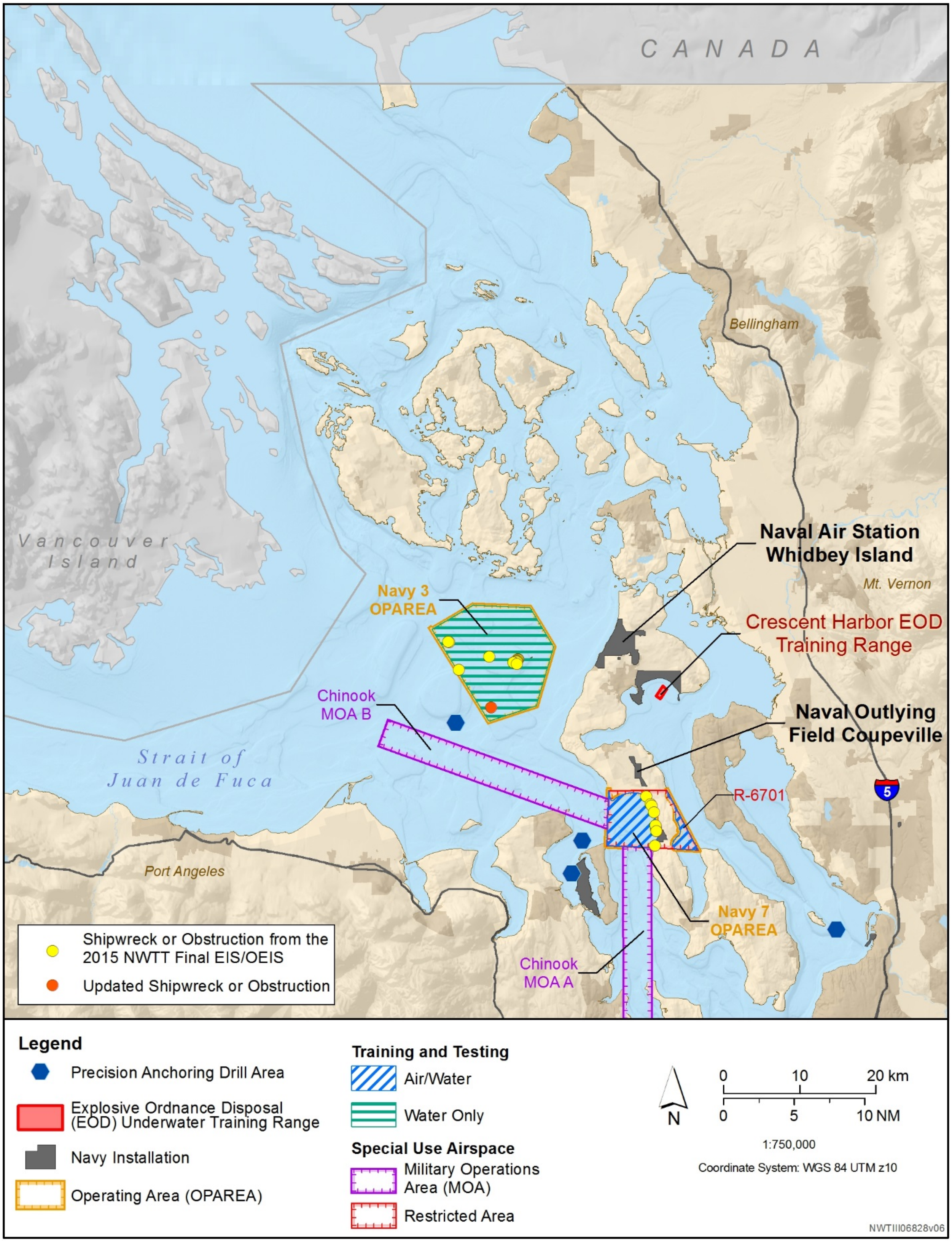

Figure 3.10-2: Known Shipwrecks and Obstructions in the Northern Part of the Inland Waters

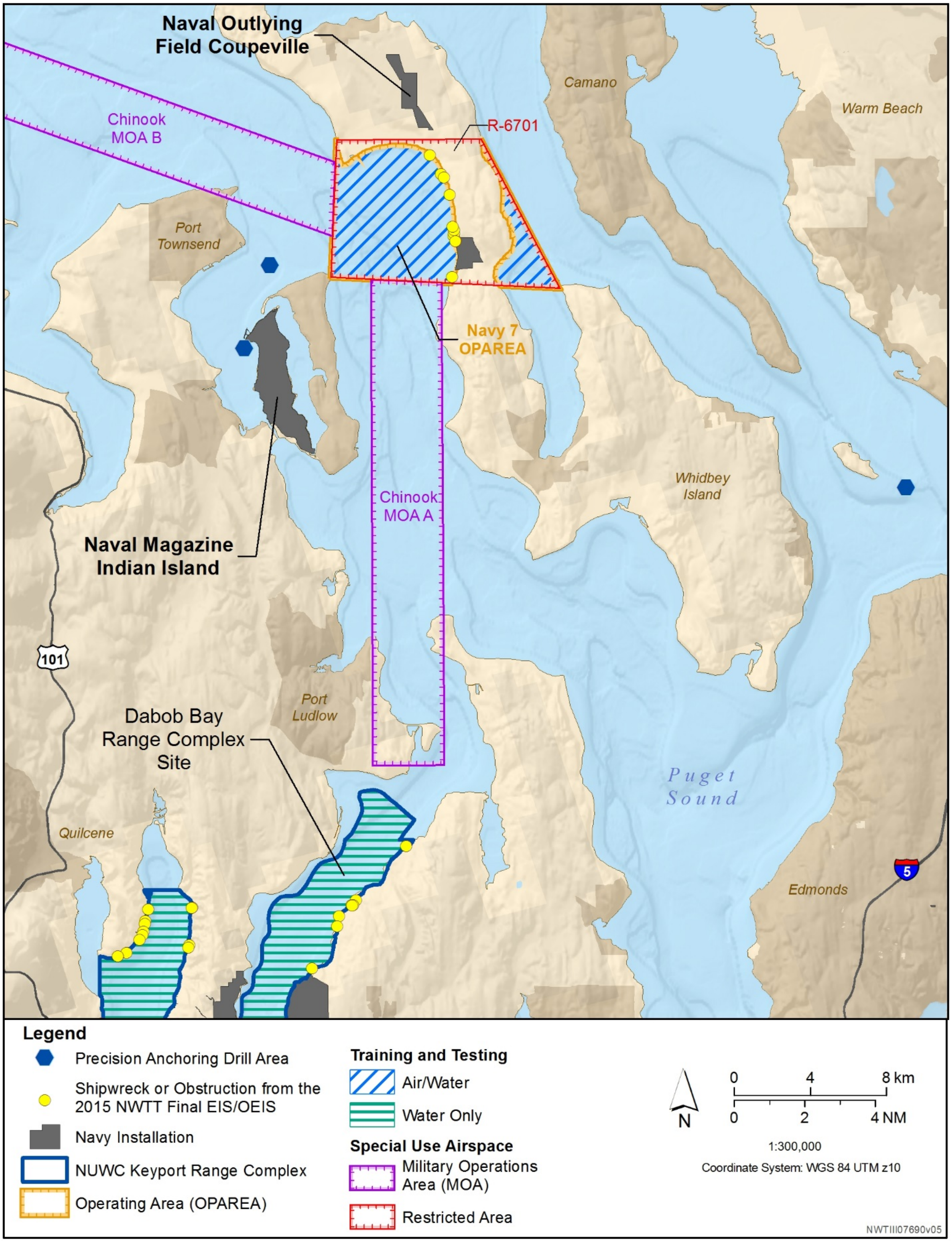

Figure 3.10-3: Known Shipwrecks and Obstructions in the Central Part of the Inland Waters

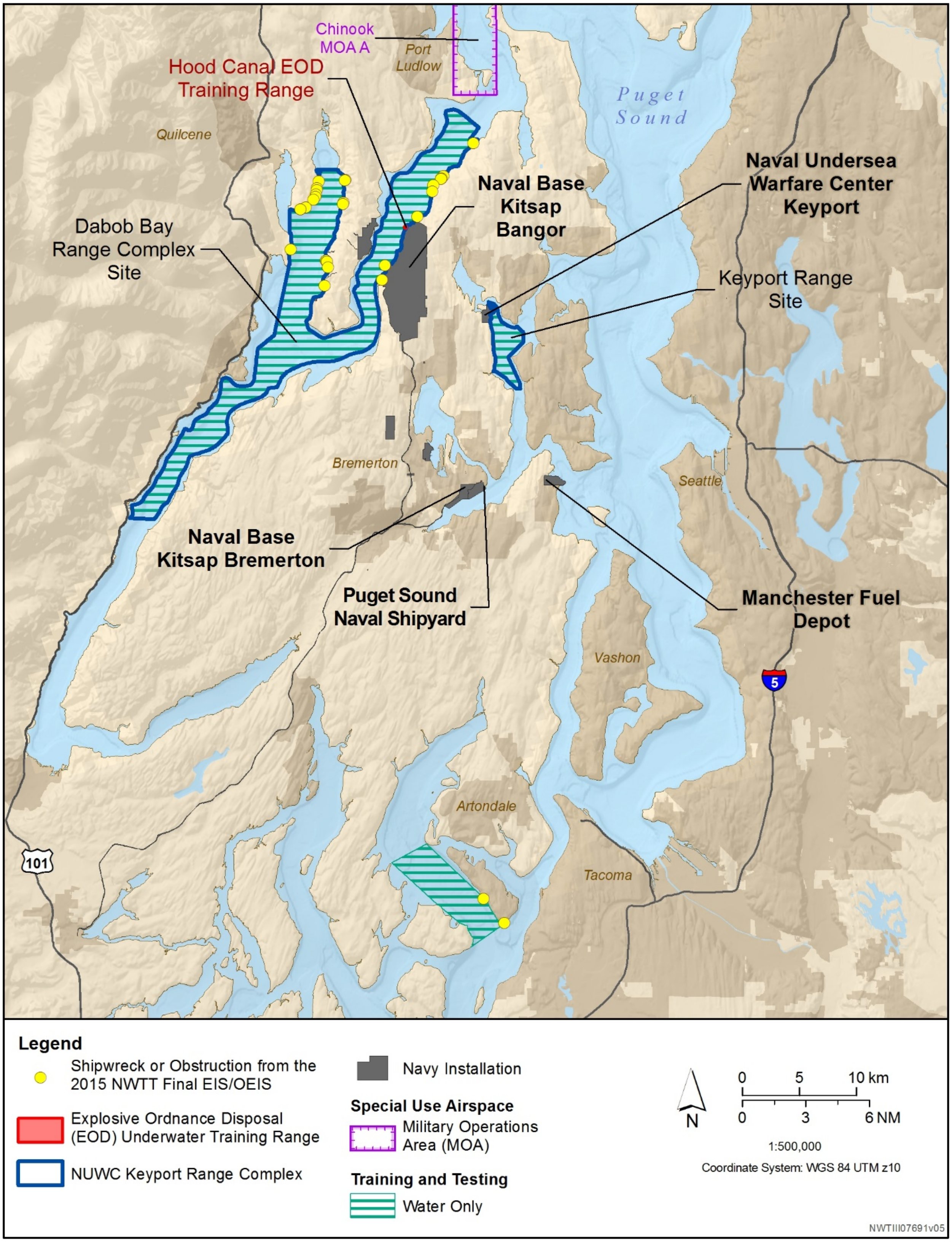

Figure 3.10-4: Known Shipwrecks and Obstructions in the Southern Part of the Inland Waters

3.10.1.2.3 Western Behm Canal, Alaska

As presented in the 2015 NWTT Final EIS/OEIS, the Western Behm Canal contains shipwrecks such as steamers, a skiff, a ferry, a salmon troller, and numerous gas screws; these shipwrecks may be eligible for the NRHP. The databases that were queried have been updated since publication of the 2015 NWTT Final EIS/OEIS, and results of the search indicate that there are no new shipwrecks or obstructions within or on the border of the Western Behm Canal (Figure 3.10-5). New or newly found shipwrecks and obstructions occur outside of the Southeast Alaska Acoustic Measurement Facility. Islands shown on Figure 3.10-5 are depicted differently than they were in the 2015 NWTT Final EIS/OEIS. The figure shown in the 2015 NWTT Final EIS/OEIS was incorrect in its depiction of these islands; that depiction has been corrected in this Supplemental.

3.10.1.3 Traditional Cultural Properties

The Navy recognizes the importance of identifying properties of traditional, religious and cultural significance to living communities, the Navy requested input from both tribal and non-tribal communities regarding resources to which they ascribe traditional, religious, or cultural significance within the Study Area. Tribes possess special expertise in assessing the eligibility of resources of traditional, religious, and cultural significance to their communities. Accordingly, consistent with 36 C.F.R. § 800.4(a)(4), Navy requested input from federally recognized Washington tribes regarding properties to which they ascribe traditional, religious and cultural significance within the APE. Some tribes chose to submit comments pertaining to cultural resources, historic properties, and/or their expectations for the NEPA and NHPA processes within the NEPA public scoping period, during the draft Supplemental Environmental Impact Statement (EIS)/Overseas EIS review period, and/or during government-to-government (GtG) consultation meetings about the undertaking. In general, the Navy received input from tribes about traditional activities associated with the Pacific Coast and Salish Sea, including the sacred nature of marine life and associated habitats.

3.10.1.3.1 Offshore Area

Local communities are closely and directly linked to the Olympic Peninsula and the ocean (Offshore Area) in culture, heritage, and tradition. They also provide important historical information and give meaning to the Offshore Area’s landscape and waterscape. To date, federally recognized tribes have expressed concerns regarding the adequacy of the Navy’s consideration of the tribes’ natural, cultural, and social resources and potential impacts on those resources by Navy activities. Additionally, in comments provided by multiple tribes during the scoping and comment periods for the NWTT Supplemental, the tribes requested that the Navy take further steps to inform both the NEPA and NHPA processes and associated Navy responsibilities to identify impacts on the broad human-environment relationship resulting from project activities. Within the Olympic Peninsula, the Olympic National Park's outstanding attributes have also led to international recognition. In 1976, the park was designated as an International Biosphere Reserve in the Man and the Biosphere Program by United Nations Educational, Scientific, and Cultural Organization. In 1981, the park was declared a World Heritage Site by the World Heritage Convention, joining it to a system of natural and cultural properties that are considered irreplaceable treasures of outstanding universal value (U.S. Department of the Interior, 2016). The Olympic National Park was analyzed in detail in the 2015 NWTT Final EIS/OEIS, specifically in Appendix K (World Heritage Site Analysis), and this analysis remains valid for this Supplemental. Six federally recognized tribes of the Olympic Peninsula—the Hoh, Makah, Quinault, Quileute, Lower Elwha Klallam, and Jamestown S'Klallam—have lived in this area since time immemorial and continue to maintain strong relationships to the lands and waters.

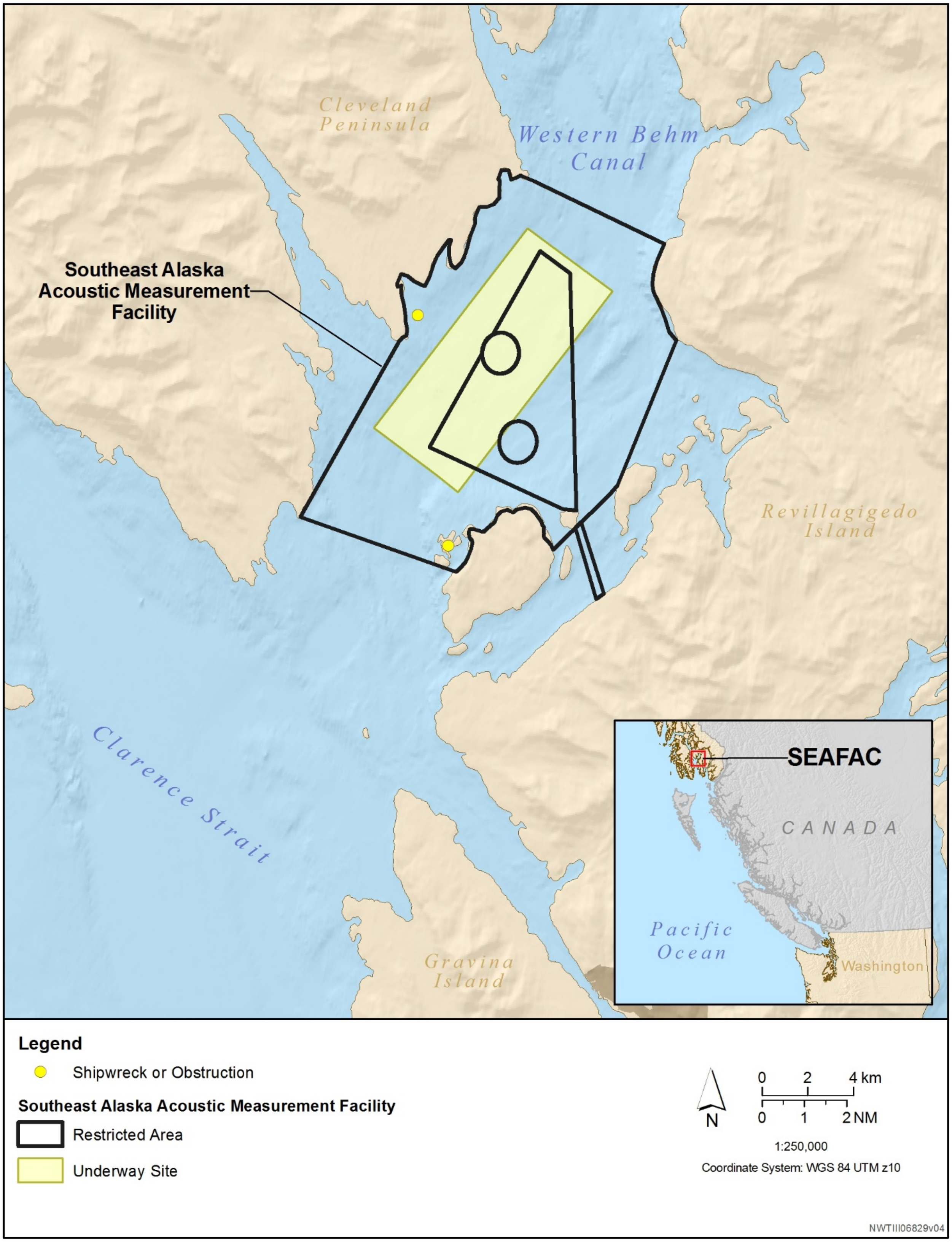

Figure 3.10-5: Known Shipwrecks and Obstructions in the Western Behm Canal, Alaska

Consultation with the Hoh Tribe began in November 2014 during prior NWTT environmental reviews. Through ongoing consultation, the Hoh Tribe noted that the tribe considers natural resources to be cultural resources. They requested that the Navy consider the tribe's worldview, values, and belief system particularly as they apply to the lands, waters, and resources of their traditional area. They also requested that the Navy conduct a traditional cultural landscape study to understand impacts on the tribe, including environmental justice concerns, as well as to inform the NEPA and NHPA processes. The Navy has made multiple but has been unsuccessful in efforts to meet with the tribe to learn more.

The Makah Indian Tribe of the Makah Reservation expressed interest in participating in the Section 106 process on June 25, 2018 and requested a GtG meeting in a letter on June 12, 2019. Multiple attempts to schedule meetings have continued. The Navy reached out to the tribe's cultural resources staff on July 3, 2019 to solicit any questions the tribe had about the APE. The Navy also requested information regarding the tribe's knowledge and concerns about properties of traditional religious and cultural significance to them in the APE on November 27, 2019 with a follow up e-mail to the cultural resources staff on January 7, 2020. The Navy did not receive any information regarding properties of traditional, religious, and cultural significance from the tribe and will continue GtG relations.

3.10.1.3.2 Inland Waters

Local communities are closely and directly linked to the Puget Sound (Inland Waters) in culture, heritage, and tradition. They also provide important historical information and give meaning to the Inland Waters' landscape. During the 2015 NWTT EIS/OEIS consultation, the Port Gamble S'Klallam Tribe notified the Navy that the northern Hood Canal represents a network of marine resource locations and other site types within the context of a traditional cultural landscape. The tribe believes that this network of sites is likely to be considered eligible for the NRHP as a traditional cultural property. At the time, there was insufficient information to delineate the portion of the northern Hood Canal wherein the traditional properties and networks were located, and specific historic properties could not be evaluated. During the current consultation, the Navy provided the Port Gamble S'Klallam Tribe with all key Section 106 correspondence, and a staff level discussion regarding NWTT occurred at the 20th Annual National Tribal Historic Preservation Conference, September 1-14, 2018. The Navy has not received additional comments or information regarding properties of traditional, religious and cultural significance to the Port Gamble S'Klallam.

In March 2018, the Lummi Nation resolved the Salish Sea is eligible for listing on the NRHP as a National Historic Landmark and inclusion in the World Heritage List "for its association with the culture, traditions, and history of the Lummi people." The Lummi Nation and the Navy met for GtG consultation on October 29, 2019 to discuss the NWTT proposed action. During the meeting and in a follow-up e-mail, the Lummi Nation made a series of specific requests pertaining to NHPA: (1) Treat Sk'aliCh'elh (Southern Resident killer whales) (que'ihol'mechen "our relatives under the water") as a traditional cultural district eligible for the NRHP, noting that it is already considered eligible for the Lummi Cultural Register; (2) Treat Xw'ullemy (the Salish Sea) as a traditional cultural district eligible for the National Register, noting that it is already considered eligible for the Lummi Cultural Register; (3) Conduct a rigorous and vigorous Section 106 process regarding Sk'aliCh'elh and Xw'ullemy based on the principle of meaningful consultation: full, prior and informed consent, consistent with the Associated Tribes of Northwest Indians Resolution on the Salish Sea. The Navy provided responses on December 27, 2019 from the Commander, U.S. Pacific Fleet and January 24, 2020 and June 26, 2020 from the Commanding Officer of Naval Air Station Whidbey Island.

With regard to Southern Resident killer whales, the Navy understands that while resources such as (1) clean air and water, (2) plants and animals, (3) and intangible cultural values, relationships, or lifeways can be closely related to historic properties, they are not themselves eligible for listing in the NRHP (36 C.F.R. § 800.16(l)(1)). Since living animals are not a property type eligible for the NRHP, the Navy is unable to evaluate them as historic properties. Other environmental laws, however, require the Navy to carefully address potential impacts on Southern Resident killer whales, including the Endangered Species Act and Marine Mammal Protection Act. Analyses of the potential impacts of the proposed action on these resources are presented in the Supplemental EIS/OEIS. The Navy is committed to balancing its mission requirements with its environmental stewardship responsibilities, and this includes best practices and mitigation of potential impacts on the Southern Resident killer whale.

With regard to the Xw'ullemy (the Salish Sea), the Navy does not have sufficient information at this time to adequately delineate, document, and evaluate the physical resource(s) that would constitute a traditional cultural district. While we recognize and respect the tribes' views, we find that an adequate assessment of potential eligibility of Xw'ullemy (the Salish Sea) as a historic property would require study and consultation that significantly exceeds the reasonable and good faith identification efforts commensurate with the nature and magnitude of the proposed undertaking. In reaching this determination, the Navy carefully considered the types and locations of testing and training activities, and their overall consistency with longstanding Navy activities. Furthermore, we believe questions related to the traditional cultural significance of the Salish Sea must be addressed in partnership with affiliated tribes, accountable Federal and State agencies, and other interested parties, as appropriate, and we look forward to working together on them.

As a result of these consultations and careful consideration of information provided, the Navy has awareness that the Hoh Indian Tribe, Lummi Nation, and Port Gamble S'Klallam Tribe all identify resources of traditional, religious, and cultural significance within the APE. Some of those resources, such as the Sk'aliCh'elh (Southern Resident killer whale), are not a property type eligible for the NRHP, and the Navy is unable to directly address them under the Section 106 consultation process. For the Xw'ullemy (the Salish Sea) and potential traditional cultural landscape in the Hood Canal, we find that an adequate assessment of potential eligibility of either of these resources as historic properties would require study and consultation that significantly exceeds the reasonable and good faith identification efforts commensurate with the nature and magnitude of the proposed undertaking. The Navy recognizes that Federal statutory and regulatory processes may not respond fully to tribal concerns. We acknowledge that these laws, including NHPA, may constrain the consideration of the complex, interconnected relationships of traditional resources and represent a continuing challenge to agencies and tribes. The Navy is committed to good faith consultation in the context of GtG relationships, which endure above and beyond consultations limited to a specific law, project, action, or undertaking.

3.10.1.3.3 Western Behm Canal, Alaska

After literary and academic research into this area and in consultation with affected tribes, the Navy found that there were no cultural resources eligible for or listed in the NRHP or as traditional cultural properties identified in the Western Behm Canal.

3.10.1.4 Current Requirements and Practices

As stated in the 2015 NWTT Final EIS/OEIS, the Navy has established standard operating procedures (SOPs) to reduce potential impacts on cultural resources from training and testing activities. Such procedures include using inert ordnance; avoiding known shipwreck sites; not conducting precision anchoring; explosive mine countermeasure and neutralization activities; or explosive mine neutralization activities involving Navy divers within a certain distance of shipwrecks. See Appendix K (Geographic Mitigation Assessment) of this Supplemental for mitigation measures.

3.10.1.4.1 Avoidance of Obstructions

As stated in the 2015 NWTT Final EIS/OEIS, the military routinely avoids locations of known obstructions, including submerged cultural resources (Appendix K, Geographic Mitigation Assessment), such as shipwrecks. Known obstructions are avoided to prevent injury to crew and damage to sensitive equipment and vessels, and to ensure the accuracy of training and testing activities.

3.10.2 Environmental Consequences

The 2015 NWTT Final EIS/OEIS considered training and testing activities that were proposed to occur in the Offshore Area, Inland Waters, and Western Behm Canal which may have the potential to impact cultural resources in the greater Study Area (including areas subjected to aircraft noise) and historic properties in the more narrowly defined APE. The stressors applicable to cultural resources in the Study Area are:

- **Explosive** (in-water explosives)
- **Physical disturbance, strike, visual intrusions** (anchors, settling of military expended materials)
- **Acoustic** (aircraft noise)
- **Cultural** (limiting access/temporary change of use)
- **Visual and atmospheric**

This section evaluates how and to what degree potential impacts on cultural resources from stressors described in Section 3.0 (Introduction) may have changed since the analysis presented in the 2015 NWTT Final EIS/OEIS was completed. Table 2.5-1, Table 2.5-2, and Table 2.5-3 in Chapter 2 (Description of Proposed Action and Alternatives) list the proposed training and testing activities and include the number of times each activity would be conducted annually and the locations within the Study Area where the activity would typically occur under each alternative. The tables also present the same information for activities presented in the 2015 NWTT Final EIS/OEIS so that the proposed levels of training and testing under this Supplemental can be easily compared.

The Navy conducted a review of federal regulations and standards relevant to the treatment of cultural resources and reviewed literature published since 2015 for new information on cultural resources that could adjust the analysis presented in the 2015 NWTT Final EIS/OEIS. The analysis presented in this section also considers SOPs discussed in Section 2.3.3 (Standard Operating Procedures) and mitigation measures that are presented in Chapter 5 (Mitigation) and Appendix K (Geographic Mitigation Assessment). The Navy would implement these measures to avoid potential impacts on cultural resources from stressors associated with the proposed training and testing activities and effects on historic properties within the APE.

3.10.2.1 Explosive Stressors

3.10.2.1.1 Impacts from Explosives

Explosive stressors that have the potential to impact cultural resources are shock (pressure) waves and vibrations from explosions (such as explosive torpedoes, missiles, bombs, and projectiles) and cratering created by underwater explosions. While the number of training and testing activities would change under this supplement, the locations of activities presented in the 2015 NWTT Final EIS/OEIS, Section 3.10.3.1.1 (Impacts from Explosive Shock [Pressure] Waves from Underwater Explosions) remain the same.

No training activities with underwater detonations on or near the ocean bottom are proposed in the Offshore Area or Western Behm Canal under any alternative, and no testing activities with underwater detonations on or near the ocean bottom are proposed in the Western Behm Canal portion of the Study Area under any alternative; therefore, only training activities in the Inland Waters portion of the Study Area and testing activities in the Offshore Area and Inland Waters are analyzed for impacts from underwater explosives shock (pressure) waves and cratering.

3.10.2.1.1.1 Impacts from Explosives Under Alternative 1

Impacts from Explosives Under Alternative 1 for Training Activities

Under Alternative 1, there is no change to the level, type of training, or locations for training using explosives (see Table 3.0-7 in Section 3.0 of this Supplemental) in the Inland Waters; therefore, the analysis in the 2015 NWTT Final EIS/OEIS remains applicable. Training activities with an explosive stressor remain the same and the Navy routinely avoids locations of known obstructions, which includes submerged cultural resources as discussed in the 2015 NWTT Final EIS/OEIS, Section 3.10.3.1.1 (Impacts from Explosive Shock [Pressure] Waves from Underwater Explosions). These events would occur in designated and well-established Explosive Ordnance Disposal (EOD) Training Ranges where no cultural resources, including historic properties, have been identified.

In summary, given that the training activities would be conducted in the same areas as described in the 2015 NWTT Final EIS/OEIS, the amount of shock (pressure) waves, vibrations, or cratering from explosives would not appreciably change the conclusions. Therefore, the conclusion from the 2015 NWTT Final EIS/OEIS, that no impacts on cultural resources from shock waves created by underwater detonations at depth are expected, remains valid. Explosive stressors resulting from underwater explosions creating shock (pressure) waves, vibrations, and cratering of the seafloor would not impact submerged cultural resources within the Study Area or affect historic properties within the APE under Alternative 1 because known submerged cultural resources would be avoided during training exercises.

Impacts from Explosives Under Alternative 1 for Testing Activities

Under Alternative 1, mine countermeasure and neutralization testing and torpedo explosive testing activities are proposed in the Offshore Area. Mine countermeasure and neutralization testing is a new activity as compared to the 2015 NWTT Final EIS/OEIS (see Table 2.5-2). Although mine countermeasure and neutralization testing could occur on the sea floor, explosives would only be used in the water column.

Torpedo explosive testing would also occur in the water column, as described in the 2015 NWTT Final EIS/OEIS (see Table 2.5-2); although tempo would increase, the military routinely avoids locations of known obstructions, which includes submerged cultural resources as discussed in the 2015 NWTT Final EIS/OEIS, Section 3.10.3.1.1 (Impacts from Explosive Shock [Pressure] Waves from Underwater Explosions). Explosives would only be used in the water column at least 75 feet above the seafloor, and the Seafloor Resource Mitigation Area (see Table 5.4-1) creates a 350-yard radius around shipwrecks in which the Navy will not conduct explosive mine countermeasure and neutralization activites. Additionally, the Navy will not place mine shapes, anchors, or mooring devices on the seafloor except in designated ranges where no cultural resources have been identified. Therefore, no impacts on cultural resources or effects on historic properties from shock waves created by underwater detonations are expected.

3.10.2.1.1.2 Impacts from Explosives Under Alternative 2

Impacts from Explosives Under Alternative 2 for Training Activities

Under Alternative 2, the number of proposed training activities that would involve the use of underwater explosives in the Inland Waters would stay the same compared to the number of activities proposed in the 2015 NWTT Final EIS/OEIS (see Table 2.5-1) and would be the same compared to Alternative 1. These events would occur in designated and well-established EOD Training Ranges where no cultural resources, including historic properties, have been identified. Regardless, it is unlikely that these resources could be disturbed by the use of explosives.

In summary, given that the training activities would be conducted in the same areas as described in the 2015 NWTT Final EIS/OEIS, the amount of shock (pressure) waves, vibrations, or cratering from explosives would not appreciably change the conclusions. Therefore, the conclusion from the 2015 NWTT Final EIS/OEIS, that no impacts on cultural resources from shock waves created by underwater detonations at depth are expected, would remain valid. Therefore, the analysis presented in the 2015 NWTT Final EIS/OEIS, Section 3.10.3.1.1 (Impacts from Explosive Shock [Pressure] Waves from Underwater Explosions) and Section 3.10.3.1.2 (Impacts from Explosives – Cratering) remains valid. Explosive stressors resulting from underwater explosions creating shock (pressure) waves, vibrations, and cratering of the seafloor would not impact submerged cultural resources within U.S. territorial waters under Alternative 2 because known submerged cultural resources and obstructions, which may include historic properties, are avoided during training exercises.

Impacts from Explosives Under Alternative 2 for Testing Activities

Under Alternative 2, the number of proposed testing activities that would involve the use of underwater explosives in the Offshore Area would stay the same compared to the number of activities proposed in under Alternative 1. Therefore, underwater explosions under Alternative 2 would not impact cultural resources, including historic properties, as described under Alternative 1.

3.10.2.1.1.3 Impacts from Explosives Under the No Action Alternative

Under the No Action Alternative, the proposed training and testing activities would not occur. Explosive stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer explosive stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would not impact cultural resources, including historic properties.

3.10.2.2 Physical Disturbance and Strike Stressors

3.10.2.2.1 Impacts from In-Water Devices

The physical disturbance and strike stressors that may impact cultural resources include military expended materials and seafloor devices.

3.10.2.2.1.1 Impacts from In-Water Devices Under Alternative 1

Impacts from In-Water Devices Under Alternative 1 for Training Activities

Under Alternative 1, there is an overall increase in the use of in-water devices (Table 3.0-13 in Chapter 3.0 of this Supplemental EIS/OEIS), all of which are associated with small, slow-moving unmanned underwater vehicles. The proposed increase of over 100 in-water devices between both the Offshore Area and the Inland Waters would not change the conclusion presented in the 2015 NWTT Final EIS/OEIS.

As stated in the 2015 NWTT Final EIS/OEIS, the impact of physical disturbance and strike stressors on cultural resources would be insignificant for in-water devices because (1) the types of activities associated with towed systems are conducted in areas where the sea floor is deeper than the length of the tow lines; and (2) devices are operated within the water column and do not contact the seafloor. Activities involving towed and other in-water devices are not expected to impact submerged cultural resources. In-water devices such as crawlers would not disturb the bottom enough to disturb buried or imbedded archaeological resources. Similarly, anchors placed by divers on the seafloor or deployed in a controlled manner by vessels would not dig or plow along the bottom and disturb cultural resources. Therefore, as stated in the 2015 NWTT Final EIS/OEIS, no impacts on cultural resources, including historic properties, are expected from training activities using in-water devices.

Impacts from In-Water Devices Under Alternative 1 for Testing Activities

Under Alternative 1, the number of proposed testing activities involving the use of in-water devices would increase compared to those proposed in the 2015 NWTT Final EIS/OEIS (Table 3.0-13). As described in the 2015 NWTT Final EIS/OEIS, the testing activities in the Offshore Area would include activities where in-water devices would contact bottom substrates, such as with certain types of unmanned underwater vehicles in the Quinault Range Site at Pacific Beach in the tidal zone. This portion of the Study Area is a high-energy environment with sandy bottom/beach where intact cultural resources are unlikely to exist, and known cultural resources would be avoided. Testing activities in the Inland Waters portion of the Study Area would also include activities using in-water devices that contact bottom substrates. For the same reasons as listed for training activities, impacts on cultural resources or historic properties from in-water devices are not anticipated.

Testing activities would occur in the same locations and in a similar manner as were analyzed previously. In spite of these increases, and as described in the 2015 NWTT Final EIS/OEIS, these in-water device activities remain unlikely to impact cultural resources. For the same reasons as listed under the analysis for training activities, testing activities using in-water devices, in the Study Area would not impact cultural resources, including historic properties.

3.10.2.2.1.2 Impacts from In-Water Devices Under Alternative 2

Impacts from In-Water Devices Under Alternative 2 for Training Activities

Under Alternative 2, training activities with in-water devices would not increase significantly in the Offshore Area or Inland Waters compared to Alternative 1. Therefore, the analysis for Alternative 2 would be the same as under Alternative 1.

Impacts from In-Water Devices Under Alternative 2 for Testing Activities

Testing activities under Alternative 2 that include in-water devices in the Study Area would not increase significantly in the Offshore Area or Inland Waters compared to Alternative 1. Therefore, impacts on cultural resources from testing activities under Alternative 2 would be the same as described under Alternative 1.

3.10.2.2.1.3 Impacts from In-Water Devices Under the No Action Alternative

Under the No Action Alternative, the proposed training and testing activities would not occur. Physical disturbance and strike stressors from in-water devices associated with the Proposed Action would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer physical disturbance and strike stressors within the marine environment where training and testing activities have historically been conducted. Discontinuing training and testing activities under the No Action Alternative would not impact cultural resources, including historic properties.

3.10.2.2.2 Impacts from Military Expended Materials

Military expended materials from activities occurring outside 50 NM from land that could impact cultural resources include heavy inert practice munitions (Table 3.0-14 in Chapter 3.0 of this Supplemental EIS/OEIS), other military materials (Table 3.0-15 in Chapter 3.0 of this Supplemental EIS/OEIS), explosive munitions that may result in fragments (Table 3.0-16 in Chapter 3.0 of this Supplemental EIS/OEIS), and targets (Table 3.0-17 in Chapter 3.0 of this Supplemental EIS/OEIS) that could strike or settle on shipwrecks, submerged aircraft, or other cultural resources.

3.10.2.2.2.1 Impacts from Military Expended Materials Under Alternative 1

Impacts from Military Expended Materials Under Alternative 1 for Training Activities

Under Alternative 1, the number of military materials that would be expended during training activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. The majority of military training items would be expended in the open ocean, where the settling of military expended materials would occur and where shipwrecks and other cultural resources would less commonly be found. Areas in the Inland Waters where military expended materials would settle to the seafloor are areas with known cultural resources, but for the reasons below military expended materials would not affect them.

There would be no impact of military expended materials on cultural resources under Alternative 1 because: (1) most anticipated expended munitions would be small objects and fragments that would slowly drift to the seafloor after striking the ocean surface, (2) expended materials would not alter the archaeological or cultural characteristics of the submerged cultural resource if they should sink on the resource itself or in the vicinity, and (3) it is unlikely these materials would come into contact with or remain on submerged cultural resource. Therefore, activities involving military expended materials are not expected to impact submerged cultural resources or affect historic properties.

Impacts from Military Expended Materials Under Alternative 1 for Testing Activities

Under Alternative 1, the number of military materials that would be expended during testing activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. As described under training activities for military expended materials, the majority would be expended in open ocean where shipwrecks and other cultural resources are less commonly found and where the likelihood these materials permanently come to rest on or near these resources is low. For the same reasons as stated in the analysis for military expended materials and impacts on cultural resources under training activities, there would be no impact on submerged cultural resources or effects on historic properties as a result of Alternative 1.

3.10.2.2.2.2 Impacts from Military Expended Materials Under Alternative 2

Impacts from Military Expended Materials Under Alternative 2 for Training Activities

Under Alternative 2, the number of military materials that would be expended during training activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously and do not contain known cultural resources. Therefore, the impacts on cultural resources would be the same as described under training activities for Alternative 1, and activities involving military expended materials would have no impact on submerged cultural resources, including historic properties.

Impacts from Military Expended Materials Under Alternative 2 for Testing Activities

Under Alternative 2, the number of military materials that would be expended during testing activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. Compared to the 2015 NWTT Final EIS/OEIS numbers, the single category of stationary sub-surface targets is proposed to increase from 5,422 to 7,317 in the Inland Waters and from 7 to 3,335 in the Offshore Area (Table 3.0-17). These targets are typically recovered and, while they are appropriately included in the military expended materials category, pose limited risk of physical disturbance and strike to cultural resources, as known cultural resources are avoided during testing activities. There is an increase in all of the other military expended materials except for mine shapes (non-explosive and recovered) in the Inland Waters, which decrease from 12,982 to 5,266. For the same reasons as stated in the analysis for military expended materials and impacts on cultural resources under training activities, testing activities would not impact submerged cultural resources, including historic properties, as a result of Alternative 2.

3.10.2.2.2.3 Impacts from Military Expended Materials Under the No Action Alternative

Under the No Action Alternative, the proposed testing and training activities would not occur. Physical disturbance and strike stressors from military expended materials associated with the Proposed Action would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer physical disturbance and strike stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would not impact cultural resources or affect historic properties.

3.10.2.2.3 Impacts from Seafloor Devices

Several training and testing activities include the use of seafloor devices—items that may contact the ocean bottom temporarily. The activities and the specific seafloor devices are (1) precision anchoring training, where ship anchors are lowered to the seafloor and recovered; (2) EOD mine countermeasures training exercises, where some mine targets may be moored to the seafloor; and (3) various testing activities where anchors are placed on the seafloor to hold instrumentation in place.

3.10.2.2.3.1 Impacts from Seafloor Devices Under Alternative 1

Impacts from Seafloor Devices Under Alternative 1 for Training Activities

No training activities with seafloor devices are proposed in the Offshore Area under Alternative 1 (see Table 3.0-18), therefore having no impact on cultural resources in the Offshore Area. Under

Alternative 1, the number of training activities that include the use of ship anchors (as seafloor devices) would increase from 10 to 40, in the Inland Waters as part of the Precision Anchoring exercise. The activity consists of a vessel navigating to a precise, pre-determined location and releasing the ship's anchor to the bottom (see Figure 3.10-2). The ship anchor is later recovered and the activity is complete. These training events should not impact cultural resources because SOPs include avoidance of shipwrecks and obstructions. As stated in the 2015 NWTT Final EIS/OEIS, the impact of seafloor devices such as heavy ship anchors on cultural resources could be damaging; however, impacts are unlikely because seafloor devices are stationary or move slowly across the bottom (in the case of crawlers), and have a selection criterion for precision anchoring to purposefully avoid shipwrecks, obstructions, and other cultural resources. Mine Neutralization EOD Training activities would remain at the same location and event amount (13) under Alternative 1 as discussed in the 2015 NWTT Final EIS/OEIS. These events would occur in designated and well-established EOD Training Ranges where no cultural resources have been identified. It is unlikely that these resources could be disturbed by the use of seafloor devices. Therefore, activities involving seafloor devices are not expected to impact submerged cultural resources or affect historic properties.

<u>Impacts from Seafloor Devices Under Alternative 1 for Testing Activities</u>

Under Alternative 1, the number of testing activities that include the use of seafloor devices would decrease by approximately 20 percent in the Offshore Area for anchors to secure mine shapes, and increase in the Inland Waters from 433 to 512 for anchors (as shown in Table 3.0-18). The majority of the activities involve the temporary placement of anchors on the seafloor. When the test is completed, the anchors are recovered, again at a slow speed. The testing activities in the Western Behm Canal would include activities where seafloor devices would contact bottom substrates. Heavy ship anchors could still damage resources; however, these testing events should not impact cultural resources because the military routinely avoids locations of known obstructions, especially when anchoring ships. As stated in the 2015 NWTT Final EIS/OEIS, the impact of seafloor devices on cultural resources would be unlikely because (1) seafloor devices are either stationary or move slowly along the bottom, causing little or no disturbance of seafloor sediments which may have the potential to contain cultural resources; and (2) the military routinely avoids locations of known obstructions, which include submerged cultural resources. Mine shapes should not impact cultural resources for the same reasons as discussed under training: that the military routinely avoids locations of known obstructions, and that mine activities would only occur in designated and well-established EOD Training Ranges where no cultural resources have been identified. Activities involving seafloor devices are not expected to impact submerged cultural resources, which include historic properties.

3.10.2.2.3.2 Impacts from Seafloor Devices Under Alternative 2

<u>Impacts from Seafloor Devices Under Alternative 2 for Training Activities</u>

Under Alternative 2, the number of training activities that include the use of seafloor devices would be the same as described under Alternative 1 for Precision Anchoring in the Inland Waters. However, mine shape use would increase from 13 to 21 under Alternative 2. For the same reasons as stated under training activities under Alternative 1, activities involving seafloor devices are not expected to impact submerged cultural resources because (1) seafloor devices are either stationary or move very slowly along the bottom, causing little or no disturbance of seafloor sediments which may have the potential to contain cultural resources; and (2) the military routinely avoids locations of known obstructions which include submerged cultural resources. Mine shapes would not impact cultural resources for the same reasons as discussed under training: that the military routinely avoids locations of known obstructions, and that mine activities would only occur in designated and well-established EOD Training Ranges where no cultural resources have been identified. Therefore, training activities involving seafloor devices are not expected to impact submerged cultural resources or affect historic properties.

Impacts from Seafloor Devices Under Alternative 2 for Testing Activities

Under Alternative 2, the number of testing activities that include the use of seafloor devices would be greater than the number described under Alternative 1. Anchoring would be at 536 activities compared to 512 in the Inland Waters, and 71 rather than 70 in the Offshore Area under Alternative 2. Mine use would increase from 54 to 55 activities in the Offshore Area, from 454 to 478 activities in the Inland Waters, and remain the same in the Western Behm Canal. The majority of the activities involve the temporary placement of anchors on the seafloor. Although these anchors could be descending slowly, reducing risk to cultural resources, heavy anchors could still damage resources. Mine shapes should not impact cultural resources for the same reasons as discussed under training: that the military routinely avoids locations of known obstructions, and that mine activities would only occur in designated and well-established EOD Training Ranges where no cultural resources have been identified. Therefore, testing activities involving seafloor devices are not expected to impact submerged cultural resources, including historic properties.

3.10.2.2.3.3 Impacts from Seafloor Devices Under the No Action Alternative

Under the No Action Alternative, the proposed training and testing activities would not occur. Physical disturbance and strike stressors from seafloor devices associated with the Proposed Action would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer physical disturbance and strike stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would not impact cultural resources in the Study Area or affect historic properties in the APE.

3.10.2.3 Acoustic

The public and American Indians have expressed the belief that cultural properties, ceremonies on the Olympic Peninsula, and traditional cultural locations would be impacted significantly by noise caused by the implementation of the Proposed Action. The Navy modeled the noise from aircraft while conducting training activities within the Olympic MOA and W-237A, and while transiting to and from the Olympic MOA and W-237A, in order to provide a discussion of the potential impacts on these resources (see Appendix J, Airspace Noise Analysis for the Olympic Military Operations Area). The Noise Study concluded that the noise exposure within the Olympic MOA and W-237A is within the DoD's Noise Zone 1, with Day Night Average Sound Levels below 65 A-weighted decibels (dBA) for the entire area studied. For the cumulative noise metrics (Day-Night Average Sound Level [DNL]), the noise modeling results show that the area underneath the Olympic MOA would experience a cumulative noise exposure of less than 37 dBA for both the reference (current) activities and the proposed activities. The slightly higher noise levels for the proposed activities are a reflection of the 13.5 percent projected increase in sorties over the current level of activities (an increase from approximately 2,300 to 2,600). For the lower ground elevations, the computed noise levels are correspondingly lower, as the distance would increase between the airborne source and the receptor on the ground (see Figure J-2 and Table J-11 in Appendix J, Airspace Noise Analysis for the Olympic Military Operations Area). For comparison, 35 dBA would be considered the natural ambient noise level of a wilderness area, and 39 dBA the level of a rural residential area.

The noise exposure within the Olympic MOA and W-237A is within the DoD's Noise Zone 1 (the frequency and intensity of sound events does not exceed 65 dB DNL). Therefore, there would be no significant impact on cultural resources from jet noise in the Olympic MOA. With the highest modeled noise exposure for NWTT activities less than 37 dB DNL, well below a level with the potential to affect historic properties, the areas subject to aircraft noise are not included in the APE. Accordingly, aircraft noise would not affect historic properties.

3.10.2.4 Limiting Access/Temporary Change of Use

Limits to access and temporary changes of use in the Study Area are discussed in Section 3.11 (American Indian and Alaska Native Traditional Resources); please see Section 3.11.2 (Environmental Consequences) for the analysis and conclusions.

3.10.2.5 Visual and Atmospheric

Visual and atmospheric stressors should result from observation of aircraft, their lights, and condensation trails (aka contrails), which are a visual representation of atmospheric changes. Continuing aircraft flights within the altitude restrictions of established air space, however, may result in minimal and temporary changes to a visual setting on the ground but unlikely to result in more-than-de-minimis visual intrusions or unwanted aesthetic impacts. This limits the extent to which a visual impact from the observation of aircraft would be experienced at a cultural resource location. Contrails may readily evaporate but do mark the temporary presence of aircraft, albeit nonintrusive due to altitude and distance, especially when the presence of contrails from private and commercial aircraft are taken into consideration. Due to the altitude of the aircraft, only minimal and temporary impacts would occur as a result of visual and atmospheric stressors to cultural resources, and no historic properties would be affected.

3.10.2.6 Impacts on Cultural Resources and Effects on Historic Properties

NEPA requires consideration of the impacts on cultural resources within the human environment, represented by the NWTT Study Area in this Supplemental. Accordingly, the Navy considered potential impacts on cultural resources, including areas over which aircraft operate, and no cultural resources would be impacted by stressors associated with the Proposed Action. As detailed in the 2015 NWTT Final EIS/OEIS, historic properties are a subset of cultural resources and fall within the purview of the NHPA. The NHPA APE is a subarea of the NEPA Study Area. The Navy has found that no historic properties would be affected by activities associated with the proposed undertaking within the defined APE.

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3.11 American Indian and Alaska Native Traditional Resources

Supplemental Environmental Impact Statement/
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3.11 American Indian and Alaska Native Traditional Resources

3.11.1 Affected Environment

For purposes of this Supplemental Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) (Supplemental), the Study Area for American Indian and Alaska Native traditional resources remain the same as that identified in the 2015 Northwest Training and Testing (NWTT) Final EIS/OEIS. As presented in the 2015 NWTT Final EIS/OEIS, there are 56 federally recognized tribes and Nations (hereinafter referred to as tribes) with traditional resources (e.g., plants, animals, usual and accustomed [U&A] fishing grounds) in the Study Area. The Study Area is divided into three distinct regions for American Indian and Alaska Native traditional resources evaluation: the Offshore Area; the Inland Waters; and Western Behm Canal, Alaska. Several types of traditional resources are present in the Study Area, including various plants and animals as well as tribal marine resource gathering areas (e.g., traditional fishing areas; whaling areas; and seaweed-, mussel-, abalone-, and clam-gathering grounds). These traditional resources include off-reservation treaty U&A fishing grounds, some of which extend beyond 12 nautical miles (NM).

Protected tribal resources, as defined in Department of Defense Instruction 4710.02, *DoD Interactions with Federally Recognized Tribes* (U.S. Department of Defense, 2018), are "those natural resources and properties of traditional or customary religious or cultural importance, either on or off Indian lands, retained by or reserved by or for Indian tribes through treaties, statutes, judicial decisions, or EOs [Executive Orders], including Tribal trust resources." Tribal trust resources are Indian lands or treaty rights to certain resources. These resources include plants, animals, and locations associated with hunting, fishing, and gathering activities for subsistence or ceremonial use. For the purposes of this section, the term "traditional resources" will be used to encompass protected tribal resources.

The connection between native peoples and tribal resources varies between individuals, cultures, and the unique interactions they have with the plants, animals, waters, and earth they encounter during their life journey. This connection holds another layer of complexity when considering what information and stories are passed down from previous generations of tribal members. A Statement from the Hopland Band of Pomo Indians, California was shared as part of the *Intertribal Sinkyone Wilderness Council et al v. National Marine Fisheries Service et al.* case filed January 26, 2012 (Intertribal Sinkyone Wilderness Council, 2012). The statement describes cultural traditions that are vital to the traditions, physical health, and spiritual health shared by many tribes along the Pacific coastline.

American Indian and Alaska Native historic properties of traditional religious and cultural importance to Tribes and Alaska Natives (i.e., cultural resources eligible for listing in the National Register of Historic Places under the National Historic Preservation Act) are discussed in Section 3.10 (Cultural Resources).

3.11.1.1 Government-to-Government Consultation

In October 1998 and as amended in 1999, the Department of Defense (DoD) promulgated its Native American and Alaska Native Policy, emphasizing the importance of respecting and consulting with Tribal governments on a government-to-government basis (U.S. Department of Defense, 2018). The policy requires an assessment, through consultation, of the effects of proposed DoD actions that may have the potential to significantly affect traditional resources (including traditional subsistence resources such as shellfish), Tribal rights (such as fisheries), and American Indian lands before decisions are made by DoD personnel. In addition, the DoD issued its *Department of Defense American Indian and Alaska Native Policy: Alaska Implementation Guidance* to consider situations and issues unique to Alaska Native Tribes.

The United States (U.S.) Department of the Navy (Navy) will continue government-to-government communications with several tribes in Washington, California, and Alaska in accordance with Secretary of the Navy Instruction 11010.14B, *Department of the Navy Policy for Consultation with Federally Recognized Indian Tribes, Alaska Native Tribal Entities, and Native Hawaiian Organizations*; Commander, Navy Region Northwest Instruction 11010.14, *Policy for Consultation with Federally-Recognized American Indian and Alaska Native Tribe*s (November 10, 2009); Executive Order (EO) 13175, *Consultation and Coordination with Indian Tribal Governments*; EO 13007, *Indian Sacred Sites*; the Presidential Memorandum dated April 29, 1994, *Government-to-Government Relations with Native American Governments*; the National Historic Preservation Act of 1966 as amended in 2006; the American Indian Religious Freedom Act of 1978, and Navy consultation policies as needed. It is Navy policy to establish permanent government-to-government working relationships with tribal governments that are built upon respect, trust, and openness. Under these policies, the Navy is required to consider tribal comments and concerns prior to making a final decision on a proposed action. However, reaching formal agreement with a tribe or obtaining tribal approval prior to a final decision is not required.

During the preparation of the 2015 NWTT Draft EIS/OEIS, the Navy consulted with tribes. On February 7, 2018, the Navy invited 56 federally recognized tribes to consider initiating government-to-government consultation for the Proposed Action in this Supplemental (see Appendix I, Agency Correspondence). Tribes and their concerns regarding the Navy's training and testing activities as they relate to tribal resources are summarized below.

Certain tribes in the Puget Sound region have expressed concerns regarding the potential of Navy training and testing activities to impede access to adjudicated treaty U&A fishing grounds and stations as well as concerns regarding the potential for Maritime Security Operations to damage tribal fishing gear. The Navy continues to communicate with the Jamestown S'Klallam Tribe, Lower Elwha Tribal Community, Port Gamble S'Klallam Tribe, Skokomish Indian Tribe, Upper Skagit, and Suquamish Indian Tribe of the Port Madison Reservation regarding these concerns and improving on-water vessel coordination in order to eliminate or minimize potential impacts to tribal fishing in these co-use marine waterways. Also, the Navy continues to coordinate with potentially affected tribes for activities conducted in Crescent Harbor.

Since 2015, the Navy has engaged in government-to-government consultation with the Intertribal Sinkyone Wilderness Council, representing the Cahto Tribe of Laytonville Rancheria; Coyote Valley Band of Pomo Indians of California; Hopland Band of Pomo Indians; Pinoleville Pomo Nation, California; Potter Valley Tribe, California; Redwood Valley Little River Band of Pomo Indians; Round Valley Indian Tribes, Round Valley Reservation, California; Scotts Valley Band of Pomo Indians of California; and Sherwood Valley Rancheria of Pomo Indians of California regarding potential impacts to traditional resources in the marine environment to address the tribes' concerns regarding Navy training and testing activities within the Study Area. The Navy also received and considered comments from the Intertribal Sinkyone Wilderness Council; Lummi Nation of Western Washington; Makah Tribe, Northwest Washington; the Port Gamble S'Klallam Tribe; Potter Valley Tribe; Quinault Indian Nation, of Washington; Squaxin Island Tribe; Suquamish Indian Tribe of the Port Madison Reservation; and Yurok Tribe regarding the training and testing exercises proposed by the Navy.

Based on Navy policies for tribal consultation, the Navy protects culturally sensitive information identified by tribes, as well as government-to-government consultation information, from public disclosure; consultation documents are maintained in the Navy's administrative record and are not included as an attachment to this document. However, comments submitted by tribes and tribal organizations during the public comment period and Navy's response to comments, which are separate and distinct from government-to-government consultations, are provided in Appendix H (Public Comments and Responses).

3.11.1.2 American Indian and Alaska Native Tribes

3.11.1.2.1 Offshore Area

As discussed in Section 3.11.1.4 (Federal Trust Responsibility and Federally Secured Off-Reservation Fishing Rights) of the 2015 NWTT Final EIS/OEIS, 18 federally recognized tribes are currently or historically associated with the Offshore Area. Tribal lands for these federally recognized tribes and for some of the tribes listed under the Inland Waters (Section 3.11.1.2.2) are shown in Figure 3.11-1, if data was available for them and if their lands were within or close to the Study Area. The Navy has received updated information from 10 of these tribes and the InterTribal Sinkyone Wilderness Council, as shown in Table 3.11-1, and has considered this information in this analysis. Each of the 10 tribes is a member of the lnterTribal Sinkyone Wilderness Council that is comprised of 10 federally recognized North Coast Tribes in California. The Council is a non-profit land conservation consortium that owns and manages 4,000 acres of redwood forestland (lnterTribal Wilderness land) along the Lost Coast north of Fort Bragg, California. Please see the profile in Table 3.11-1 regarding InterTribal Sinkyone Wilderness Council.

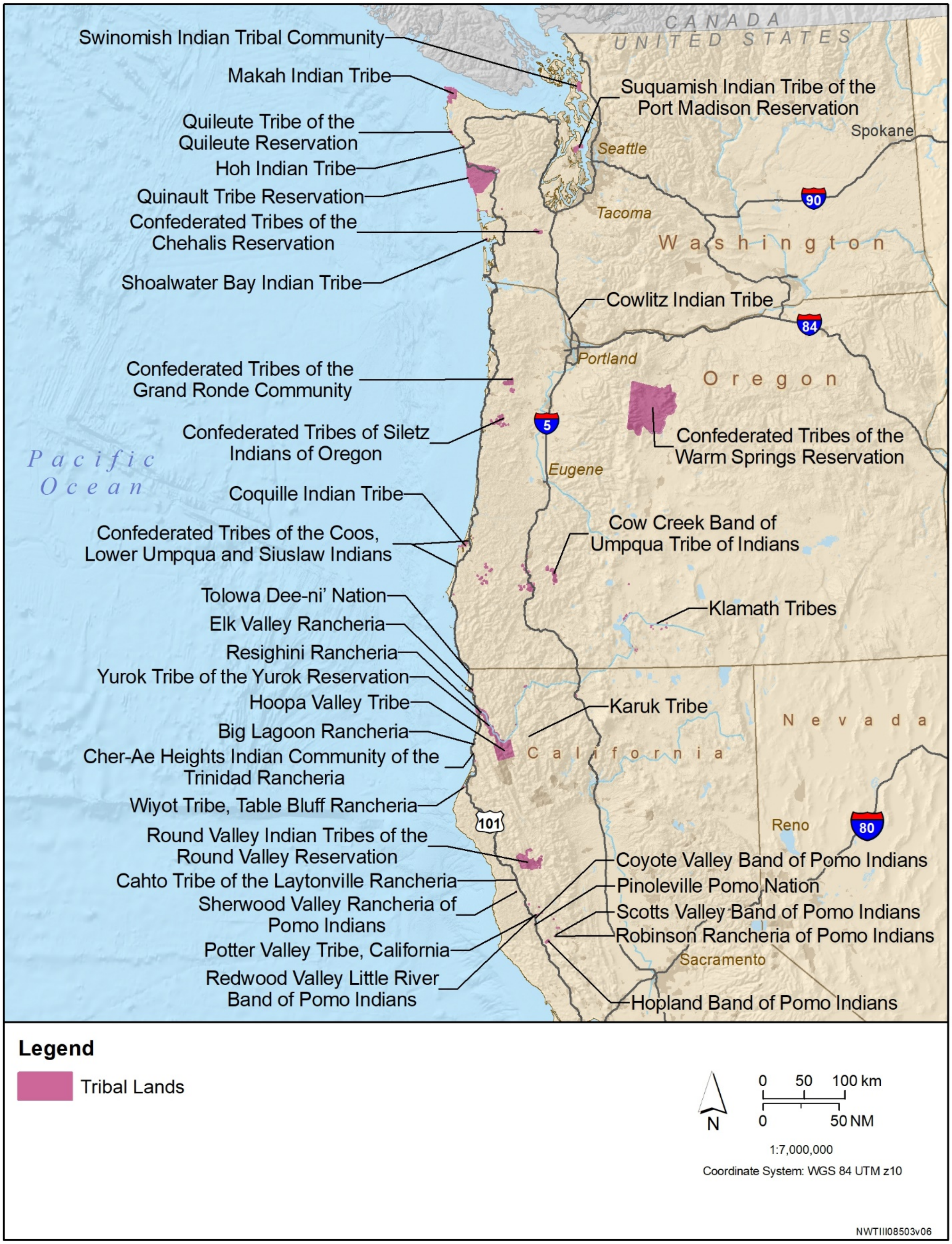

Figure 3.11-1: Tribal Lands for American Indian Tribes Associated with the Offshore Area

Table 3.11-1: Offshore Area – Updates for American Indian Tribes and Traditional Resources

Resource Type	***Tribe***	***Brief Profile****
Traditional Resources	Cahto Tribe of the Laytonville Rancheria	The name Cahto (Kato) means loosely "People of the Lake" or "Lake People," and refers to an ancient lakeshore where the Cahto people once lived, although we, the inhabitants of the six villages of the Long Valley, called ourselves the Tlokyáhan or "Grass People." Our homeland is comprised of mountains and hills covered with fir, pine, oak and redwoods and is veined with streams. A nearby 4,213-foot-high mountain summit is named Cahto peak in our honor. Besides gathering the plentiful nuts, seeds, berries, roots, bulbs, and tubers, we hunted for deer, rabbits, quail, and fish to provide additional food for our people. We traveled within our traditional homeland to where the food was plentiful, and to the Mendocino coast to harvest seaweed and fish. Today, once a year the Cahto retrace their migrations to the coast using sacred trails in remembrance of the ancient tradition.
Traditional Resources	Coyote Valley Band of Pomo Indians of California	The Coyote Valley Band of Pomo Indians live on the Coyote Valley Reservation located in Redwood Valley, California. Traditionally, subsistence is based on acorns, nuts, seeds, root plants, deer, elk, antelope, seal, sea lion, and lake, stream, and sea-going fish (Bean & Theodoratus, 1978; McLendon & Lowy, 1978). The tribe still practices their traditional songs, dances and spiritual ways. Currently, the economy is based on gaming, hotel, convenience store, and gas station (Tiller, 2005).
Traditional Resources	Hopland Band of Pomo Indians, California	The Hopland Band of the Pomo Indians resides in northwestern California south of Ukiah. Traditional territory includes Humboldt County to San Pablo Bay; fishing and gathering trips to the Pacific Ocean were seasonally based. Traditionally, subsistence was based on acorns, nuts, seeds, root plants, deer, elk, antelope, seal, sea lion, and lake, stream, and ocean fish (Bean & Theodoratus, 1978; McLendon & Lowy, 1978). Currently, the economy is based on agriculture, commercial development, and gaming (Tiller, 2005).
Traditional Resources	Pinoleville Pomo Nation, California	The Pinoleville Pomo Nation resides in northern California in Mendocino and Lake Counties (Tiller, 2005). Traditionally, subsistence was based on acorns, nuts, seeds, root plants, deer, elk, antelope. seal, sea lion, and lake, stream, and sea-going fish (Bean & Theodoratus, 1978; McLendon & Lowy, 1978). Currently, the economy is based on agriculture.
Traditional Resources	Potter Valley Tribe, California	The Potter Valley Tribe resides in northern California northeast of Ukiah, and Tribal members are of the Little Lake Pomo Band (Tiller, 2005). Traditionally, subsistence was based on acorns, nuts, seeds, root plants, deer, elk, antelope, seal, sea lion, and lake, stream, and ocean fish (Bean & Theodoratus, 1978; McLendon & Oswalt, 1978). Currently, the economy is based on commercial development.

Table 3.11-1: Offshore Area – Updates for American Indian Tribes and Traditional Resources (continued)

Resource Type	*Tribe*	*Brief Profile**
Traditional Resources	Redwood Valley Little River Band of Pomo Indians	The Redwood Valley Little River Band of Pomo Indians resides northeast of Redwood Valley in Mendocino County along the northeastern side of the Russian River valley. Members of the Redwood Valley Little River Band of Pomo Indians belong to the Northern Pomo (Tiller, 2005). Traditionally, subsistence was based on acorns, nuts, seeds, root plants, deer, elk, antelope, seal, sea lion, and lake, stream, and ocean fish (Bean & Theodoratus, 1978; McLendon & Oswalt, 1978).
Traditional Resources	Robinson Rancheria of Pomo Indians	The Robinson Rancheria of Pomo Indians is located northwest of Sacramento, California. Traditionally, subsistence was based on acorns, nuts, seeds, root plants, waterfowl, and lake and stream fish such as suckers, pike, and carp (McLendon & Lowy, 1978; McLendon & Oswalt, 1978). Currently, the economy is based on commercial development, gaming and tourism (Tiller, 2005).
Traditional Resources	Round Valley Indian Tribes Round Valley Reservation	The Round Valley Indian Tribes reside on the Round Valley Reservation located in the northeastern portion of Mendocino County, California. The greater area was the aboriginal traditional territory of the Yuki Tribe, until 1858 when the Round Valley Reservation was established with the establishment of the Nome Cult Farm. Now the reservation is home to the Yuki, Concow, Pomo, Nomlacki, Wailacki, and Pit River Indians. The tribal territory reached from the mountains around the valley to the coast. Traditionally foods as well as medicinal and personal needs remained to be gathered from this vast area. Subsistence came from gathering from trees, roots, grasses, brush and most other plant life (Seeds, berries, nuts, leaves, stems, and roots were utilized); large and small game; vertebrates and invertebrates (i.e., deer, elk, birds, surf fish, shellfish, eel, salmon, steelhead, otter, etc.) were harvested from the waterways in and around the tribal territory.
Traditional Resources	Scotts Valley Band of Pomo Indians of California	The Scotts Valley Band of Pomo Indians resides on the Sugar Bowl Rancheria in northern California (Tiller, 2005). Traditionally, subsistence was based on acorns, nuts, seeds, root plants, deer, elk, antelope, seal, sea lion, and lake, stream, and sea-going fish (Bean & Theodoratus, 1978; McLendon & Oswalt, 1978).

Table 3.11-1: Offshore Area – Updates for American Indian Tribes and Traditional Resources (continued)

Resource Type	*Tribe*	*Brief Profile**
Traditional Resources	Sherwood Valley Rancheria of Pomo Indians of California	Sherwood Valley Rancheria is located within aboriginal homelands we have used and occupied since time immemorial. Our homeland extends from approximately the Highway 101 corridor, through the Redwood Forests on to the Coast. As the original stewards of this land we retain original usufructuary rights to protect the land, air, water, and food sources upon our homeland. We have freely gathered coastal resources since time immemorial, and protection of the aboriginal food sources and traditional gathering places is a fundamental human right. Sherwood Valley Rancheria was established under Secretarial Order in 1909. Sherwood Valley is the successor in interest to ownership of the Mendocino Indian Reservation, established by Act of Congress on March 3, 1853. Sherwood Valley Rancheria is governed under a Constitution and Bylaws duly adopted and approved by the Secretary of the Interior on July 25, 1974. The Sherwood Valley Rancheria Tribal Council, as representatives of individual tribal members, strives to promote and perpetuate the protection of natural resources for future generations.
Traditional Resources	**InterTribal Sinkyone Wilderness Council** is a consortium comprised of the following federally recognized tribes: • Cahto Tribe of Laytonville Rancheria • Coyote Valley Band of Pomo Indians • Hopland Band of Pomo Indians	The InterTribal Sinkyone Wilderness Council is a non-profit consortium of 10 sovereign Tribal Nations whose duty is to protect culturally important traditional lands and waters of its member tribes. Established in 1986, the Sinkyone Council is charged with safeguarding the coastal rainforest and ocean ecosystems on which its member tribes depend for their cultural ways of life, traditional foods, wellbeing, and identity. It owns and manages 4,000 acres of redwood rainforest in northwestern Mendocino County, California that includes portions of nine coastal watersheds. InterTribal Sinkyone lands are situated within California's Coastal Zone. The Study Area encompasses marine waters situated within the traditional territories of several west coast Tribal Nations. The Sinkyone Council's 10 member tribes each retain important cultural, ancestral, historic, and contemporary ties to ocean and coastal areas within the Navy's Study Area, specifically the portion of traditional Sinkyone Tribal territorial marine waters, (and adjacent) estuarine waters and coastal environments that are situated between the Mendocino-Humboldt county line and the mouth of the Mattole River.

Table 3.11-1: Offshore Area – Updates for American Indian Tribes and Traditional Resources (continued)

Resource Type	*Tribe*	*Brief Profile**
Traditional Resources	**InterTribal Sinkyone Wilderness Council** (continued) • Redwood Valley Little River Band of Pomo Indians • Pinoleville Pomo Nation • Potter Valley Tribe • Robinson Rancheria of Pomo Indians • Round Valley Indian Tribes • Scotts Valley Band of Pomo Indians • Sherwood Valley Rancheria of Pomo Indians	(continued) An abundance of extant oral and written evidence substantiates the tribes' assertions of historical, current and ongoing coastal and maritime cultural uses and ways of life including traditional gathering, fishing, harvesting, ceremonial and other practices within and adjacent to marine waters situated within the Study Area. These areas have been a part of the tribes' traditional territories for millennia. This area of the Study Area is located within the documented and acknowledged geographical boundaries of traditional Sinkyone Tribal territory held and controlled by the original Sinkyone coastal peoples from which enrolled members of the Council's member tribes are directly descended.

*The Navy met with the InterTribal Sinkyone Wilderness Council and received these updates in 2018 and 2019. These profiles are direct quotes from the tables received by the Navy (InterTribal Sinkyone Wilderness Council, 2018) and (InterTribal Sinkyone Wilderness Council, 2019). Each of the 10 tribes is a member of the lnterTribal Sinkyone Wilderness Council that is comprised of 10 federally recognized North Coast Tribes in California. The Council is a non-profit land conservation consortium that owns and manages 4,000 acres of redwood forestland (lnterTribal Wilderness land) along the Lost Coast north of Fort Bragg, California.

Four tribes, listed below, have off-reservation Treaty U&A fishing grounds in co-use navigable water areas in Washington where the Navy conducts training and testing in the Offshore Area:

- Hoh Indian Tribe
- Makah Indian Tribe of the Makah Reservation
- Quileute Tribe of the Quileute Reservation
- Quinault Indian Nation

The following 14 Washington, Oregon, and California federally recognized tribes have traditional resources (e.g., migratory fish species, specifically salmon, that migrate upstream into the inland waters) in co-use navigable water areas where the Navy conducts training and testing activities in the Offshore Area:

- Big Lagoon Rancheria, California
- Cher-Ae Heights Indian Community of the Trinidad Rancheria, California
- Confederated Tribes of Coos, Lower Umpqua and Siuslaw Indians, Oregon
- Confederated Tribes of Grand Ronde Community of Oregon, Oregon
- Confederated Tribes of Siletz Indians of Oregon, Oregon
- Confederated Tribes of the Chehalis Reservation, Washington
- Coquille Indian Tribe, Oregon
- Cowlitz Indian Tribe, Washington
- Elk Valley Rancheria, California
- Resighini Rancheria, California
- Shoalwater Bay Indian Tribe of the Shoalwater Bay Indian Reservation, Washington
- Tolowa Dee-ni' Nation, California (listed as Smith River Rancheria in the 2015 NWTT Final EIS/OEIS)
- Wiyot Tribe (formerly the Table Bluff Rancheria), California
- Yurok Tribe of the Yurok Reservation, California

Also, 15 federally recognized tribes with traditional use areas inland of the Oregon and California coast may have traditional resource habitat in the Offshore Area; these migratory marine resources (e.g., salmon, steelhead, lamprey eel, and sturgeon) travel the rivers upstream into the tribes' traditional territories and are part of the local subsistence and ceremonial activities of the tribes:

- Cahto Tribe of the Laytonville Rancheria, California
- Confederated Tribes of the Warm Springs Reservation, Oregon
- Cow Creek Band of Umpqua Tribe of Indians, Oregon
- Coyote Valley Band of Pomo Indians of California, California
- Hoopa Valley Tribe, California
- Hopland Band of Pomo Indians, California
- Karuk Tribe, California
- Klamath Tribes, California
- Pinoleville Pomo Nation, California
- Potter Valley Tribe, California
- Redwood Valley Little River Band of Pomo Indians
- Robinson Rancheria of Pomo Indians, California
- Round Valley Indian Tribes, Round Valley Reservation, California
- Scotts Valley Band of Pomo Indians, California
- Sherwood Valley Rancheria, California

The traditional use areas and resources for these tribes as discussed in the 2015 NWTT Final EIS/OEIS have not changed.

3.11.1.2.2 Inland Waters

Twenty federally recognized tribes are currently or were historically associated with the Inland Waters. Tribal lands for these federally recognized tribes are shown in Figure 3.11-1 and Figure 3.11-2, if data was available for them and if their lands were within or close to the Study Area. In Washington, these 20 tribes have federally secured off-reservation Treaty U&A fishing rights in co-use navigable waters where the Navy conducts training and testing in the Inland Waters:

- Confederated Tribes and Bands of the Yakama Nation
- Jamestown S'Klallam Tribe
- Lower Elwha Tribal Community
- Lummi Tribe of the Lummi Reservation
- Makah Indian Tribe of the Makah Reservation
- Muckleshoot Indian Tribe
- Nisqually Indian Tribe
- Nooksack Indian Tribe
- Port Gamble S'Klallam Tribe
- Puyallup Tribe of the Puyallup Reservation
- Samish Indian Nation
- Sauk-Suiattle Indian Tribe
- Skokomish Indian Tribe
- Snoqualmie Indian Tribe
- Squaxin Island Tribe of the Squaxin Island Reservation
- Stillaguamish Tribe of Indians of Washington
- Suquamish Indian Tribe of the Port Madison Reservation
- Swinomish Indian Tribal Community
- Tulalip Tribes of Washington
- Upper Skagit Indian Tribe

There is no new or updated information, since the 2015 NWTT Final EIS/OEIS, regarding the traditional use areas and resources for these tribes as discussed in the 2015 NWTT Final EIS/OEIS.

3.11.1.2.3 Western Behm Canal, Alaska

Four federally recognized Alaska Native tribes are currently or historically associated with the Western Behm Canal in co-use navigable waters where the Navy conducts testing:

- Central Council of the Tlingit and Haida Indian Tribes
- Ketchikan Indian Corporation
- Metlakatla Indian Community, Annette Island Reserve
- Organized Village of Saxman

Tribal and Alaska Native corporation lands for these federally recognized Alaska Native tribes are shown in Figure 3.11-3, if data was available for them and if their lands were within or close to the Study Area. The traditional use areas and resources for these tribes as discussed in the 2015 NWTT Final EIS/OEIS have not changed.

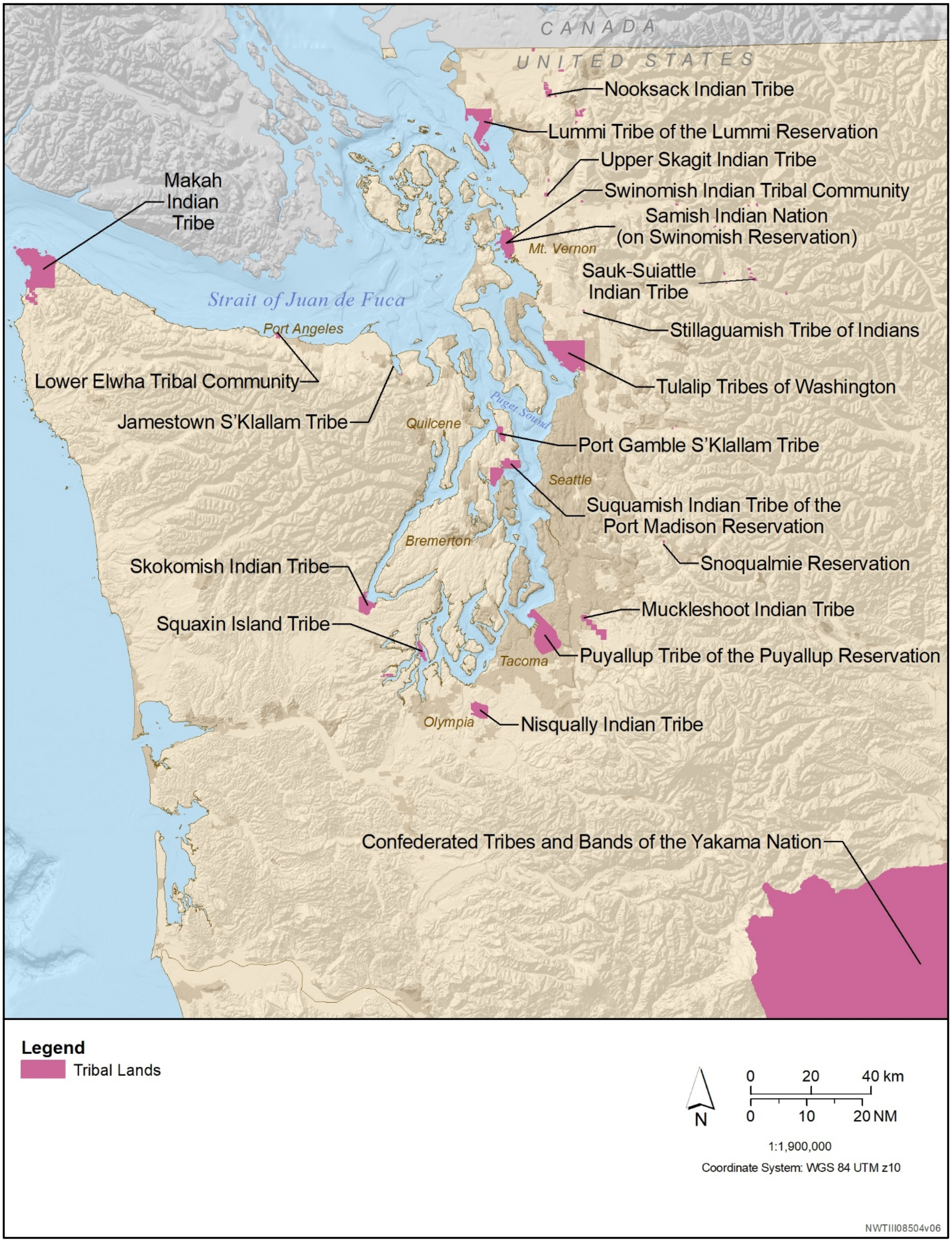

Figure 3.11-2: Tribal Lands for American Indian Tribes Associated with the Inland Waters

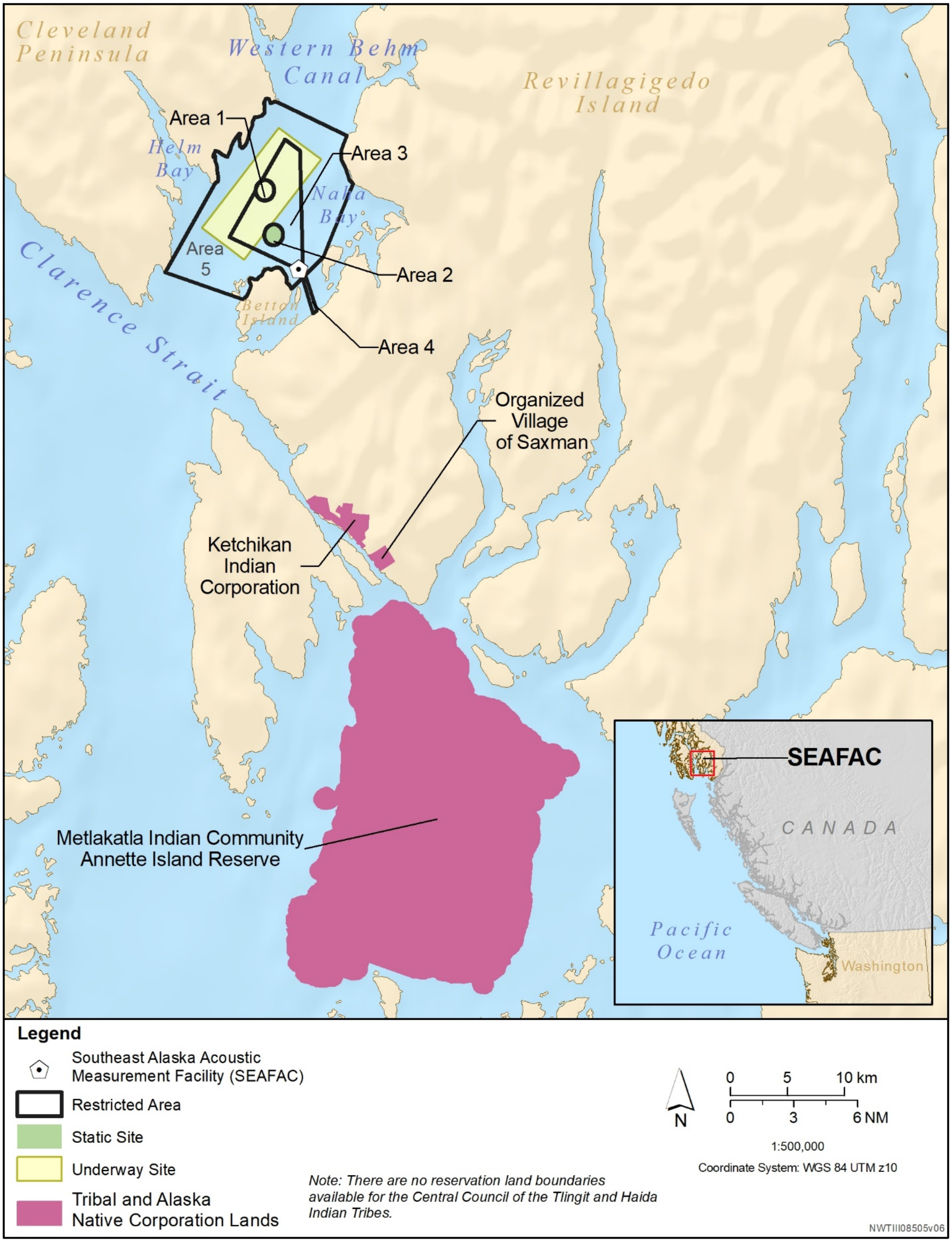

Figure 3.11-3: Tribal and Alaska Native Corporation Lands Associated with the Western Behm Canal

3.11.1.2.4 Tribal Traditional Knowledge

During the Draft Supplemental NWTT EIS/OEIS 2019 commenting period, Tribes provided Tribal Traditional Knowledge in the form of public comments. These comments stressed the importance of whales in general and Southern Resident killer whales in particular, to their cultural practices. The Navy acknowledges the concerns and comments received, which asked that the Navy protect whale habitats, prey species (e.g., Chinook salmon, herring, other fisheries, and prey), and migration patterns. The Navy has undertaken extensive analysis of potential impacts to marine mammals as a result of the Proposed Action in Section 3.4 (Marine Mammals). The Navy also has developed and implemented geographic and other operational mitigation measures as discussed in Chapter 5 (Mitigation) and Appendix K (Geographic Mitigation Assessment) of this Supplemental.

3.11.1.3 Tribal Fishing Areas and Use

As presented in the 2015 NWTT Final EIS/OEIS, many of the marine species found within the Study Area are culturally significant to the tribes of coastal Washington, Oregon, California, and Alaska. Tribes harvest traditional resources for ceremonial and subsistence uses as well as for commercial enterprises (i.e., tribal fisheries). Tribal fisheries are place-oriented and, in some cases, limited to the adjudicated U&A fishing grounds. For this reason, the availability and health of marine resources and supporting habitats is a concern for tribes in the Study Area.

3.11.1.3.1 Offshore Area

The U&A fishing grounds for the Hoh Indian Tribe, Makah Indian Tribe of the Makah Reservation, Quileute Tribe of the Quileute Reservation, and the Quinault Indian Nation include Olympic Peninsula Rivers and watersheds, and offshore areas. These tribes utilize the Northwest Indian Fisheries Commission (NWIFC), which provides technical support to Western Washington member tribes for intertribal fisheries management and harvest policy. Tribal U&A fishing grounds were established in offshore areas beyond U.S. territorial waters (greater than 12 NM), including within Olympic Coast National Marine Sanctuary as described in the 2015 NWTT Final EIS/OEIS.

In addition to tribes that have off-reservation Treaty U&A fishing grounds in co-use navigable waters, there are 14 Washington, Oregon, and California federally recognized tribes that have traditional resources (e.g., migratory fish species, specifically salmon that migrate upstream into the inland waters) in co-use navigable waters (as described in the 2015 NWTT Final EIS/OEIS, Section 3.11.2.1.1, Offshore Area). Also, there are 15 federally recognized tribes with traditional use areas inland to the Oregon and California coast that may have traditional resource habitat in Offshore Areas associated with migratory marine resources (e.g., salmon, steelhead, lamprey eel, and sturgeon) (as described in the 2015 NWTT Final EIS/OEIS, Section 3.11.2.1.1, Offshore Area).

3.11.1.3.1.1 Salmon Fisheries

Commercial, ceremonial, and subsistence fishing for salmon in the Offshore Area as described in the 2015 NWTT Final EIS/OEIS has not changed except as for variable changes in salmon population health.

3.11.1.3.1.2 Groundfish Fisheries

Treaty rights to fish for groundfish in the Offshore Area are the same now as they were described in the 2015 NWTT Final EIS/OEIS.

3.11.1.3.1.3 Pacific Halibut Fisheries

Commercial, ceremonial, and subsistence fishing for Pacific halibut in the Offshore Area as described in the 2015 NWTT Final EIS/OEIS has not changed.

3.11.1.3.1.4 Shellfish Harvests

Along the Pacific coastal sandy beaches from the Columbia River to Kalaloch, federal management plans are signed each year between Washington Department of Fish and Wildlife and tribal governments with razor clam harvest rights and substantial treaty harvest of Dungeness crab. Razor clam harvests are set and monitored within each of the five management beaches: Twin Harbors from Willapa Bay north to the south jetty at the mouth of Grays Harbor, Copalis Beach from the north jetty at the mouth of Grays Harbor to the Copalis River, Mocrocks from the Copalis River to the Moclips River (south boundary of the Quinault Indian Reservation), and Kalaloch from the South Beach campground to Olympic National Park Beach Trail 3 (U.S. Department of the Navy, 2006).

3.11.1.3.2 Inland Waters

As stated in the 2015 NWTT Final EIS/OEIS, 20 American Indian tribes have U&A fishing grounds (including the Strait of Juan de Fuca, Puget Sound, and inland rivers in the Inland Waters of the Study Area). These tribes include:

- Confederated Tribes and Bands of the Yakama Nation
- Jamestown S'Klallam Tribe
- Lower Elwha Tribal Community
- Lummi Tribe of the Lummi Reservation
- Makah Indian Tribe of the Makah Reservation
- Muckleshoot Indian Tribe
- Nisqually Indian Tribe
- Nooksack Indian Tribe
- Port Gamble S'Klallam Tribe
- Puyallup Tribe of the Puyallup Reservation
- Samish Indian Nation
- Sauk-Suiattle Indian Tribe
- Skokomish Indian Tribe
- Snoqualmie Indian Tribe
- Squaxin Island Tribe of the Squaxin Island Reservation
- Stillaguamish Tribe of Indians of Washington
- Suquamish Indian Tribe of the Port Madison Reservation
- Swinomish Indian Tribal Community
- Tulalip Tribes of Washington
- Upper Skagit Indian Tribe

The Western Washington Treaty tribes created the NWIFC to coordinate fisheries management of these tribes for implementation of orders arising from the 1974 *United States v. Washington* decision. As stated previously, this commission provides technical support to American Indian tribes assisting in intertribal coordination on harvest policy. The Columbia River Treaty Tribes created the Columbia River Intertribal Fish Commission (U.S. Department of the Navy, 2015).

Since the 2015 NWTT Final EIS/OEIS, the Makah Tribal Council issued its "Makah Ocean Policy" (2017) to assist the Makah Tribal Government in asserting its sovereign authority to protect the Makah Tribe's culture and the continued exercise of its treaty-reserved rights. This policy includes, among other things, guiding principles, historical ocean use, and consultation procedures.

3.11.1.3.2.1 Salmon Fisheries

As presented in the 2015 NWTT Final EIS/OEIS, each tribe regulates its own fisheries, including allowable gear and locations individually within its U&A fishing grounds. Salmon fisheries are co-managed between the NWIFC, referenced above, and the State Department of Fish and Wildlife to establish harvest limits and timing of fisheries. A coordinated management approach is applied if these areas overlap the U&A fishing grounds of other tribes. Commercial, ceremonial, and subsistence fishing for salmon in the Inland Waters has not changed from its description in the 2015 NWTT Final EIS/OEIS.

3.11.1.3.2.2 Pacific Halibut Fisheries

Commercial, ceremonial, and subsistence fishing for Pacific halibut in the Inland Waters as described in the 2015 NWTT Final EIS/OEIS has not changed.

3.11.1.3.2.3 Shellfish Harvest

Commercial, ceremonial, and subsistence harvesting of shellfish in the Inland Waters as described in the 2015 NWTT Final EIS/OEIS has not changed.

3.11.1.3.3 Western Behm Canal, Alaska

Nonsubsistence Use Areas are defined by Alaska state law as areas where, "… dependence upon subsistence (customary and traditional uses of fish and wildlife) is not a principal characteristic of the economy, culture, and way of life" (Alaska Department of Fish and Game Division of Subsistence, 1992). As discussed in the 2015 NWTT Final EIS/OEIS, the Western Behm Canal is within the Ketchikan Nonsubsistence Use Area (U.S. Department of the Navy, 2015). The State of Alaska established the Ketchikan Nonsubsistence Use Area (Alaska Department of Fish and Game, 2011) around the Southeast Alaska Acoustic Measurement Facility Range and Western Behm Canal, based on interviews with Alaska Natives who testified that this area was not used for subsistence hunts or harvests (Alaska Department of Fish and Game Division of Subsistence, 1992, 2011).

The Navy has extended communication to the Native tribes at both the regional and community level. The Navy sent correspondence to the Ketchikan Indian Corporation, the Organized Village of Saxman, Metlakatla Indian Community, and Central Council of the Tlingit and Haida Indian Tribes, through the NEPA process on 11 Aug 2017, with the Notice of Intent; on 06 February 2018 with an invitation to initiate government to government consultation; and on 20 March 2019 with the Notice of Availability. The Installation Environmental Director for Naval Base Kitsap, which overseas natural resources management at the Navy's Southeast Alaska Acoustic Facility (SEAFAC), met with representatives from the Ketchikan Indian Corporation and the Organized Village of Saxman to discuss the Facility and its operations on March 18, 2019. No concern regarding tribal fisheries or the tribes' ability to harvest harbor seal was mentioned during this face to face meeting and tour of the facility. In addition to these correspondence, the Navy followed up with its invitation to initiate government to government on 21 April 2020, with a specific request for any concerns regarding the Navy's proposed activities on the availability of marine mammals for subsistence use. The Navy followed up this correspondence again on 12 May 2020, with another email asking if there were any concerns the Navy's proposed activities in the

Western Behm and the availability of marine mammal species or stocks for Alaska Native subsistence use. No responses have been received from the tribes to the Navy's correspondence.

3.11.2 Environmental Consequences

The 2015 NWTT Final EIS/OEIS considered training and testing activities that were projected to occur between 2015 and 2020 in the Study Area and analyzed how associated stressors might impact tribal traditional resources. Stressors applicable to tribal traditional resources in the Study Area are the same stressors analyzed in the 2015 NWTT Final EIS/OEIS:

- Impeding access to tribal U&A fishing grounds or other traditional fishing areas in co-use navigable waters
- Changes to the availability of marine resources or habitat
- Loss or damage to tribal fishing gear

This section evaluates how and to what degree potential impacts on tribal traditional resources from stressors described in Section 3.0 (Introduction) may have changed since the analysis was completed for the 2015 NWTT Final EIS/OEIS. Proposed training and testing activities, the number of times each activity would be conducted annually, and the locations within the Study Area where the activity would typically occur under each alternative are presented in Table 2.5-1, Table 2.5-2, and Table 2.5-3 in Chapter 2 (Description of Proposed Action and Alternatives). The tables also present the same information for activities proposed in the 2015 NWTT Final EIS/OEIS so that the proposed levels of training and testing under this supplement can be easily compared.

The analysis presented in this section also considers standard operating procedures described in Section 2.3.3 (Standard Operating Procedures), and mitigation measures described in Chapter 5 (Mitigation). The Navy would implement these measures to avoid potential impacts on tribal traditional resources from stressors associated with the proposed training and testing activities.

The specific analysis of the training and testing activities presented in this section considers relevant components and associated data with the geographic location of the activity and tribal traditional resources and incorporates analysis from applicable sections such as Section 3.9 (Fishes), Section 3.10 (Cultural Resources), and Section 3.12 (Socioeconomic Resources and Environmental Justice). Training activities are not proposed in the Western Behm Canal; therefore, only the Offshore Area and the Inland Waters are analyzed under training activities.

3.11.2.1 Impeding Access to Usual and Accustomed Fishing Grounds or Traditional Fishing Areas

3.11.2.1.1 Impacts from Impeding Access to Usual and Accustomed Fishing Grounds or Traditional Fishing Areas

As stated in the Affected Environment section, the U&A fishing grounds in co-use navigable waters and the NWTT Study Area have not changed since the 2015 NWTT Final EIS/OEIS. U&A fishing grounds are located in the Inland Waters portion of the Study Area and in portions of the Offshore Area located off the coast of Washington. No U&A fishing grounds exist in Western Behm Canal or portions of the Offshore Area located off the coasts of Oregon or California. Because traditional resources in the Western Behm Canal are not available for subsistence uses by Alaska Native tribes, no impact on Alaska Native accessibility of traditional fishing areas would occur as a result of testing activities. Traditionally, some Oregon and California tribes procured marine resources directly from coastal and nearshore areas (less than 12 NM). These traditional fishing and harvesting areas are outside the Study Area, and access to these areas would not be affected by the Proposed Action. This was the conclusion reached in the

2015 NWTT Final EIS/OEIS; as the underlying facts have not changed, the Navy's conclusion remains valid for this Supplemental.

3.11.2.1.1.1 Impacts from Impeding Access to Usual and Accustomed Fishing Grounds or Traditional Fishing Areas Under Alternative 1

Impacts from Impeding Access to U&A Fishing Grounds or Traditional Fishing Areas Under Alternative 1 for Training Activities

Under Alternative 1, the number of proposed training activities in the Offshore Area and Inland Waters would change from the number of activities proposed in the 2015 NWTT Final EIS/OEIS (see Table 2.5-1). Given that the activities would be conducted in the same areas as described in the 2015 analysis, and that the number of training activities would not change significantly, the analysis and impact conclusions from the 2015 NWTT Final EIS/OEIS remains valid. Therefore, Navy training activities in the Offshore Area under Alternative 1 are not likely to impede access to U&A fishing grounds except in rare instances where a vessel attempts to enter an established safety zone during ongoing activities or if it approaches too close to a Navy vessel (33 CFR 165).

The exclusion zone for Explosive Ordnance Disposal training could temporarily impede tribal access to portions of their U&A fishing grounds in the Inland Waters. However, the exclusion zones would be temporary (up to four hours per event) and infrequent (six times per year), and would affect a relatively small area in Hood Canal and Crescent Harbor. Navy training activities in Inland Waters under Alternative 1 could also temporarily impede tribal access to portions of their U&A fishing grounds because of Maritime Security Operations, such as Transit Protection Program training events. The Navy would communicate with potentially affected tribes in advance to de-conflict schedules where possible. In addition, the U.S. Coast Guard (USCG) Maritime Force Protection Unit would provide notification of Transit Protection Program events to Tribal Fisheries Enforcement Officers. Coastal Riverine Group One also provides notifications to Tribal Fisheries Enforcement Officers when they escort high-value units from NAVSTA Everett and Bremerton.

Impacts from Impeding Access to U&A Fishing Grounds or Traditional Fishing Areas Under Alternative 1 for Testing Activities

Under Alternative 1, the number of proposed testing activities in the Offshore Area, Inland Waters, and Western Behm Canal would change from the number of activities proposed in the 2015 NWTT Final EIS/OEIS (see Table 2.5-2 and Table 2.5-3). Given that the activities would be conducted in the same areas as described in the 2015 analysis, and that the number of training and testing activities would not change significantly, the analysis and impact conclusions from the 2015 NWTT Final EIS/OEIS remains valid. As stated in the 2015 NWTT Final EIS/OEIS, the Navy normally has the ability to obtain a clear range for testing activities in the Offshore Area without asking other vessels to leave the area. Navy testing activities would not prevent the use of an area by fishing or other vessels, absent unusual circumstances. Navy testing activities in the Offshore Area under Alternative 1 are not likely to impede access to U&A fishing grounds except in rare instances where a vessel attempts to enter an established safety zone during ongoing activities or if it approaches too close to a Navy vessel.

Alternative 1 would include testing of explosive torpedoes and explosive mine-countermeasure and neutralization testing. However, explosive torpedo testing would be conducted greater than 50 NM off the coast of Washington, outside of U&A fishing grounds. Explosive mine-countermeasure and neutralization testing would occur outside the Olympic Coast National Marine Sanctuary, at least 3 NM or greater from the shore in the Quinault Range Site and at least 12 NM or greater elsewhere in the Offshore Area.

Testing events using aircraft in the Offshore Area under Alternative 1 would not affect access to U&A fishing grounds. As part of the consultation effort during preparation of the 2015 NWTT Final EIS/OEIS, the Navy engaged in consultation with tribes that have U&A fishing grounds that overlap the Quinault Range Site to exchange range and fishing schedule information to de-conflict schedules where possible. This exchange of schedule information continues to occur.

Under Alternative 1, some new activities would occur in the Inland Waters portion of the Study Area such as at-sea sonar testing and non-explosive mine countermeasure and neutralization (see Tables 2.5-2 and 2.5-3). When required to accomplish a test safely and efficiently, the Navy may restrict marine traffic and request the USCG to issue notices to mariners (NTMs). Restrictions placed on marine traffic during testing activities in Inland Waters under the Alternative 1 could temporarily impede tribal access to portions of their U&A fishing grounds. Although these restrictions would temporarily impact U&A fishing grounds, information exchange between the tribes and Navy currently helps to ensure schedules are de-conflicted where possible, and they will continue to coordinate to de-conflict schedules where possible.

The Western Behm Canal is within the Ketchikan Nonsubsistence Use Area (Alaska Department of Fish and Game, 2011; Alaska Department of Fish and Game Division of Subsistence, 1992). The designation as a Nonsubsistence Use Area recognized that the location was not used for subsistence activities, including the hunting of seals and sea otters, by Alaska Natives (Alaska Department of Fish and Game Division of Subsistence, 1992). The renewal of that original designation in 2011 (Alaska Department of Fish and Game Division of Subsistence, 2011) reaffirmed that there was no subsistence use of resources in the Western Behm Canal by both Alaska Native and non-Native fishermen or hunters. Because traditional resources in the Western Behm Canal were not fished, harvested, or hunted and are now not available for subsistence uses by Alaska Native tribes, no impact on Alaska Native accessibility to traditional fishing areas would occur as a result of Navy's testing activities. Additionally, there would be no injury or mortality to fish or marine mammals resulting from Navy activities in Western Behm Canal and thus there would be no impact to use of these resources by Alaska Natives in subsistence harvest. No concern regarding tribal fisheries or the tribes' ability to harvest harbor seal was mentioned during a face-to-face meeting. No responses from the tribes have been received to the Navy's correspondence on the availability of marine mammals for subsistence use.

3.11.2.1.1.2 Impacts from Impeding Access to Usual and Accustomed Fishing Grounds or Traditional Fishing Areas Under Alternative 2

Impacts from Impeding Access to U&A Fishing Grounds or Traditional Fishing Areas Under Alternative 2 for Training Activities

Under Alternative 2, the number of proposed training activities in the Offshore Area and Inland Waters would change from the number of activities proposed in the 2015 NWTT Final EIS/OEIS (see Table 2.5-1), and in some cases vary slightly from the number of activities proposed under Alternative 1. Given that the activities would be conducted in the same areas as described in the 2015 analysis, and that the number of training activities would not change significantly, the analysis and impact conclusions from the 2015 NWTT Final EIS/OEIS remains valid. Therefore, Navy training activities in the Offshore Area under Alternative 2 are not likely to impede access to U&A fishing grounds except in rare instances where a vessel attempts to enter an established safety zone during ongoing activities or if it approaches too close to a Navy vessel (33 CFR 165).

Impacts on U&A access in the Inland Waters as a result of the training activities under Alternative 2 would be the same as described under Alternative 1.

Impacts from Impeding Access to U&A Fishing Grounds or Traditional Fishing Areas Under Alternative 2 for Testing Activities

Under Alternative 2, the number of proposed testing activities in the Offshore Area, Inland Waters, and Western Behm Canal would change from the number of activities proposed in the 2015 NWTT Final EIS/OEIS (see Table 2.5-2 and Table 2.5-3), but would not change from the number of activities proposed under Alternative 1. Given that the activities would be conducted in the same areas as described in the 2015 analysis, and that the number of training activities would not change significantly, the analysis and impact conclusions from the 2015 NWTT Final EIS/OEIS remains valid.

Impacts on U&A access in the Offshore Area, Inland Waters, and Western Behm Canal as a result of testing activities under Alternative 2 would be the same as described under Alternative 1.

3.11.2.1.1.3 Impacts from Impeding Access to Usual and Accustomed Fishing Grounds or Traditional Fishing Areas Under the No Action Alternative

Under the No Action Alternative, the Navy would not conduct proposed at-sea training and testing activities in the Study Area. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Impeding access to U&A fishing grounds or traditional fishing areas by Navy training and testing activities would not occur in the Offshore Area, Inland Waters, or Western Behm Canal. Therefore, existing U&A fishing grounds or traditional fishing area access would either remain unchanged or would improve slightly after cessation of ongoing at-sea training and testing activities.

3.11.2.2 Changes in the Availability of Marine Resources or Habitat

3.11.2.2.1 Impacts from Changes in the Availability of Marine Resources or Habitat

As described in the 2015 NWTT Final EIS/OEIS, the availability and health of marine resources is a concern for tribes with U&A fishing grounds in the Study Area, as well as those with U&A fishing grounds in inland areas outside the Study Area. In many cases, the main traditional resources harvested in these inland U&A fishing grounds are species such as shellfish, salmon, steelhead, or sturgeon that complete a portion of their life-cycle in marine environments. The availability of harvested traditional resource species could be affected if training and testing activities resulted in the following issues:

- A measurable reduction in a population or stock caused by direct impacts such as mortality or indirect impacts on water quality and habitat.
- Bioaccumulation of contaminates to levels where fish or shellfish would be unhealthy to consume.
- Mobile species avoiding U&A fishing grounds or altering their migratory patterns in response to disturbances.

When resource population levels dip, it becomes more likely that the tribal and state co-managers will close a fishery to harvest, reduce the duration of open seasons, or reduce the catch quota. Furthermore, when there is less fish, more effort and time must be expended to catch the same number of fishes. Where fish populations are low, greater effort means more commercial fishermen may give up fishing as their main source of income.

Impacts from Changes in the Availability of Marine Resources or Habitat Under Alternative 1, Alternative 2, and the No Action Alternative for Training and Testing

In this Supplemental, the Navy has analyzed potential impacts of Alternative 1, Alternative 2, and the No Action Alternative on resources harvested by tribes and Alaska Natives and associated habitat in the following sections of this Supplemental: 3.1 (Sediments and Water Quality), 3.3 (Marine Habitats), 3.4 (Marine Mammals), 3.7 (Marine Vegetation), 3.8 (Marine Invertebrates), and 3.9 (Fishes). Based on the analyses in these sections, the Proposed Action in the NWTT Inland and Offshore portions of the Study Area could directly affect individuals of some species of fish harvested by tribes, including mortality in a relatively small number of individuals. However, there would be no population- or stock-level impacts and there would be no measurable change in availability. Impacts on water quality and habitat would be localized and negligible, and would not be expected to affect availability of resources for harvest by tribes and Alaska Natives. The Proposed Action is not expected to contribute to bioaccumulation in fish and shellfish species harvested by the tribes based on the types and quantities of potential contaminates released and their fate and transport in the environment. Disturbances associated with the Proposed Action would be intermittent, of short duration, and widely dispersed, and are not expected to cause harvested species to avoid U&A fishing grounds or alter their migratory patterns.

Chapter 5 (Mitigation) describes protective measures the Navy implements within the Study Area. Although some of the measures specifically address species listed under the Endangered Species Act, many of them would also benefit species harvested by tribes and Alaska Natives.

The Proposed Action is not expected to have a measurable effect on the availability of marine resources for harvest by tribes or Alaska Natives given there is no mortality or injury to any marine resources expected from testing activities in Western Behm Canal, and that the Ketchikan Nonsubsistence Use Area surrounding the Southeast Alaska Acoustic Measurement Facility and the Western Behm Canal is not a place where subsistence use or subsistence harvest occurs (Alaska Department of Fish and Game, 2011).

3.11.2.3 Loss of Fishing Gear

3.11.2.3.1 Impacts from Loss of Fishing Gear

As discussed in Section 3.11.2.1 (Impeding Access to Usual and Accustomed Fishing Grounds or Traditional Fishing Areas), tribal fishing activities and Navy training and testing activities occur in co-use areas in the Inland Waters portion of the Study Area and in portions of the Offshore Area located off the coast of Washington. Consequently, the potential exists for interactions between naval vessels and equipment and tribal fishing gear. Loss or damage to gear is a concern for tribal fishermen because it can result in lost fishing opportunities and increase the cost of fishing, which could ultimately reduce harvest and income.

The 2015 NWTT Final EIS/OEIS describes the types of fishing gear used in the Study Area, and states that any gear that is designed to be fished unattended, either in the water column or on the bottom (e.g., gillnets, longlines, pots), would be most susceptible to snagging by a vessel or mobile in-water device. However, tribal fishermen mark their gear in accordance with fishing regulations and the Navy uses standard navigational practices to avoid potential interactions with fixed gear. In addition, the Navy would coordinate with the USCG to issue NTMs that advise Tribal Fisheries Enforcement Officers on locations of planned training and testing activities when the activity would involve a potential hazard to navigation. Activities based from a range craft with full maneuverability would not require an NTM. Interactions between mobile fishing gear such as a trawl (i.e., a net towed by a vessel along the bottom or in the water column) and naval vessels is unlikely because the vessels involved would avoid each other. Interactions between mobile gear and a fixed in-water device such as testing equipment would also be unlikely because fixed devices would be clearly marked on the surface with a buoy. These practices have not changed; therefore, the conclusions from the 2015 NWTT Final EIS/OEIS remain valid.

As discussed in the 2015 NWTT Final EIS/OEIS, mobile fish gear located on or near the bottom could encounter military expended materials that the Navy would be unable to recover. These items are typically small, constructed of soft materials (such as target cardboard boxes or tethered target balloons), or intentionally designed to sink to the bottom after serving their purpose (e.g., sonobuoys), so they would not represent an entanglement risk to fishing gear. Military expended materials used in the Study Area have not changed; therefore, the conclusions from the 2015 NWTT Final EIS/OEIS analysis remain valid.

As discussed in Section 3.11.1.1 (Government-to-Government Consultation) of this Supplemental, the Navy and several tribes with U&A fishing grounds in the Study Area engaged in ongoing government-to-government consultation. The potential for interactions between tribal fishing gear and naval vessels and equipment is a topic of mutual interest addressed through the consultation process. As discussed in Section 3.11.2.1 (Impeding Access to U&A Fishing Grounds or Traditional Fishing Areas), several tribes and the Navy have implemented or are continuing formal communication procedures to de-conflict schedules where possible. These communications, in addition to standard NTMs issued by USCG, help to avoid and minimize the potential for lost or damaged tribal fishing gear associated with Navy training and testing activities. Any claims for loss or damage to fishing gear related to Navy activities are addressed through the Navy's claims adjudication process[1].

3.11.2.3.1.1 Impacts from Loss of Fishing Gear Under Alternative 1

<u>Impacts from Loss of Fishing Gear Under Alternative 1 for Training Activities</u>

The Navy normally has the ability to avoid areas that are actively being used by other vessels, which reduces the potential to encounter and damage fishing gear in the Offshore Area. The amount of some military expended material items would increase and some would decrease under Alternative 1, although not by a significant amount, and not with materials that are large enough to cause a loss of fishing gear (see Table 2.5-1). Therefore, as discussed and concluded in the 2015 NWTT Final EIS/OEIS, tribal fishermen using bottom trawls may encounter these materials, but the probability would remain low. Damage to fishing gear from Navy training activities in the Offshore Area would be rare under Alternative 1.

In the Inland Waters, loss or damage to tribal fishing gear could reduce fishing opportunities while the gear is being replaced or repaired, and could increase the amount of effort and resources required to catch the same amount of fish. The USCG Maritime Force Protection Unit would continue to provide notification of locations of planned training activities to Tribal Fisheries Enforcement Officers. Information exchange between the tribes and the Navy helps ensure schedules are de-conflicted when possible.

[1] Information on admiralty claims can be found at the Navy Judge Advocate General's Corps website: http://www.jag.navy.mil/organization/code_11.htm.

<u>**Impacts from Loss of Fishing Gear Under Alternative 1 for Testing Activities**</u>

As discussed under training activities, the Navy normally has the ability to avoid areas that are actively being used by other vessels, which reduces the potential to encounter and damage fishing gear in the Offshore Area. The number of some military expended material would increase under Alternative 1, however in some cases military expended materials from testing activities would decrease. Therefore, as discussed and concluded in the 2015 NWTT Final EIS/OEIS, tribal fishermen using bottom trawls may encounter these materials, but the probability would remain low. Damage to fishing gear from Navy testing activities in the Offshore Area would be rare under Alternative 1.

Under Alternative 1, the Navy is retaining the Carr Inlet Operating Area (OPAREA) and infrequent operational and acoustic research studies could be conducted in the area under Alternative 1. As discussed in the 2015 NWTT Final EIS/OEIS, the nature of activity and the in-water infrastructure at Carr Inlet OPAREA has changed since the dis-establishment of the shore lab in 2009. Fixed buoys and hydrophones are no longer in place. Use of this area under Alternative 1 may include temporary placement of underwater testing devices. Appropriate safety procedures and temporary marine traffic restrictions would be used to avoid interactions with fishing gear. Notifications would continue to be published in local newspapers and in the local USCG NTM if the Navy plans testing activities in the Carr Inlet OPAREA. The Navy would coordinate with the USCG to issue NTMs that advise Tribal Fisheries Enforcement Officers on locations of planned testing activities when the activity would involve a potential hazard to navigation. Activities based from a range craft with full maneuverability would not require an NTM. Information exchange between the tribes and the Navy helps ensure schedules are de-conflicted when possible.

Pierside sonar and acoustic testing would be performed under Alternative 1 at Naval Base Kitsap Bremerton in Sinclair Inlet, Naval Base Kitsap Bangor Waterfront in Hood Canal, and Naval Station Everett. Existing security restrictions prevent unapproved access at Navy pierside locations; therefore, fishing gear would not be affected by these activities.

As discussed in the 2015 NWTT Final EIS/OEIS, most of the materials and items used during testing are recovered after use in the Inland Waters. Military expended materials could present a risk to fishing gear located on the bottom, but the probability of encountering these items would be low. Standard procedures used to ensure safety, security, and testing data integrity; and procedures for communicating with tribes that have U&A fishing grounds in testing areas would continue to be implemented under Alternative 1 and would minimize the risk of fishing gear damage. Implementing these procedures would make damage to fishing gear from Navy testing activities in Inland Waters rare under Alternative 1.

The Western Behm Canal is within the Ketchikan Nonsubsistence Use Area (Alaska Department of Fish and Game, 2011), which has been identified as a place where subsistence uses of resources in the Western Behm Canal by both Alaska Native and non-Native fishermen does not occur. Because the Western Behm Canal is a Nonsubsistence Use Area, loss or damage to Alaska Native fishing equipment would not occur as a result of testing activities resulting in vessel or in-water device strikes. No testing activities resulting in the settling of military expended materials occur in the Western Behm Canal.

3.11.2.3.1.2 Impacts from Loss of Fishing Gear Under Alternative 2

<u>**Impacts from Loss of Fishing Gear Under Alternative 2 for Training Activities**</u>

Under Alternative 2, the number of proposed training activities in the Offshore Area and Inland Waters would change from the number of activities proposed in the 2015 NWTT Final EIS/OEIS (see Table 2.5-1), and in some cases vary slightly from the number of activities proposed under Alternative 1. Given that the activities would be conducted in the same areas as described in the 2015 analysis, and that the number of training activities would not change significantly, the analysis and impact conclusions from the 2015 NWTT Final EIS/OEIS remains valid. Therefore, the analysis presented for training activities in the Offshore Area under Alternative 1 also applies to Alternative 2. Damage to fishing gear from Navy training activities in the Offshore Area would be rare under Alternative 2.

Training activities under Alternative 2 would be the same for the Inland Waters as described in the Offshore Area (see Table 2.5-1). Therefore, the analysis presented for training activities in Inland Water under Alternative 1 also applies to Alternative 2. The USCG Maritime Force Protection Unit would provide notification of the location of planned training events to Tribal Fisheries Enforcement Officers. Information exchange between the tribes and the Navy helps ensure schedules are de-conflicted when possible.

Impacts from Loss of Fishing Gear Under Alternative 2 for Testing Activities

Under Alternative 2, the number of proposed testing activities in the Offshore Area, Inland Waters, and Western Behm Canal would change from the number of activities proposed in the 2015 NWTT Final EIS/OEIS (see Tables 2.5-2 and 2.5-3), and in some cases vary slightly from the number of activities proposed under Alternative 1. In the Offshore Area, as discussed for Alternative 1, the change in testing activity is not expected to increase damage to fishing gear and the testing of explosive torpedoes would be conducted greater than 50 NM off the coast of Washington, outside of U&A fishing grounds. The Navy normally has the ability to avoid areas that are actively being used by other vessels, which reduces the potential to encounter and damage fishing gear in the Offshore Area. Under Alternative 2, the number of military expended material items, including sonobuoys, chaff, and flares, would not change significantly from Alternative 1. Therefore, as discussed and concluded in the 2015 NWTT Final EIS/OEIS, tribal fishermen using bottom trawls may encounter these materials, but the probability would remain low. Damage to fishing gear from Navy testing activities in the Offshore Area would be rare under Alternative 2.

In the Inland Waters, use of the Carr Inlet OPAREA may include temporary placement of underwater testing devices. Appropriate safety procedures and temporary marine traffic restrictions would be used to avoid interactions with fishing gear. Existing security restrictions prevent unapproved access at Navy pierside locations; therefore, fishing gear would not be affected by these activities. Military expended materials could present a risk to gear used to fish on the bottom due to snagging of fishing line, snagging of nets, or tangling of other bottom traps. The probability of encountering military expended materials that would impact fishing gear would be low. Standard procedures used to ensure safety, security, and testing data integrity; and procedures for communicating with tribes that have U&A fishing grounds in testing areas would continue to be implemented under Alternative 2 and would minimize the risk of fishing gear damage. Damage to fishing gear from Navy testing activities in Inland Waters is expected to be rare under Alternative 2.

Testing activities under Alternative 2 would remain the same as discussed under Alternative 1 in the Western Behm Canal and therefore would have no impact on loss of fishing gear in the area under Alternative 2.

3.11.2.3.1.3 Impacts from Loss of Fishing Gear Under the No Action Alternative

Under the No Action Alternative, the Navy would not conduct proposed at-sea training and testing activities in the Study Area. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Loss of fishing gear due to Navy activities would not occur in the Offshore Area, Inland Waters, or Western Behm Canal. Military expended materials may still remain in the water column or on the bottom of the seafloor in the Offshore Area, Inland Waters, or Western Behm Canal after cessation of training and testing at-sea activities, but cessation would not measurably improve the condition of the environment throughout the Study Area because the impacts are so minimal under Alternatives 1 or 2. Therefore, American Indian and Alaska Natives fishing gear retention rates would either remain unchanged or would improve slightly after cessation of ongoing at-sea training and testing activities.

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3.12 Socioeconomic Resources and Environmental Justice

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3.12 Socioeconomic Resources and Environmental Justice

3.12.1 Introduction and Methods

The purpose of this section is to supplement the analysis of impacts on socioeconomic resources presented in the 2015 Northwest Training and Testing (NWTT) Final Environmental Impact Statement (EIS)/Overseas EIS (OEIS) with new information relevant to proposed changes in training and testing activities conducted at sea. Information presented in the 2015 NWTT Final EIS/OEIS that remains valid is noted as such and referenced to the appropriate sections. Any new or updated information describing the affected environment and analysis of impacts on socioeconomic resources associated with the Proposed Action is provided in this section.

The alternatives were also reviewed for any disproportionately high and adverse effects on any minority populations and low-income populations in accordance with Executive Order (EO) 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*. This EO requires each federal agency to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States and its territories and possessions. An analysis of environmental justice should also include an analysis of effects from the proposed action on children as described in EO 13045, *Protection of Children From Environmental Health Risks and Safety Risks*. EO 13045 requires that federal agencies prioritize assessing environmental health risks and safety risks that may disproportionately impact children. The Council on Environmental Quality has emphasized the importance of incorporating environmental justice review in the analyses conducted by federal agencies under NEPA and of developing protective measures, as appropriate for the action, that reduce or avoid disproportionate environmental effects on minority and low-income populations and the health and safety of children.

3.12.2 Affected Environment

The socioeconomic resources analyzed in this Supplemental EIS/OEIS (Supplemental) are the same as the resources identified and analyzed in the 2015 NWTT Final EIS/OEIS. The training and testing activities described in Chapter 2 (Description of Proposed Action and Alternatives) of this Supplemental are generally consistent with the training and testing activities analyzed in the 2015 NWTT Final EIS/OEIS and are representative of activities that the Department of Defense has been conducting in the NWTT Study Area for decades.

The concerns over socioeconomic resources raised by the public and how those resources may be impacted by the proposed training and testing activities are similar to concerns previously raised in the 2015 NWTT Final EIS/OEIS. The United States (U.S.) Navy's operating procedures to avoid or lessen impacts on local socioeconomic resources, as described in the 2015 NWTT Final EIS/OEIS, remain applicable and will continue to be implemented.

As described in detail in the 2015 NWTT Final EIS/OEIS, the socioeconomic analysis evaluated how elements of the human environment might be affected by ongoing and proposed training and testing activities in the Study Area. The Navy identified three broad socioeconomic elements, based on their association with human activities and livelihoods in the Study Area:

- commercial transportation and shipping (Section 3.12.2.1)
- commercial and recreational fishing (Section 3.12.2.2)

  - usual and accustomed fishing by Pacific Northwest American Indian tribes and nations and Alaska Natives is analyzed in Section 3.11 (American Indian and Alaska Native Traditional Resources)

- tourism and recreation (Section 3.12.2.3)

Each of these resources is an aspect of the human environment that involves economics (e.g., employment, income, or revenue) and social conditions (e.g., enjoyment and quality of life) in the Study Area. These three elements were chosen as the focus of the analysis in this section because of their importance to the local economy and the way of life in the region, and the potential for these elements to be impacted by the proposed training and testing activities.

The analysis of environmental justice in the 2015 NWTT Final EIS/OEIS was expanded upon in this Supplemental EIS/OEIS to address concerns expressed by the public on the potential for some training and testing activities to disproportionately impact vulnerable populations.

Data and information from government technical documents and reports, scientific journals, and state and federal agency databases were reviewed to assess any changes in the socioeconomic environment from conditions described in the 2015 NWTT Final EIS/OEIS. Based on this review, and as summarized in this section with the support of updated information, socioeconomic resources in the marine environment and adjacent land areas have not changed appreciably since 2015.

A complete description of the extent of the Study Area, including special use airspace, sea space, and pierside and inland facilities, is provided in Section 2.1 (Description of the Northwest Training and Testing Study Area). Briefly, training and testing activities proposed in this Supplemental would occur in one or more of these three Study Area subdivisions:

- Offshore Area (Pacific Northwest Operations Area, including the surf zone at Pacific Beach and the Olympic Military Operations Area [MOA])
- Inland Waters (Washington State inland waters)
- Western Behm Canal (Southeast Alaska Acoustic Measurement Facility [SEAFAC])

There are over 192,000 Sailors, Marines, civil servants, military retirees, and their family members who live and work in the Pacific Northwest. Washington State's second-largest employment sector is defense, with $12.7 billion in spending each year. The immediate and surrounding communities in which Navy personnel live and work benefit from over $7.6 billion being added to the economy each year, along with the Navy's life-saving mutual aid for emergency response and search and rescue capabilities.

Navy leadership and the regional environmental team are actively involved in community partnerships in the Pacific Northwest and Alaska in a number of ways. For example, Navy personnel provide support for search and rescue operations, fire protection and response services, medical transportation, and humanitarian assistance and disaster relief. A number of the training and testing activities proposed in this Supplemental support these operations. Strategic engagement efforts within communities allow the Navy to strengthen relationships with federal, state, and local agencies; tribes; and non-governmental organizations.

3.12.2.1 Commercial Transportation and Shipping

The Navy conducts training and testing activities in areas where commercial transportation and shipping also occurs. Notifications of potentially hazardous military activities are communicated to all vessels and operators by use of Notices to Mariners (NTMs), issued by the United States Coast Guard (USCG), and Notices to Airmen (NOTAMs), issued by the Federal Aviation Administration (FAA).

Following a review of recent literature, including government technical documents, reports, and scientific journals, the information presented on ocean traffic in the Study Area, as described in the 2015 NWTT Final EIS/OEIS, has not appreciably changed.

3.12.2.1.1 Ocean Traffic

Commercial shipping is a significant component of the regional economy. Commercial goods are transported through the Offshore Area to the major international ports of Seattle, WA; Tacoma, WA; and Portland, OR, as well to smaller domestic ports in Washington's inland waters. The maritime Port of Seattle-Tacoma (combining the trade at the two ports) was the nation's sixth-highest ranked port (out of 150) by value of internationally traded cargo (imports + exports) in 2017. Goods valued at nearly $83 billion passed through the combined port (American Association of Port Authorities, 2018). The Port of Seattle-Tacoma was ranked 11th nationally by cargo tonnage (foreign + domestic) in 2017, processing over 48 million metric tons of goods; this amounted to a decrease of 2.4 percent compared to the 2016 total but was 8 percent greater than the 2015 total (American Association of Port Authorities, 2018; U.S. Army Corps of Engineers, 2018b). The Port of Seattle-Tacoma specializes in international trade, but it also contributes significantly to the national economy through domestic trade, handling 10 million tons of goods in 2017 (U.S. Army Corps of Engineers, 2018b). Much of the domestic trade is with Alaska and Hawaii, making the port a key link between the country's two most remote states and the contiguous United States. Separately, the two ports were ranked 29th and 32nd, respectively, for total trade (foreign and domestic) by volume (tons) in 2017. Combined, the two ports ranked 14th in total trade (by volume).

Since 2013, international trade at the ports of Seattle and Tacoma has ranged between 33 and 39 million metric tons per year, and the volume of domestic trade has remained relatively consistent at 10 million tons per year (Figure 3.12-1) (U.S. Army Corps of Engineers, 2018b). Farther to the south, the Port of Portland was ranked 33rd in total trade (foreign and domestic) by volume, handling over 23 million metric tons of goods in 2017. The Port of Portland supports more domestic trade than either of the ports of Seattle or Tacoma (U.S. Army Corps of Engineers, 2018b).

Together, the ports of Tacoma and Seattle had nearly 1,950 port calls in 2017, approximately 95 percent by vessels transporting 20-foot equivalent units (i.e., containers) (The Northwest Seaport Alliance, 2019). Over 3.7 million containers combined passed through the two ports. The Port of Portland received just 11 port calls from container vessels in 2015 but 277 port calls from vessels transporting dry bulk goods. Due to a labor dispute, just 46 containers were handled at the Port of Portland in 2017, down from over 130,000 just three years prior (Wilson, 2017). The active commercial shipping industry at these three major U.S. international ports has a direct economic impact on numerous businesses and jobs that support the shipping industry, from dock workers to trucking companies, and, indirectly, smaller businesses in the food and retail sector. In 2017, the ports of Seattle and Tacoma supported over 58,000 jobs, including over 20,000 direct jobs; and generated over $12 billion in business revenue ($5.9 billion direct) and $1.9 billion in personal income. The average annual wage for direct jobs was $95,000. In addition, the ports generated over $136 million in various taxes for the State of Washington (The Northwest Seaport Alliance, 2019).

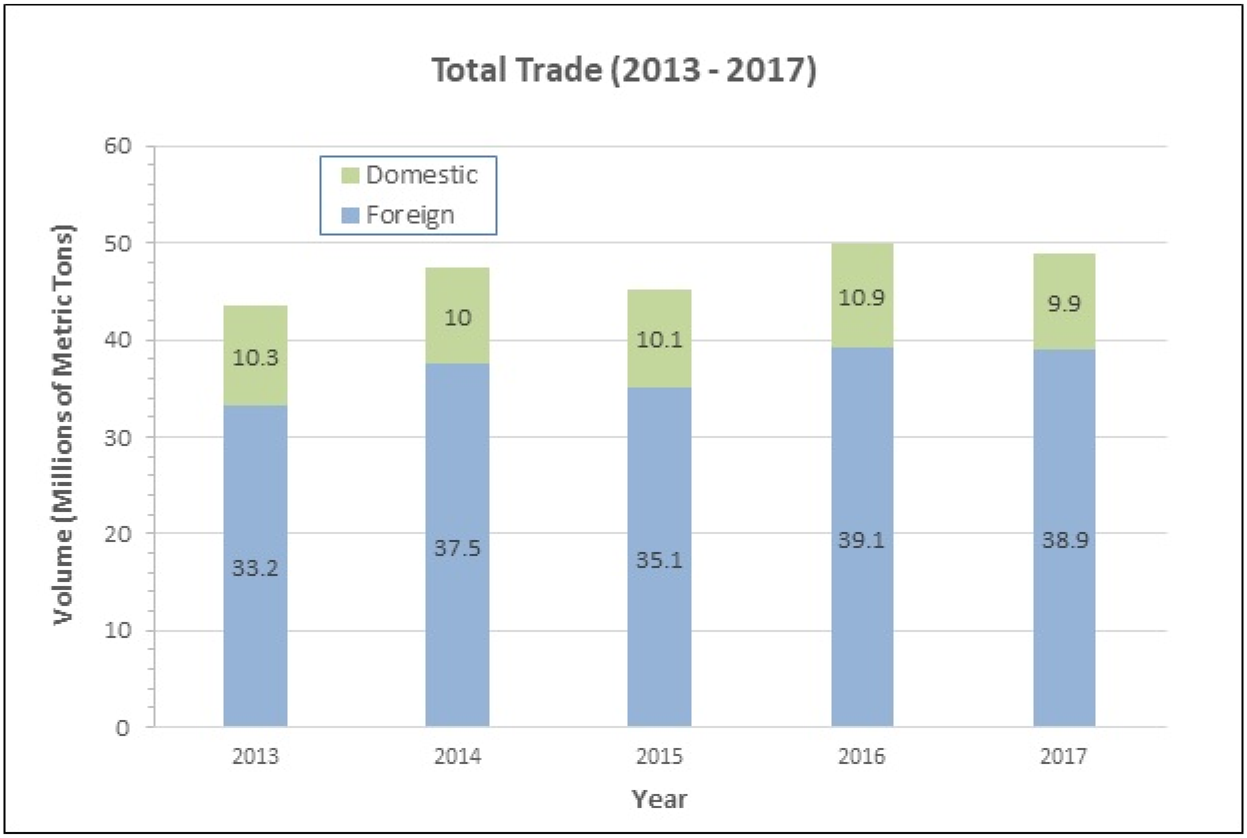

Figure 3.12-1: Total Waterborne Trade (Foreign and Domestic) at the Port of Seattle-Tacoma from 2013 to 2017

A port call, the metric commonly used by commercial ports to evaluate port operations, is equivalent to two vessel transits (one inbound and one outbound). Vessel transits are a more relevant metric for assessing potential interactions between commercial shipping and the proposed training and testing activities. Nearly 1,950 vessels called at the ports of Tacoma and Seattle combined in 2017, and 500 called at the Port of Portland in 2015 (the most recent data available) (The Northwest Seaport Alliance, 2019; U.S. Maritime Administration, 2016). Considering only these three major ports, approximately 4,900 vessels transits of large commercial vessels would be expected annually in the Study Area.

Refer to Section 3.12.2.1.1 (Commercial Shipping) in the 2015 Final NWTT EIS/OEIS for additional information on the economic contributions of commercial shipping at the ports of Seattle, Tacoma, and Portland to the region.

3.12.2.1.1.1 Offshore Area

Most vessels entering or leaving ports in Washington, Oregon, and Northern California travel northwest, southwest, or south through the Study Area without incident or delay. Shipping to and from the south typically follows the coastline. Smaller vessels may travel within 3 or 12 nautical miles (NM) from shore and remain shoreward of the Study Area, but larger commercial shipping vessels typically remain farther from shore (Figure 3.12-2).

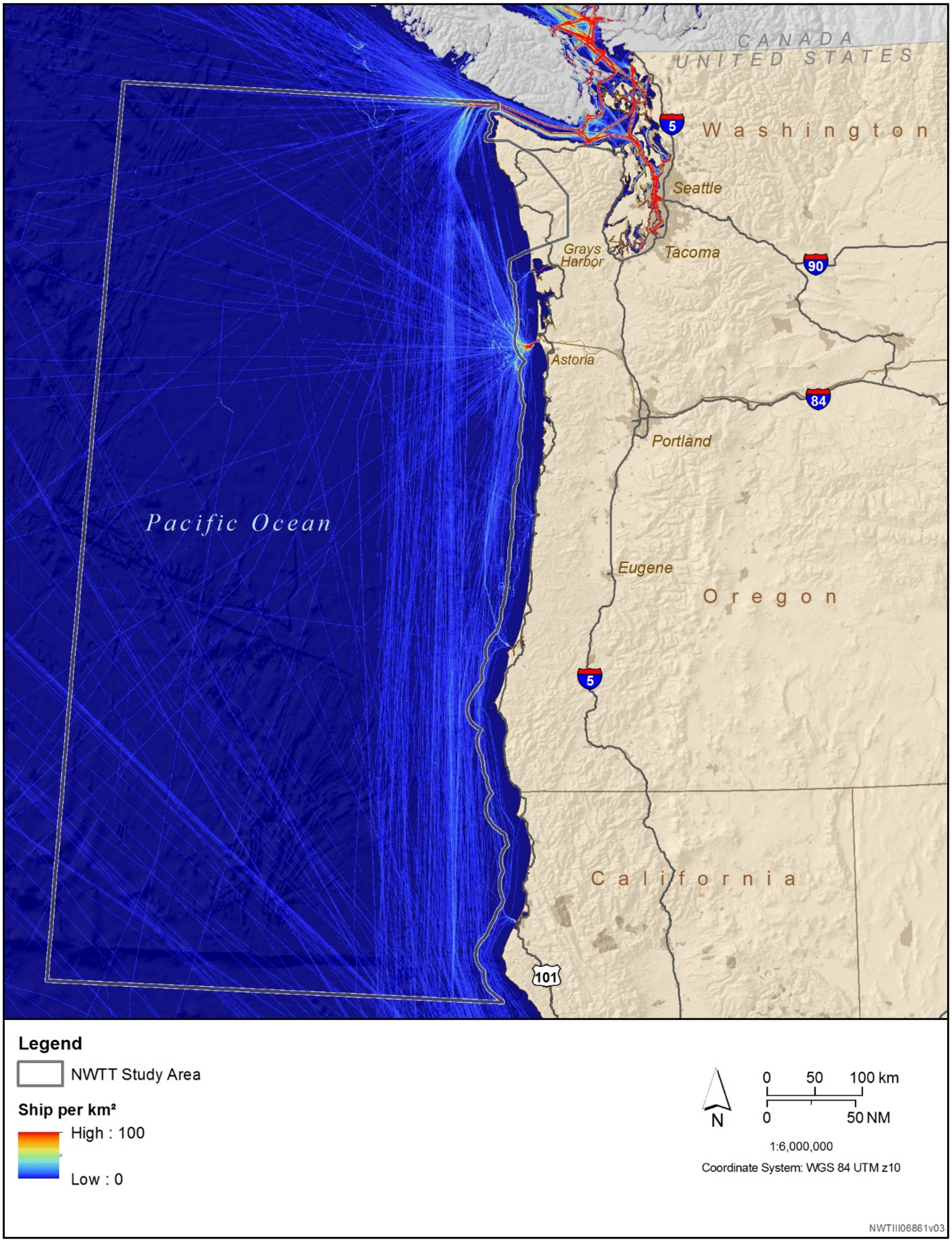

Figure 3.12-2: Relative Density of Vessel Traffic Along Shipping Routes in the Offshore Area

Ships traveling overseas between ports in the Study Area, Hawaii, Alaska, and the Far East typically travel via the most direct route or the great circle route. Vessel tracks depicted in Figure 3.12-2 are primarily from larger commercial vessels (e.g., container ships, oil tankers); however, some tracks may represent smaller vessels that are broadcasting location information via the Automatic Identification System (National Oceanic and Atmospheric Administration, 2015).

3.12.2.1.1.2 Inland Waters

There are six smaller ports in Inland Waters portion of the Study Area, five of which were ranked by the U.S. Army Corps of Engineers in 2017 to be in the top 150 U.S. ports by cargo volume (Table 3.12-1). The Port of Vancouver is not in the Study Area and is not a U.S. port, but data on the port are included to show that the majority of commercial vessel transits through the Strait of Juan de Fuca transit north to Vancouver rather than south into the Inland Waters. In addition to transferring cargo, these smaller ports are used by other commercial vessels, such as ferries that transport people and vehicles across Puget Sound, and whale-watching vessels that take passengers on excursions into Puget Sound and surrounding waters. These activities have been co-occurring with military activities with minimal interactions for years.

Table 3.12-1: Ports in the Inland Waters Portion of the Study Area Ranked by Cargo Volume in 2017

Port	Rank	Cargo Volume (tons)	Vessel Transits[2]
Anacortes	51	9,212,192	410
Grays Harbor	105	2,303,154	168
Everett	127	1,590,855	236
Olympia	141	1,089,375	Not Available
Port Angeles	147	773,840	488
Cherry Point	NR	Not Available	518
Vancouver, Canada[1]	NR	138,082,585	6,290

[1]If ranked as a U.S. port, Vancouver, Canada would have ranked third in total trade by volume.
[2]Vessel transit data are for the year 2015.
Source: (U.S. Army Corps of Engineers, 2018a); U.S. Maritime Administration (2016); Vancouver Fraser Port Authority (2017); NR = Not Ranked

Over 1,300 port calls at smaller ports in the Inland Waters portion of the Study Area occurred in 2015 (U.S. Maritime Administration, 2016). Assuming each port call is equivalent to two vessel transits, over 2,600 vessel transits were handled by those ports in 2015 (Table 3.12-1). Vessels accessing the ports of Seattle and Tacoma also transit through the Inland Waters portion of the Study area. As noted in Section 3.12.2.1.1 (Ocean Traffic), approximately 4,900 vessel transits to and from these two major ports would be expected annually based on data from 2017 (Seattle and Tacoma) and 2015 (Portland). Combined with totals from the smaller ports, over 6,000 vessel transits through the Inland Waters portion of the Study Area would be expected annually. The relative density of vessels in the Inland Waters portion of the Study Area is shown in Figure 3.12-3.

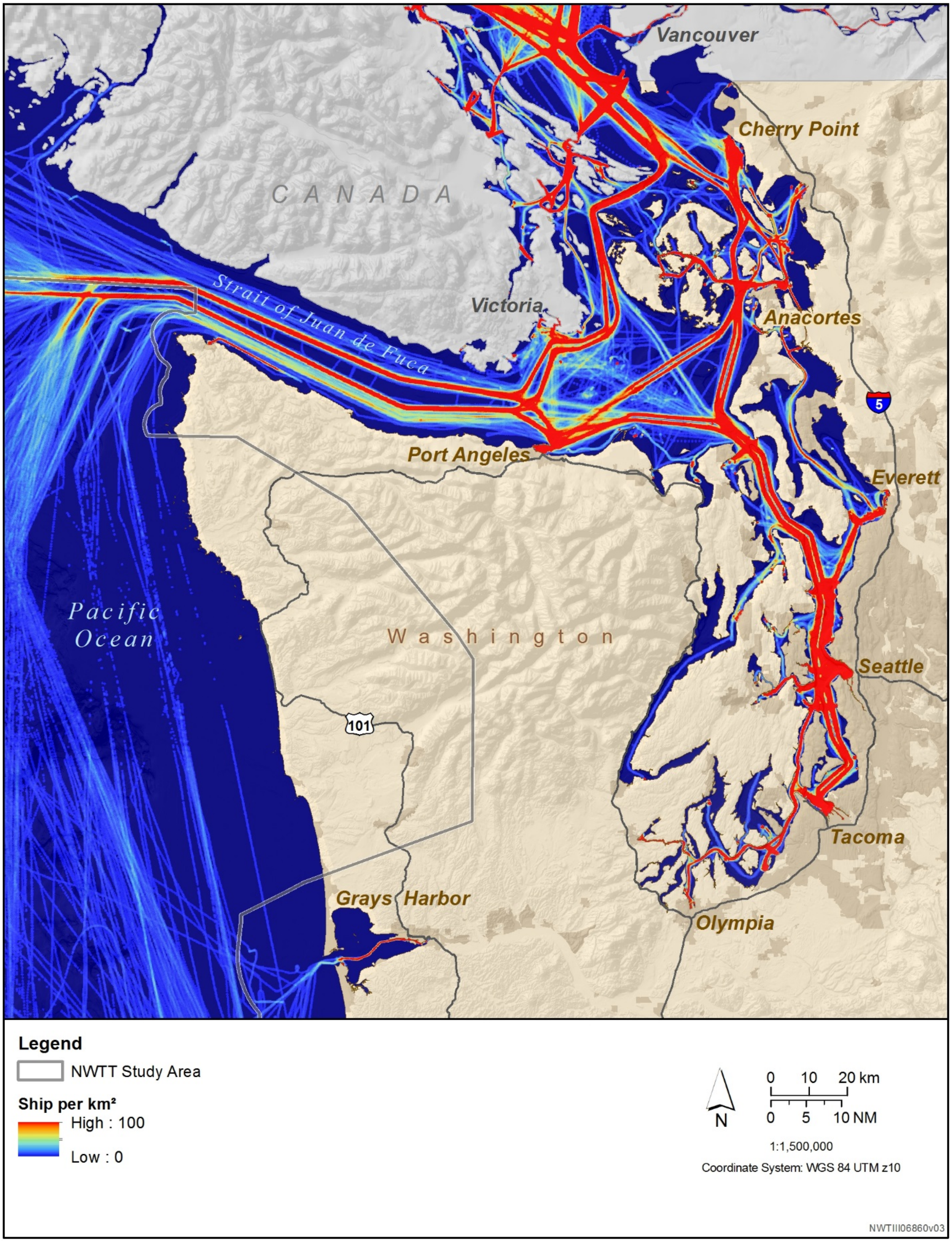

Figure 3.12-3: Relative Density of Vessel Traffic Along Shipping Routes in the Inland Waters Portion of the Study Area

The Port of Vancouver, Canada, is a major international commercial port, handling over 147 million tons of cargo and receiving 3,145 foreign vessels in 2018 (Vancouver Fraser Port Authority, 2019) (Table 3.12-1). Vessels accessing the port transit through the Strait of Juan de Fuca then head north navigating through the Haro Strait between Vancouver Island and the San Juan Islands. The Canadian port city of Victoria, located on the southern tip of Vancouver Island, is a popular cruise ship and tourist destination for international, including U.S., travelers. In 2018, 250 cruise ships carrying over 640,000 passengers visited Victoria (Greater Victoria Harbour Authority, 2019). The port also handles daily ferry traffic from Port Angeles and Seattle. With the exception of ferry transits from Seattle, vessel traffic associated with Canadian ports mainly occurs in the Strait of Juan de Fuca. The Washington State Department of Transportation operated 23 ferries along 10 routes throughout Puget Sound (equivalent to 200 miles of highway) (Washington State Department of Transportation, 2018). Combined, the ferries make nearly 450 transits between terminals daily and can operate 20 or more hours per day. On an annual basis, this equates to over 160,000 vessel transits made by ferries in the Inland Waters portion of the Study Area. The Washington State ferry system is the largest in the United States and fourth-largest in the world, and is valued at $4.8 billion (Washington State Department of Transportation, 2018).

Ocean Traffic Near Navy Ranges and Navy Vessels

The U.S. Navy makes up less than 1 percent of all vessel traffic in Puget Sound area waters. The USCG Vessel Traffic Service Puget Sound monitors maritime vessel traffic in the Strait of Juan de Fuca, Rosario Strait, Admiralty Inlet, and Puget Sound south to Olympia. In 2018, the USCG recorded 217,951 total vessel transits in these waters. Navy Region Northwest Port Operations collects data on the movements of Navy vessels transiting to and from the four Navy installations in the Inland Waters area as well as civilian ports, including the port of Seattle, used occasionally by Navy vessels. In 2018, there were 749 ship or submarine movements to and from these ports. Smaller Navy vessels are not tracked in the same way. To better estimate the movements of all Navy vessels, the Navy conservatively estimated movements of support or escort vessels that frequently accompany larger ships and submarines. After factoring in the movements of the smaller vessels, the estimate was rounded up to the nearest thousand to arrive at a very conservative estimate of 2,000 total vessel movements in 2018. As noted above, the Navy's 2,000 vessel movements are less than 1 percent of vessel movements recorded by the USCG in 2018.

The Keyport Range site, Dabob Bay Range Complex, Carr Inlet Operations Area, Navy 3 and Navy 7 Operation Areas, and several pierside facilities are all located within the Inland Waters portion of the Study Area (see Figure 2.2-3). The Navy limits or restricts access to certain areas (e.g., Crescent Harbor) to maintain the safety of the public and military personnel when potentially dangerous activities are being conducted (e.g., mine warfare training). Access to pierside locations is restricted at all times as required by security protocols.

Some activities proposed to occur in the Inland Waters would temporarily obstruct navigation through the area. These activities would be similar to activities analyzed in the 2015 NWTT Final EIS/OEIS, and limits on navigation would be of a similar nature. Mariners are notified of these activities in several ways (e.g., an NTM issued by the USCG), and those same notification procedures would continue. In addition, the USCG has published a final rule establishing protection zones extending 500 yards (yd.) around all Navy vessels in navigable waters of the United States and within the boundaries of the Coast Guard Pacific Area (33 Code of Federal Regulations [CFR] 165.2030 - Pacific Area). All vessels must proceed at a no-wake speed when within a protection zone. Non-military vessels are not permitted to enter an area within 100 yd. of a U.S. naval vessel, whether underway or moored, unless authorized by an official patrol.

Dabob Bay Range Complex and Hood Canal military operating areas are charted on navigational charts. When activities are occurring in Dabob Bay, the Navy will activate yellow, white, and red warning lights positioned at Sylopash Point, Pulali Point, Whitney Point, Zelatched Point, and the southeast end of Bolton Peninsula to notify non-military vessels of the status of the range. Yellow or alternating white and yellow lights indicate the following concerns:

- Non-military vessels should proceed with caution;
- Range activities are in progress, but no noise-sensitive acoustic measurement tests are in progress; or
- Vessels should be prepared to shut down engines when lights change to red.

Red or alternating white and red lights indicate the following concerns:

- Range activities involving critical measurements are in progress;
- Engines should be stopped until red beacons have been shut off, indicating the test is completed; and
- Advice of Navy personnel on guard boats should be followed when in or near the range site. Typically, boat passage is permitted between tests when the yellow beacons are operating.

Pierside sonar maintenance testing within the Study Area is conducted within the Puget Sound at Naval Base Kitsap Bremerton, Naval Base Kitsap Bangor Waterfront, and Naval Station Everett. Activities at these pierside locations are conducted in the established waterfront restricted areas for those installations. Additional information about restricted areas associated with these facilities, including access by the public, is provided in 33 CFR 334.1240 (Sinclair Inlet), 33 CFR 334.1220 (Hood Canal, Bangor), and 33 CFR 334.1215 (Port Gardner, Everett Naval Base).

3.12.2.1.1.3 Western Behm Canal, Alaska

The Port of Ketchikan is located approximately 10 miles south of Western Behm Canal and SEAFAC. Ketchikan is a commercial port and was ranked 145th out of 150 ports in total trade by cargo volume (tons) in 2015 (U.S. Army Corps of Engineers, 2016). The port transferred almost 1 million tons of cargo, over 90 percent in domestic trade, in 2015, indicating its importance to communities in southeast Alaska. Major commodities arriving at the port included oil and fuel, building products (e.g., wood and concrete), and groceries (U.S. Army Corps of Engineers, 2016). While salmon fishing remains an important industry in Ketchikan's economy, tourism and the passenger cruise industry are now the primary economic drivers. Over 1 million cruise ship passengers visited Ketchikan each year in 2017 and 2018. In both years, the port reported over 500 port calls by cruise vessels, all between April and September (Ketchikan Visitors Bureau, 2019). Western Behm Canal is not part of the route used by large vessels, including cruise ships, but small craft tourism traffic (e.g., sight-seeing and charter fishing) in the Canal is directly influenced by cruise ship port calls in Ketchikan. In addition, recreational and commercial fishing boats, as well as private transportation craft, use Western Behm Canal regularly.

Western Behm Canal includes five restricted areas (see Figure 2.2-4); the largest, Area 5, spans the width of the Canal and encompasses Areas 1, 2, and 3. During operations, the Navy can close the restricted areas to all vessel traffic. Typically, such closures do not exceed 20 minutes. Notices to

Mariners announcing restricted access have been issued on average 10 times per year; about 8–12 events occur annually that require restrictions on vessel traffic to ensure that the participant vessel (usually a submarine, which is out of the visual observation of small boat operators) has a clear sea space to navigate safely. Notices to Mariners usually extend for a period of four or five days, but limitations on vessel traffic typically last for 20 minutes and occur up to twice per hour. During these times, small vessels (30 feet [ft.] or less) transiting through Western Behm Canal are required to stay within 1,000 yds. of the shoreline, maintain a maximum speed of 5 knots, and be in radio contact with SEAFAC. The Navy uses the radio contact to ensure that all vessels comply with the navigation rules during these critical periods. On occasion, the engine of a transiting vessel may create noise that interferes with data collection during a test. When this occurs, SEAFAC may request that the vessel operator voluntarily turn off the engine during the period of data collection. Alternatively, SEAFAC may delay data collection until the vessel has cleared the area. When testing is not being conducted, vessel traffic is not restricted, but permanent restrictions on anchors, nets, towing, and dumping remain in force. Additional information on transiting the restricted areas in Western Behm Canal are provided in 33 CFR 334.1275 (West Arm Behm Canal, Ketchikan, Alaska, restricted areas) and summarized in Section 3.13 (Public Health and Safety).

The Navy conducts tests in the Western Behm Canal throughout the year. However, during the peak tourism and fishing season of May 1 through September 15, the Navy conducts acoustic measurement tests that require only transitory restrictions in Area 5 (see Figure 2.2-4) for a total of no more than 15 days. This timeframe is within the popular cruise ship season when visitation and recreational use of Western Behm Canal is highest. This is also the time when vessel traffic associated with commercial fishing is highest.

Public notification (e.g., NTMs) that the Navy will conduct operations in Western Behm Canal is given at least 72 hours in advance to the following Ketchikan contacts: USCG, Ketchikan Gateway Borough Planning Department, Harbor Master, Alaska Department of Fish and Game, KRBD radio, KTKN radio, and the Ketchikan Daily News.

3.12.2.1.2 Air Traffic

Air traffic refers to movements of aircraft through airspace. Safety and security factors dictate that use of airspace and control of air traffic be closely regulated. Accordingly, regulations applicable to all aircraft are promulgated by the FAA to define permissible uses of designated airspace and to control that use. These regulations are intended to accommodate the various categories of aviation, whether military, commercial, or general.

To better define and administer this process, the Federal Aviation Agency (the precursor to the FAA) was created in 1958 with the signing of the Federal Aviation Act and was given regulatory authority over all U.S. navigable airspace. The Federal Aviation Agency was renamed the FAA in 1967 with the establishment of the Department of Transportation. The FAA's primary responsibility is to issue and enforce regulations that ensure safe and efficient air transit throughout U.S. navigable airspace. The FAA has the regulatory authority to assign the use of airspace, including airspace used by military aircraft, and may revoke or otherwise modify airspace in the public interest (49 U.S.C. 40103 Sovereignty and Use of Airspace). The FAA defines the dimensions of controlled airspace (e.g., altitude range) and, in coordination with the Department of Defense, the FAA identifies and designates special use airspace needed by the military to safely conduct activities that may be hazardous to non-participating aircraft. The FAA's requirements for implementing environmental regulations under NEPA are outlined in FAA

Order 1050.1F (Environmental Impacts: Policies and Procedures). Significance thresholds for noise impacts are defined in the Order.

Common airways over the Study Area are depicted in Figure 3.12-4. A detailed description of special use airspace (military operating areas, restricted airspace, and warning areas) used by the military is provided in Chapter 2 (Description of Proposed Action and Alternatives).

3.12.2.1.2.1 Offshore Area

Air routes and airways in the Study Area are primarily managed by the Seattle Air Route Traffic Control Center located near the Seattle-Tacoma International Airport, the largest commercial airport in the region. The Seattle Terminal Radar Approach Control coordinates approach services for the Seattle-Tacoma International Airport and has over 450,000 operations per year for southern and central Puget Sound. Based on the available information, air traffic in the Offshore Area, as described in the 2015 Final NWTT EIS/OEIS, has not appreciably changed.

3.12.2.1.2.2 Inland Waters

The U.S. Navy makes up approximately 6.2 percent of all aircraft traffic in Washington State. The FAA Operations Network reported approximately 1.4 million flights in Washington State in 2018. In that same year, the Navy recorded approximately 88,000 flights at Naval Air Station (NAS) Whidbey Island, which equates to 6.2 percent of flights in Washington State. The FAA's data do not include the flights to and from British Columbia that also pass through airspace above Washington State, such that total air traffic traversing Washington State is likely higher, and the Navy's percent contribution to that total is lower. The Navy's flight data also include the dozens of search and rescue missions flown each year in support of the community.

The special use airspace in the Puget Sound portion of the Study Area consists of Restricted Area 6701 (R-6701) and Chinook MOAs (Figure 3.12-5). NAS Whidbey Approach Control, an FAA-certified control facility, not only provides service to military aircraft operating out of NAS Whidbey Island, it also provides approach control service for 18 outlying civilian and USCG airfields and 12 locations for the ambulance service Airlift Northwest. Prior to potentially hazardous training and testing activities involving aircraft, air traffic access restrictions are released to the aviation community through a NOTAM and broadcast on their Automated Terminal Information System. Based on the available information, air traffic in the Inland Waters portion of the Study Area (Figure 3.12-5), as described in the 2015 Final NWTT EIS/OEIS, has not appreciably changed.

3.12.2.1.2.3 Western Behm Canal, Alaska

Controlled airspace (Figure 3.12-4) similar to a temporary flight restriction exists over the SEAFAC area in Western Behm Canal during acoustic tests. SEAFAC currently issues an informal request to aircraft flying below 3,000 ft. above mean sea level (MSL) to divert around Restricted Area 5 during testing events. At this time, SEAFAC is not using a formal NOTAM to alert aircraft of upcoming testing events. The temporary flight restriction extends up to 3,000 ft. and has a radius of 1 NM. It is intended to keep floatplanes with tourists or fishermen at a distance when SEAFAC is conducting acoustic tests.

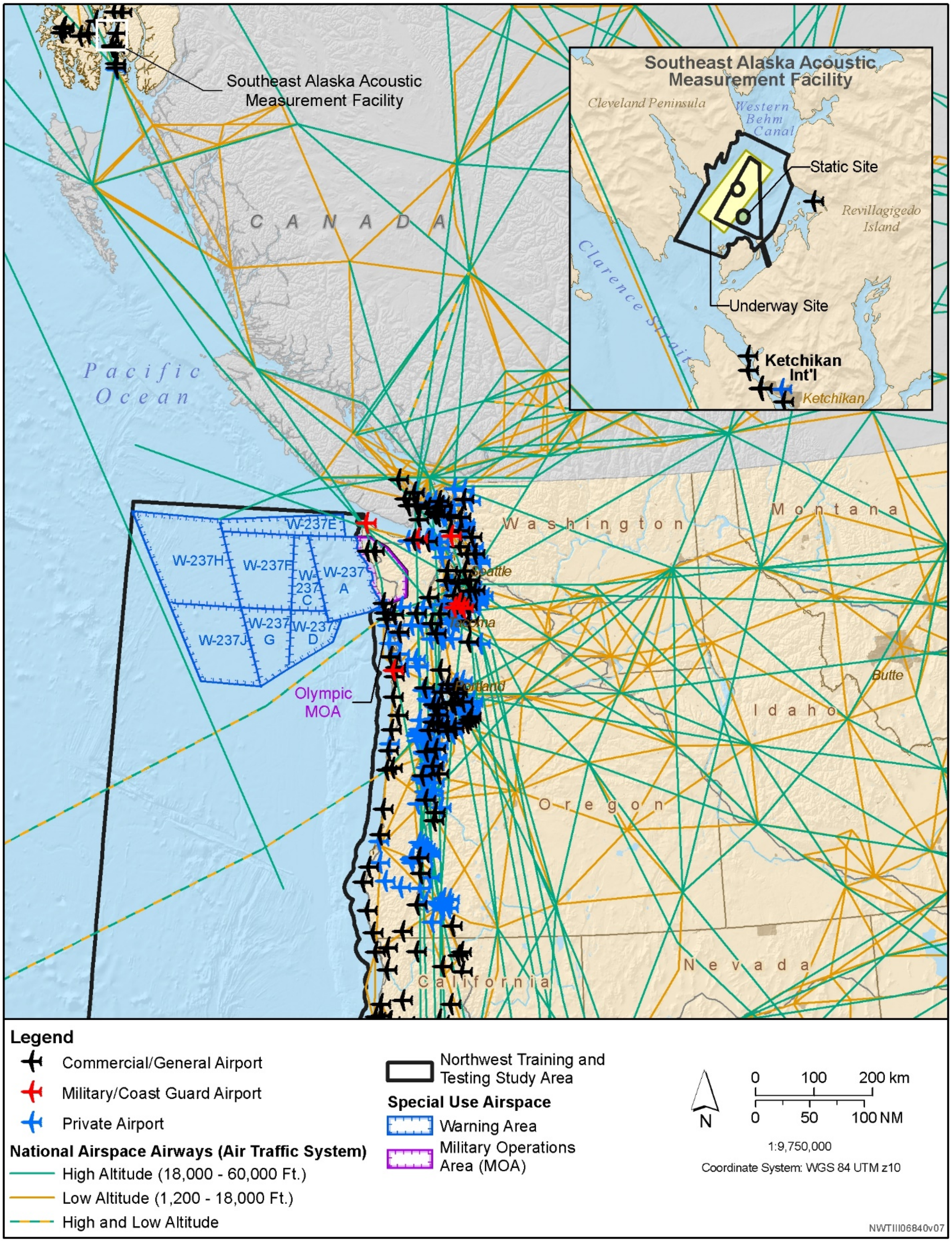

Figure 3.12-4: Airspace and Air Traffic Airways in the Northwest United States

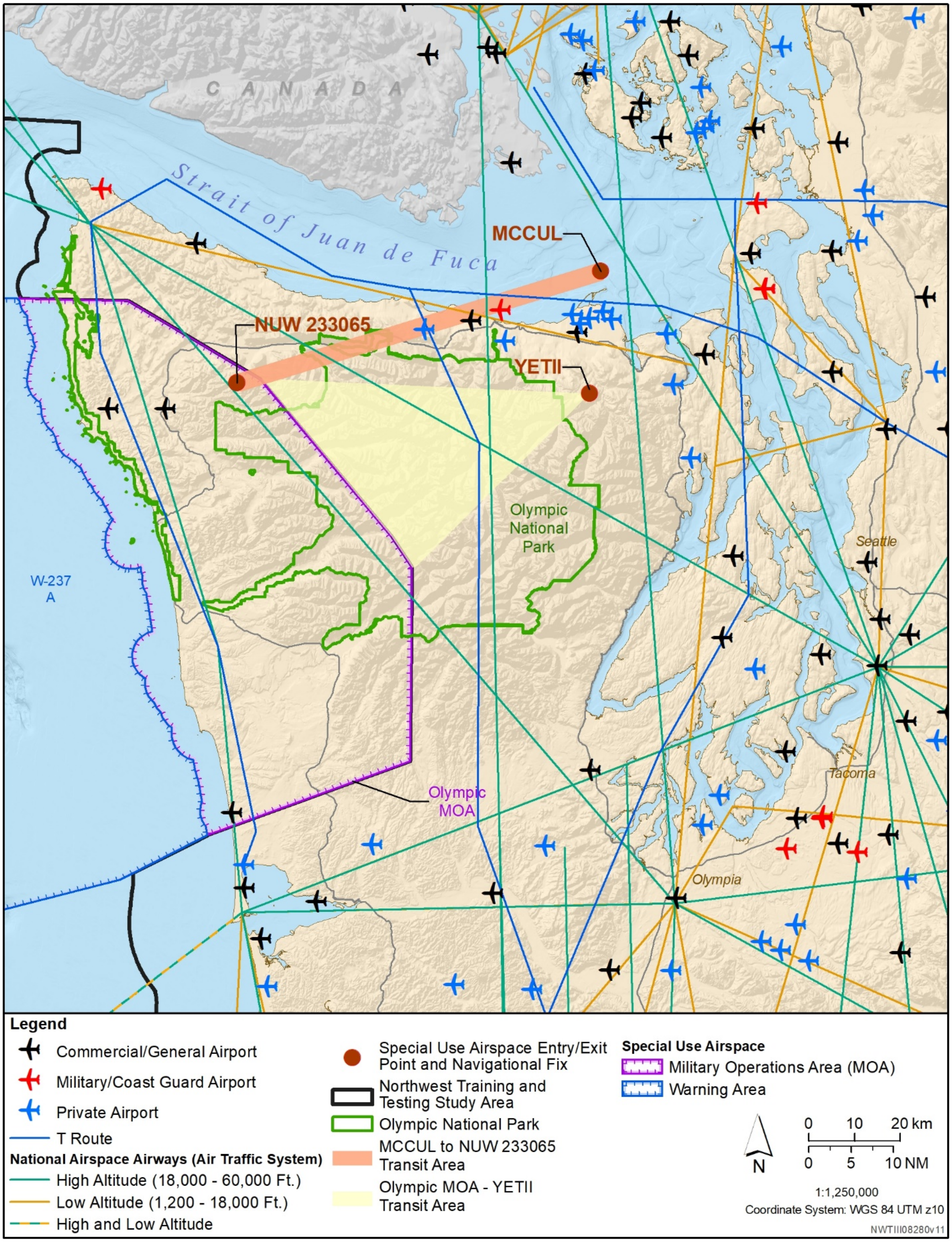

Figure 3.12-5: Airspace and Air Traffic Airways in Inland Waters Area

3.12.2.1.3 Vehicle Traffic

3.12.2.1.3.1 Inland Waters

The only portion of the Study Area with vehicular traffic that could be impacted by military activities is in the Inland Waters area, specifically that portion of State Route 104 in northern Kitsap County and eastern Jefferson County around the Hood Canal Floating Bridge[1]. The route extends across the Hood Canal Floating Bridge, a drawbridge with two 300-ft. spans that can open to allow marine traffic to pass. During openings, vehicle traffic on State Route 104 queues and back-ups occur. In 2016, an average of 18,000 vehicles crossed the bridge each day, and there were 394 bridge openings (in 2015) (Hughes, 2017). The previous three years of data (2013 through 2015) indicate an increasing trend in vehicle traffic over the bridge (16,000 vehicles in 2013 and 2014, 17,000 vehicles in 2015) (Hughes, 2017). Vehicle traffic is typically higher in summer than during other times of the year, partly due to increased tourism activities in the area, including visits to the Olympic National Park. There is no projected seasonal variation in the number of training and testing activities that require transit past the Hood Canal Bridge.

Commercial or recreational vessels intending to pass through will contact the bridge crew at least one hour before the opening (Washington State Department of Transportation, 2011). The Washington Department of Transportation uses a variety of electronic notification systems, including highway signage, web site notices, and subscriber alerts, to notify the public of upcoming openings. Vehicle traffic is held at the traffic control gates located on the bridge during openings for commercial or recreational vessels. These openings last for 10–45 minutes, though clearance of the traffic queue will take longer, particularly in summer months when tourism traffic is at its peak (Washington Department of Transportation, 2017).

Bridge openings to accommodate Navy vessels (e.g., submarines) may take longer, lasting for up to 60 minutes, because multiple large vessels must often pass the bridge in close formation, requiring that both spans are retracted to their maximum extent. Traffic can queue for up to 4 miles on either side, depending on the time of day and season. These longer bridge openings also receive advance notice via notification boards on approaching highways; however, the lead-time can be less than the state mandated minimum of one hour due to security protocols (non-military openings require a minimum lead time of one hour).

3.12.2.2 Commercial and Recreational Fishing

This section describes the importance of commercial and recreational fisheries to the local and national economy. Transits of fishing vessel are accounted for under Section 3.12.2.1.1 (Ocean Traffic). Commercial fishing, defined as the selling of the catch for commercial gain, takes place throughout the Offshore Area, from nearshore waters adjacent to the mainland to the offshore fishing grounds. For the entire United States, approximately 35 percent of commercial fisheries landings (by volume) are caught between 0 and 3 NM from shore, and 60 percent are caught between 3 and 200 NM from shore. The remaining 5 percent are caught on the high seas (beyond 200 NM from shore) or in foreign waters (National Marine Fisheries Service, 2016b).

[1] While Washington State ferries are part of the state highway system, the impacts to vehicles transiting on the ferries is accounted for under vessel traffic, not vehicle traffic.

3.12.2.2.1 Offshore Area

The Pacific Fishery Management Council is one of eight regional fishery management councils established by the Magnuson Fishery Conservation and Management Act of 1976 and is responsible for managing fishery resources along the coasts of California, Oregon, and Washington. The council has defined five main fisheries for the region: groundfish (e.g., rock fish species, flounder, sole), highly migratory species (e.g., tuna), coastal pelagic species (i.e., northern anchovy, Pacific mackerel, jack mackerel, Pacific sardine, market squid, and krill), Pacific halibut, and salmon (Pacific Fishery Management Council, 2017, 2019a).

The National Marine Fisheries Service (NMFS) maintains a database of commercial fisheries landings by state and species or species group. In 2017, commercial landings for Washington State totaled nearly 216 million pounds and were valued at over $277 million (fifth-highest in the nation) (National Marine Fisheries Service, 2018b). While the volume of commercial landings has increased substantially over the 2015 total of 155 million pounds, the total value has decreased from the 2015 total of $300 million (National Marine Fisheries Service, 2016a). Shrimp landings, specifically brine, penaeid, spot, and ocean shrimp were the highest by volume in 2015 at over 42 million pounds, but totaled only 7 million pounds in 2017. The catch of Pacific Hake, which exceeded 128 million pounds, was the highest by volume in 2017 (Figure 3.12-6). Landings of Dungeness crab and chum salmon were the second- and third-highest by volume, respectively. Species are listed from highest to lowest volume in the figure legend (Figure 3.12-6).

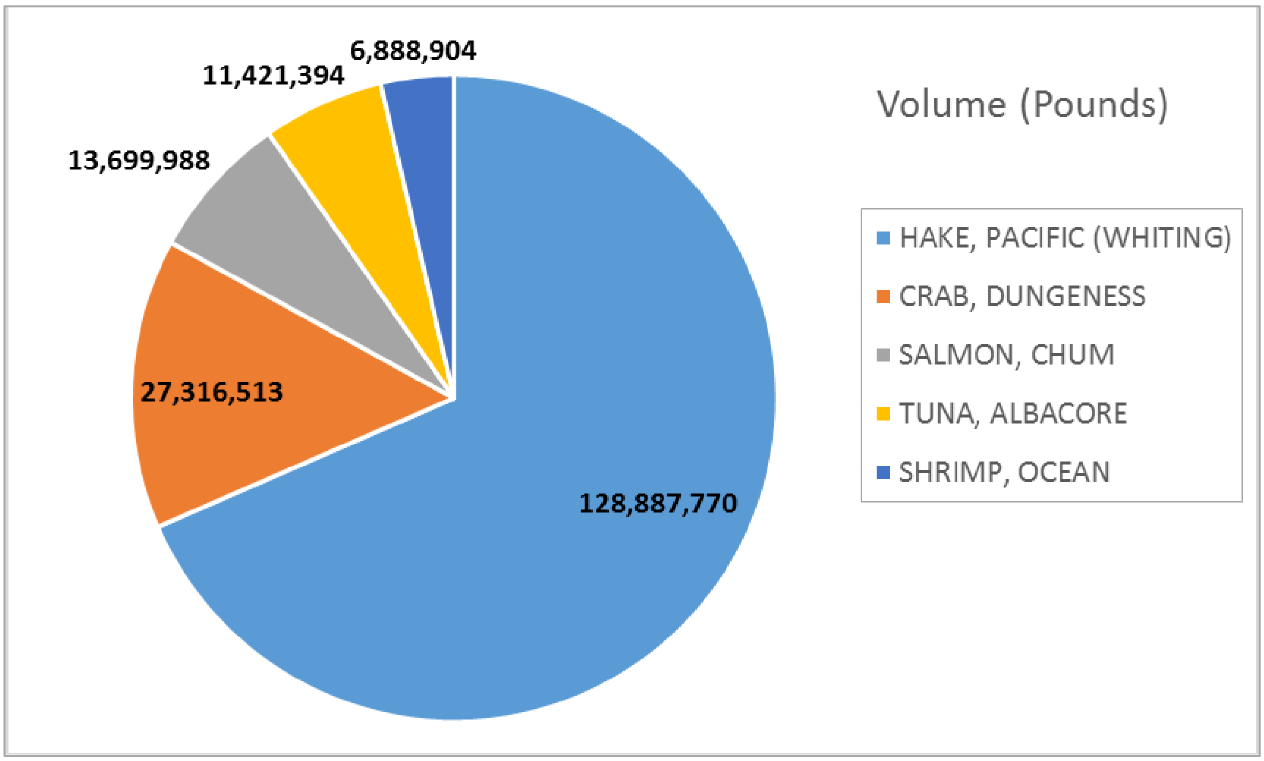

Figure 3.12-6: Volume of Commercial Landings by Species Group in Washington State Waters in 2017

The highest volume did not necessarily correspond with the most economically valuable species. Dungeness crab landings had the highest value among species at over $100 million (Figure 3.12-7) and made up over one-third of the total value of all commercial landings in 2017 (species are listed from highest to lowest value in the figure legend). Albacore tuna, valued at over $23 million, was the only other species that ranked in the top five by volume and value. As reported in the 2015 Final NWTT EIS/OEIS, in 2011, the total value of commercial landings was approximately $290 million. In 2015, the value of commercial landings had increased by approximately 3 percent (to $300 million), but in 2017, the value decreased from the 2015 total by about 7.6 percent despite a nearly 40 percent increase in volume (pounds) of commercial landings. The disparity between the increase in volume and the decrease in value can largely be attributed to the catch of Pacific hake, which increased from nearly 33 million pounds in 2015 to over 128 million pounds in 2017; however, the value of Pacific hake only increased from $2.6 million to $8 million.

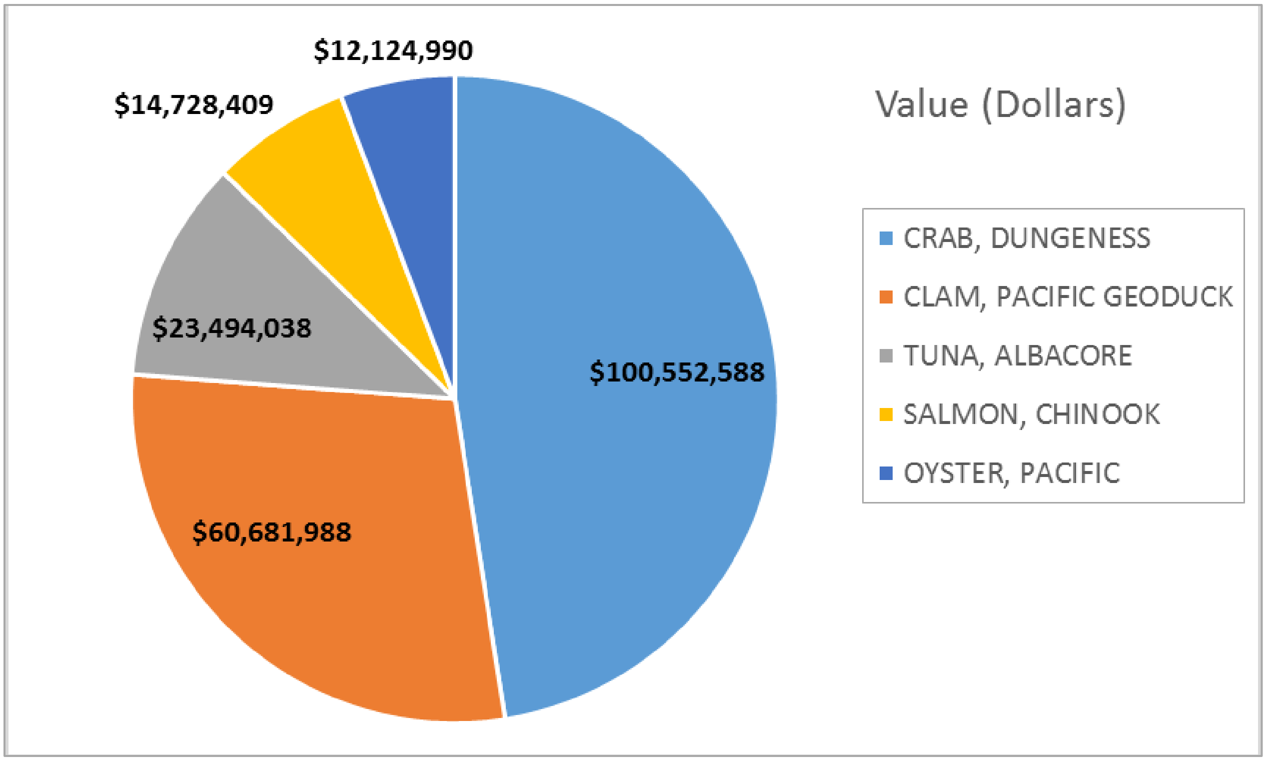

Figure 3.12-7: Value of Commercial Landings by Species Group in Washington State Waters in 2017

In 2015, commercial landings in Oregon exceeded 194 million pounds and were valued at just under $114 million (11th-highest value in the nation) (National Marine Fisheries Service, 2016a). Two years later, commercial landings in Oregon totaled more than 296 million pounds and $147 million (National Marine Fisheries Service, 2018b). In 2015, over 86 percent of landings by volume (pounds) were from groundfish species and shrimp (National Marine Fisheries Service, 2016a). However, in 2017, similar to the catch in Washington, landings of Pacific hake topped all other species by volume, making up 67 percent of total commercial landings in Oregon waters (Figure 3.12-8) (species are listed from highest to lowest volume in the figure legend). The species with the highest value in 2017 was Dungeness crab, which made up nearly 40 percent of the total value of all landings (Figure 3.12-9) (species are listed from highest to lowest value in the figure legend). The four other species that made up the top five most valued in 2017, Pacific hake, sablefish, ocean shrimp, and albacore tuna, were relatively close in total value.

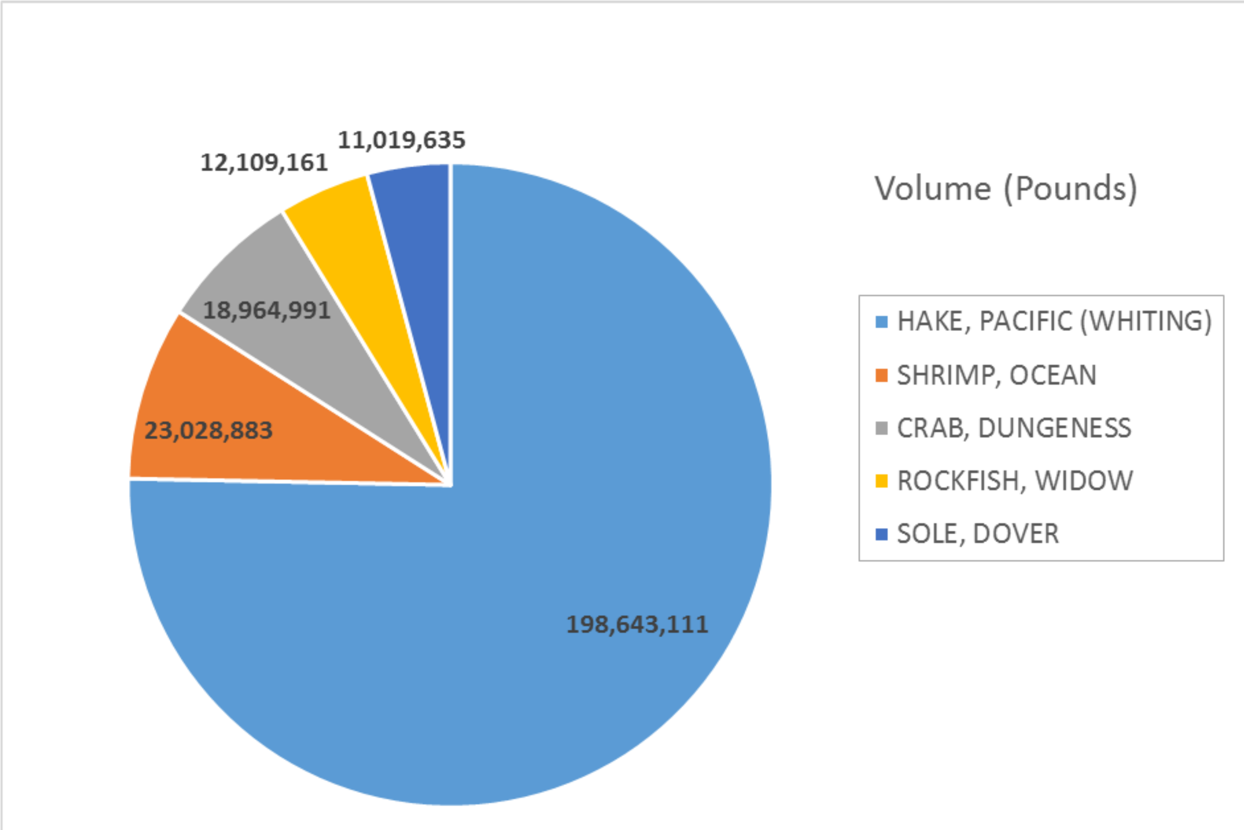

Figure 3.12-8: Volume of Commercial Landings by Species Group in Oregon Waters in 2017

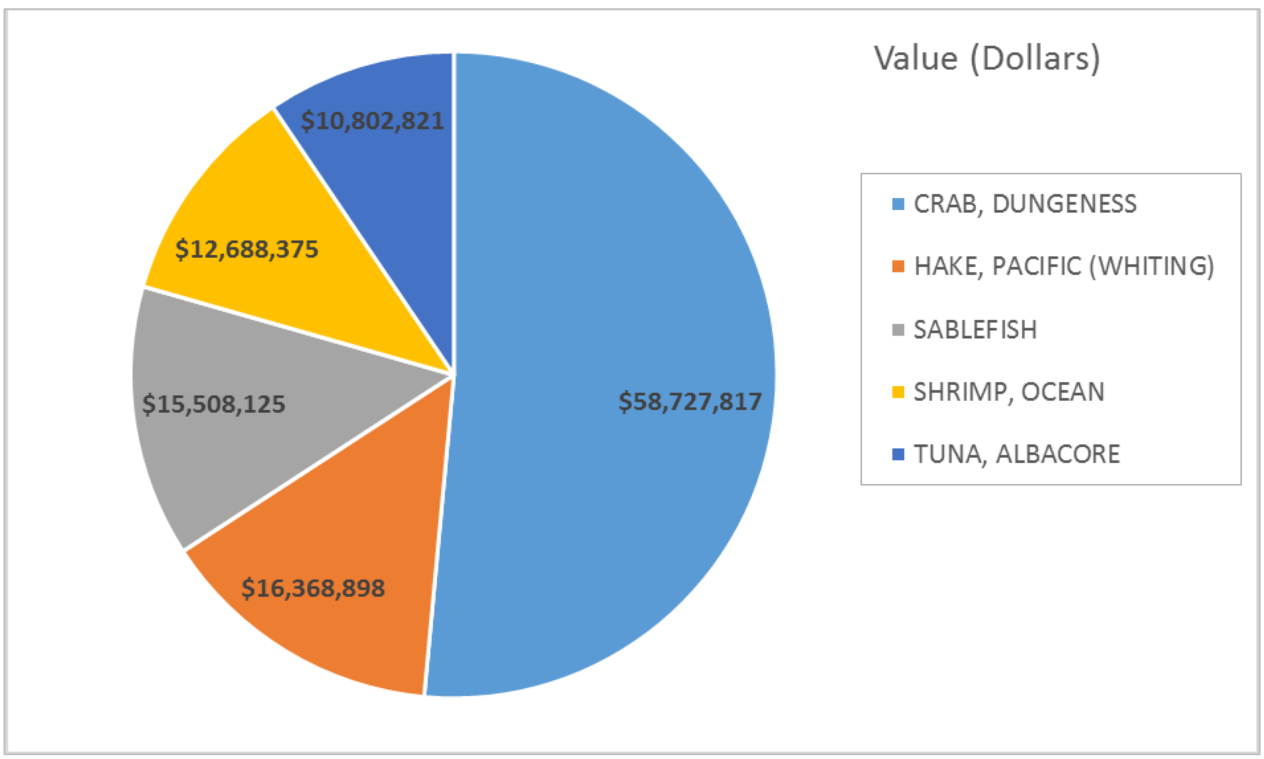

Figure 3.12-9: Value of Commercial Landings by Species Group in Oregon Waters in 2017

The information on training and testing activities in Chapter 2 (Description of Proposed Action and Alternatives) and Appendix A (Navy Activities Descriptions) shows that most activities occur in federal waters beyond 3 NM from shore. The distance from shore at which commercial species are caught is also available (National Marine Fisheries Service, 2018a). In 2017, all Pacific Hake landed off California, Oregon, and Washington were caught between 3 and 200 NM from shore, and 95 percent of albacore tuna was caught in that same region. By contrast, 85 percent of Dungeness crab was caught within 3 NM from shore (National Marine Fisheries Service, 2018a).

Commercial fishing is important to the economies of several communities that fish in the Offshore Area, as described in Section 3.12.2.2.1 (Offshore Area) of the 2015 Final NWTT EIS/OEIS and identified in Pacific Fishery Management Council (2015). The communities include Astoria, Oregon; Bellingham, Washington; Brookings, Oregon; Coos Bay, Oregon; Newport, Oregon; and Port Orford, Oregon. These communities tend to have small populations, are geographically isolated, and are heavily dependent on commercial and recreational fishing and on tourism. Changes in the regional and national economy since NMFS's 2006 community assessment have certainly affected many if not all of these communities to some degree; however, the dependency of these communities on commercial and recreational fishing is unlikely to have changed appreciably. These communities continue to be dependent on income from fisheries and would be vulnerable to substantial changes in their ability to access fishery resources and to fluctuations in the value of commercial landings.

Recreational fishing is defined for the purposes of this discussion as charter fishing and fishing for purposes other than commercial benefit or subsistence. Recreational fishing in the Offshore Area is concentrated in nearshore areas due to the smaller size and limited capabilities of typical recreational fishing vessels and the time required to complete a trip farther offshore if the vessel plans to return to port the same day. However, some recreational fishers travel up to 100 miles from shore seeking pelagic species like albacore tuna (Washington Department of Fish and Wildlife, 2018). Consequently, only approximately 10 percent of recreational fishing trips nationwide are in federal waters (beyond 3 NM from shore). Nationally, most of the recreational catch in 2015 came from inland waters (55 percent in numbers of fish), with 33 percent from state waters (0–3 NM from shore for all Pacific states) and almost 10 percent from beyond 3 NM. The majority of trips in the Pacific region fished primarily in inland waters (National Marine Fisheries Service, 2016b).

The economies of some small coastal communities are dependent on income from recreational fishing in the Offshore Area. The Oregon ports of Newport, Garibaldi, Brookings, and Charleston are the most heavily engaged Northwest ports in chartered recreational fishing, and these communities (as well as others) would be affected by substantial changes to the abundance or accessibility of species targeted by recreational fishers (Pacific Fishery Management Council & National Marine Fisheries Service, 2015).

Commercial fishing has historically been important to the economy of Northern California, including in Mendocino, Humboldt, and Del Norte counties, and remains an integral socioeconomic resource for the region (Pomeroy et al., 2011). Challenges that have impacted the commercial fishing industry in Northern California include increased costs, stagnant prices for the catch, and changes in government regulations affecting the fishing industry (Pomeroy et al., 2011). While the Study Area extends past the Oregon-California border, it is located more than 12 NM of the California coastline, and the majority of the proposed training and testing activities are conducted off the Washington State coast far from Northern California counties and nearshore waters.

Fisheries are also managed by regulating when commercial and recreational fishing can occur (i.e., the fishing season) and catch limits (e.g., limits based on the number of individual fish harvested, total weight of the catch, sizes of fish, etc.) for fisheries or, in many cases, for specific species within a fishery. These regulations vary from year to year and are set by the managing authority for each specific fishery prior to the start of the fishing season. For the salmon fishery off the west coast, which is regulated by species, the season generally occurs from June through September, with slight variations between species and dependent on a number of factors including an estimate of allowable harvest, anticipated fishing effort, allocation between commercial and recreational fisheries, and size and value of the catch (Pacific Fishery Management Council, 2016b).

The commercial Dungeness crab fishery is one of the most lucrative and competitive fisheries in Washington State and off the coast of Oregon. The Dungeness crab fishery typically opens on December 1 and runs through September 15 (Washington Department of Fish and Wildlife, 2020a). The crabs are found from the intertidal zone to a depth of 170 meters. Dungeness crabs are also fished for by recreational fishers. In Washington State, the recreational season varies by crab area with some areas open year-round; however, the most popular time to fish for Dungeness crabs is in summer (Washington Department of Fish and Wildlife, 2020b). The states of Washington, Oregon, and California jointly manage the Dungeness crab fishery along the west coast out to 200 NM from shore; typically, fishery management councils manage fisheries in federal waters. As noted above, the Pacific Fishery Management Council manages the other major fisheries in the Offshore Area (i.e., coastal pelagic species, salmon, groundfish, highly migratory species, and halibut) (Pacific Fishery Management Council, 2017, 2019a). Each fishery has its own separate regulations limiting where and when fishing (commercial and recreational) can occur, and these regulations may change annually or even during the fishing season depending on the status of the fishery (Pacific Fishery Management Council, 2018, 2019a, 2019b, 2020).

3.12.2.2.2 Inland Waters

Washington State is one of the largest producers of farmed shellfish in the nation and is a leading producer of naturally grown shellfish, most of which come from Puget Sound. Wild salmon species support a variety of fisheries in the Puget Sound region, including sport, commercial, and tribal fisheries (Pacific Fishery Management Council, 2016a). Puget Sound had a growing salmon aquaculture industry, however, a “spill” of approximately 250,000 farmed Atlantic salmon into Puget Sound in August 2017 brought the controversial industry to the forefront (Mapes, 2017). While a preliminary investigation indicated that the escaped salmon were not able to feed and died from starvation, subsequent findings contradicted that assertion and reported that Atlantic salmon continued to be caught by tribal fishermen through December 2017 (Cauvel, 2017; Mapes, 2018). The results of an investigation conducted by the State concluded that negligence by the owner was the cause of the release (Mapes, 2018). In February 2018, it was reported that 19 captured Atlantic salmon all tested positive for piscine orthoreovirus, a highly contagious and debilitating virus that could affect native salmon species (Wild Fish Conservancy, 2018). The incident and its consequences for native salmon led Governor Jay Inslee to sign a bill banning the farming of Atlantic salmon in Washington State waters (Ryan, 2018).

The Penn Cove Mussel Farm in Coupeville Washington exports large quantities of its highly renowned Penn Cove Mussels annually(Penn Cove Shellfish, 2017). Commercial and tribal traditional fisheries are conducted with purse seine or gill nets, primarily in the open waterways of Puget Sound and Hood Canal (Washington Department of Fish and Wildlife, 2012). American Indian and Alaska Native tribal and subsistence fishing is analyzed in Section 3.11 (American Indian and Alaska Native Traditional

Resources). Commercial landings at ports serving fisheries in the Inland Waters portion of the Study Area for 2017 are shown in Table 3.12-2.

Table 3.12-2: Commercial Landings at Ports in the Inland Waters Portion of the Study Area in 2017

Washington Inland Waters Port	Volume (Millions of Pounds)	Value (Millions of Dollars)
Seattle	6.3	29.0
Bellingham	8.9	22.7
Anacortes	5.5	21.3
Shelton	5.6	15.5
Olympia	2.3	15.1
Neah Bay	4.6	8.7
Blaine	1.9	6.8
Tacoma	1.8	5.4
Port Townsend	1.5	4.7
Everett	2.1	2.9

Source: (National Marine Fisheries Service, 2018b)

In 2017, marine recreational anglers took 4 million trips and caught a total of over 14 million fish in Washington, Oregon, and California waters. About 91 percent of the trips were made in California, 5 percent were in Oregon waters, and approximately 4 percent (160,000) were in Washington State waters (National Marine Fisheries Service, 2016b). As noted in Section 3.12.2.2.1 (Offshore Area), most recreational fishing trips in the Pacific region occurred primarily in inland waters (National Marine Fisheries Service, 2016b), suggesting that most of the 160,000 trips in Washington State occurred in inland waters. Recreational fishing, crabbing, and clamming typically occurs throughout the inlets of Puget Sound and Hood Canal. Recreational sportfishing in public waterways in Washington State, which consists largely of waters in the Inland Waters portion of the Study Area, contributed an estimated $805 million in 2014 to the regional economy and recorded over 19.5 million participant days (Briceno & Schundler, 2015). Motorized boating and sailing expenditures contributed an additional $1.6 billion to the economy, and expenditures on non-motorized paddle sports totaled over $578 million and recorded 7.7 million participant days. Daily expenditures on motorized and non-motorized boating and related activities ranged from $75 to $88 per person (Briceno & Schundler, 2015). These and other recreational activities that rely on access to inland waters make a valuable contribution to the Washington State economy.

3.12.2.2.3 Western Behm Canal, Alaska

Commercial landings at the port of Ketchikan in 2017 totaled 77 million pounds and had a value of nearly $46 million (National Marine Fisheries Service, 2018a). Salmon in the state waters near Ketchikan represents a large portion of the harvest for Ketchikan residents and visitors. As of the week of July 29, 2019, the Alaska Department of Fish and Game reported 40,500 chum salmon had been harvested for the year in the Western Behm Canal and Neets Bay area. In the traditional Native Alaskan fishery 32,000 chum salmon were harvested by purse seine gear, and 7,000 chum salmon were harvested by drift gillnet gear (Alaska Department of Fish and Game, 2019). Because the return of chum salmon to the Neets Bay area has been unexpectedly low, the Neets Bay Terminal Harvest Area was closed on July 30, 2019. Other important commercial fisheries in the area include sea cucumber, sea urchin, herring spawn, and shrimp.

Commercial fishing and seafood processing at the port of Ketchikan is a vital part of the local economy. Income by Ketchikan based fishers in 2015 was estimated to be $22.3 million (United Fishermen of Alaska, 2017). These earnings contributed to the local economy through property and sales taxes, purchases of homes, use of rental and hotel properties, entertainment, fuel, vehicles, food, repair and maintenance parts, transportation, medical, and other services. Virtually every business in Ketchikan benefits financially from commercial fishing and the associated industries of seafood processing and transportation (United Fishermen of Alaska, 2017).

Several open water areas near SEAFAC are considered as heavy or moderate recreational fishing areas. These waters include portions of Western Behm Canal around Betton and Back Islands, Clover Passage, Clover Pass, Smuggler's Cove, and Helm Bay (Ketchikan Gateway Borough, 2007).

3.12.2.3 Tourism and Recreation

The status and projected trends of socioeconomic resources described in this section represent the affected environment prior to the global coronavirus pandemic and subsequent dramatic declines in economies around the world, including in the United States. State and local governments either limited business operations or mandated the closure of certain businesses across multiple economic sectors. The travel and tourism industry, which many people in the NWTT Study Area are dependent on for employment and income, has been particularly hard hit. The analysis in this section shows that training and testing activities would not significantly impact tourism and related recreational activities in the Study Area. Tourism in the Pacific Northwest has grown consistently in recent years, adapting to fluctuations in domestic and international travel, and in concert with ongoing training and testing activities.

Coastal tourism and recreation can be defined as the full range of tourism, leisure, and recreation activities that take place in the coastal zone and the offshore coastal waters. These activities include coastal tourism development (e.g., hotels, resorts, restaurants, food industry, vacation homes, second homes) and the infrastructure supporting coastal development (e.g., retail businesses, marinas, fishing tackle stores, dive shops, fishing piers, recreational boating harbors, beaches, recreational fishing facilities). Also included is ecotourism (e.g., whale watching) and recreational activities such as boating, cruises, swimming, fishing, surfing, snorkeling, and self-contained underwater breathing apparatus (SCUBA) diving. Both tourists and locals also enjoy visiting the Olympic National Park and Olympic National Forest and other areas on the Olympic Peninsula to participate in activities such as hiking, camping, observing nature (e.g., bird watching), photography, and simply being outdoors (Go Northwest!, 2017).

Water sports are popular among residents of and visitors to Washington. Many communities and individual residences have piers or private docks located adjacent to the Inland Waters area and along the coastline and participate in a variety of recreational activities, including recreational fishing, which is discussed in Section 3.12.2.2 (Commercial and Recreational Fishing). Other popular water sports include motorized and non-motorized boating, kayaking, swimming, and SCUBA diving. In 2014, Washington State recorded over 28 million participant days of motorized and non-motorized boating activities and over 40 million participant days for swimming, SCUBA diving, and related activities (Briceno & Schundler, 2015), although not all of these boating and other activities would occur in the Study Area. In 2018, there were over 244,000 recreational vessels registered in the state, a 2.2 percent increase over the number of vessels registered in 2017 (U.S. Coast Guard, 2019). Registered vessels included most motorized boats, watercraft, and sailboats more than 16 ft. in length. Smaller sailboats and other unregistered vessels not counted in the data, such as kayaks and canoes, are popular in the region as well and would also be expected to be used in the Inland Waters. Based on the increase in vessel registration, it is reasonable to assume that the participation and economic data reported for 2014 has at least remained consistent or more likely trended upward since then. Swimming and related activities like tubing are the most popular water sports, but are not likely to occur in the Study Area, because the vast majority of swimmers remain close to shore and far from areas used for at-sea training and testing, which in many cases occur more than 12 NM from shore. Expenditures on motorized and non-motorized boating activities, which could occur in the same locations as some training and testing activities, totaled over $2.3 billion in 2014, averaging between $75 and $88 per person per day. The per-person, per-day expenditures on boating activities were exceeded only by SCUBA diving, for which individuals spent an average of $119 per day and total expenditures were over $130 million. In comparison, per-person, per-day expenditures on swimming averaged just $20 and on tubing were $44 (Briceno & Schundler, 2015).

Other than swimming, the most popular water sport activity in 2014 was fishing, which recorded 19.5 million participant days with average expenditures of $41 per person per day (Briceno & Schundler, 2015). Recreational fishing is discussed in Section 3.12.2.2 (Commercial and Recreational Fishing).

3.12.2.3.1 Offshore Area

Tourism and recreation within the Study Area occurs primarily within Puget Sound; however, a variety of tourism and recreational activities also occur in the Offshore Area. These activities include whale watching, which occurs March through November with peak tourism activity in the summer, and charter boat fishing. Whale watching by boat primarily occurs along the Oregon coast (Newport and Depoe Bay) and Northern California (Fort Bragg). Gray whales are the most commonly observed species, found about 5 miles off the coast during their southward migration in December and January and as close as one-half mile during their northward migration, which extends from March through June (Oregon Coast Visitors Association, 2018). Whale watching off the Washington coast occurs from boat- and land-based operations (O’Connor et al., 2009).

Portions of the Olympic National Park and Olympic National Forest underlie airspace that is part of the Study Area (Figure 3.12-5), and both of these natural areas attract tourists and locals into the state. Visitation at the park increased each year from 2013 through 2017, reaching a peak of over 3.4 million in 2017. In 2018, annual visitation declined by approximately 300,000 to 3.1 million, but, in 2019, visitation increased to 3.25 million. Summer is the most popular time to visit the park and, in nearly every year since 1979, August has had the highest number of recreational visitors to the park with nearly 738,000 in 2019. Visitation has consistently been lowest in winter and early spring. Average visitation during each month from November through March over the 40 years from 1979 through 2019 ranged between 85,000 and 113,000 people (National Park Service, 2020). While far fewer people visit the park in winter and early spring, over 100,000 people can be expected to visit the park in most months. A number of visitors stay in or nearby the Olympic National Park each year for a week or more, either camping or lodging nearby and spending the day in the park. In 2019, over 35,000 tent campers stayed in the park in August, which is historically the most popular month to camp in the park. In addition, over 28,000 backcountry campers and over 15,000 RV campers stayed in the park in August. Camping is also very popular in June, July, and September with visitation in 2019 during those three months ranging between 21,000 and 34,000 tent campers, 9,000 and 15,000 RV campers, and 8,000 and 27,000 backcountry campers. Even though summer is the most popular time to stay in the park and nearby areas, camping and lodging in the park and wilderness areas occurs year round (National Park Service, 2020). The vast majority of these camp areas and trails are located east of the Olympic MOA; however, several areas are located beneath the exit and entry points to the MOA. Most of the camp areas situated along the coastline in the Washington Islands Wilderness Area are located under the MOA (O'Brien, 2019).

The Olympic MOA partially overlaps the Olympic National Park, Olympic National Forest, Colonel Bob Wilderness Area, and Pacific Beach as well as other sites popular with locals and tourists (Figure 3.12-10). Approximately 27 percent of the Olympic National Park and 24 percent of the Olympic National Forest lies beneath the Olympic MOA. All of the Colonel Bob Wilderness Area and Pacific Beach State Park underlie the Olympic MOA as do several other points of interest and recreation areas located on the peninsula.

The Navy, along with other U.S. military forces, have trained over and off the Olympic Peninsula since World War II. The Olympic MOA, one of about 460 MOAs across the United States, was established in 1977. The military averages about 2,300 flights per year over the Olympic MOA; approximately 6.3 flights per day averaged over a full year. To estimate the number of flights that would occur on the busiest days of the year, the Navy reviewed flight data from fiscal years 2015 through 2017 and identified the busiest single day for each month over the three-year period. On average, 17 EA-18G aircraft flights would occur over the Olympic Peninsula on the busiest days.

Most Navy flights in the Olympic MOA occur on weekdays and during daylight hours. Over 95 percent of total military aircraft flight time in the Olympic MOA occurs at altitudes above 10,000 ft. MSL. Most of that flight time occurs at altitudes much higher that 10,000 ft.; about 70 percent of flight time is above 20,000 ft. Based on an analysis that included weekdays and weekends, the FAA determined that the military flies less than 25 percent of all flights that occur over the Olympic National Park per year. In the past, when the Navy had over 200 tactical aircraft assigned to NAS Whidbey Island, the Navy conducted up to three times as many flights compared to the number of flights conducted today. That comparison accounts for the training flights proposed in this Supplemental EIS/OEIS for the current number of EA-18G aircraft and the projected increase in EA-18Gs in the coming years. In the past, the Navy conducted far more training events involving low-level maneuvers than it does today due to evolving training requirements and the types of aircraft involved in training events.

The Olympic Coast National Marine Sanctuary, located offshore of the Olympic Peninsula, also attracts tourists and is analyzed in Chapter 6 (Additional Regulatory Considerations). A substantial number of tourists accessing locations on the Olympic Peninsula come by car across the Hood Canal Bridge, which is located in the Inland Waters portion of the Study Area and discussed in in Section 3.12.2.1.3 (Vehicle Traffic).

Data reported by the National Ocean Economics Program show that the tourism and recreation industry in Washington coastal counties increased steadily from 2013 to 2016 (National Ocean Economics Program, 2018d). The number of businesses specializing in ocean-related activities increased by 4 percent from 5,007 in 2013 to 5,222 in 2016. Even though the increase in the number of establishments was modest, the number of jobs in the industry rose by 11 percent over the four-year time span. Wages paid out in the industry increased by 23 percent, and the industry contribution to Gross Domestic Product grew by 27 percent (National Ocean Economics Program, 2018d).

Ocean related activities and industries in Oregon showed similar economic growth from 2013 through 2016. Businesses increased by 4 over the four-year period, jobs increased by 14 percent, wages grew by 26 percent, and the contribution of ocean associated tourism and recreation to state Gross Domestic Product grew by 38 percent (National Ocean Economics Program, 2018a).

3.12.2.3.2 Inland Waters

The Inland Waters portion of the Study Area, including Puget Sound and Hood Canal, offer a wide variety of recreational activities for tourists and residents both on the water and along the shoreline. Recreational boating and other ocean-related activities contribute millions of dollars to the regional economy (U.S. Department of Commerce & Bureau of Economic Analysis, 2019). Boating and fishing activities (including canoeing, kayaking, and sailing) increased each year from 2012 to 2017, adding over $662 million to the state economy in 2017 (U.S. Department of Commerce & Bureau of Economic Analysis, 2019). Expenditures in 2014 were highest for recreational activities associated with public waters, highlighting their importance to businesses supporting those activities. Water recreation includes a number of activities with high trip and equipment expenditures, especially activities involving motorized boating (Briceno & Schundler, 2015). The broader Travel and Tourism economic sector, including food and beverages, lodging, shopping and souvenirs, and transportation, added over $3.7 billion to the Washington economy in support of outdoor recreational activities (only expenditures for travel at least 50 mi. from home were counted) (U.S. Department of Commerce & Bureau of Economic Analysis, 2019).

Tourism is especially important to the economies in the towns of Coupeville and Langley, both waterfront towns on Whidbey Island that cater to tourists.

Vendors along the shoreline of Dabob Bay in Hood Canal offer a wide variety of boats to rent for recreational activities; services include recreational tours and group events. State parks on the shores of Hood Canal include Belfair, Twanoh, Potlatch, Triton Cove, Scenic Beach, Dosewallips, Kitsap Memorial, and Shine Tidelands (Figure 3.12-10). There are also a number of public marinas located along Hood Canal.

Puget Sound's good underwater visibility, rich sea life, and largely pristine diving conditions make it a popular destination for divers visiting the northwest. Charter dive trips to specific sites (Figure 3.12-10) are often published and booked as many as six months in advance. Diving occurs year-round, though the number of trips to popular dive sites peaks during the summer, and most dive charters are scheduled for weekends. The tourism industry is linked to multiple sectors of the Washington State economy and relies on access to public waterways, including Puget Sound, to continue attracting visitors and tourism related businesses to the state (Briceno & Schundler, 2015). In addition to adding to the state's economy through expenditures associated with tourism, the outdoor recreation industry employs millions of state residents. In 2017, the Arts, Entertainment, and Recreation sector supported over 23 million jobs and $711 million in total compensation (U.S. Department of Commerce & Bureau of Economic Analysis, 2019).

3.12.2.3.3 Western Behm Canal, Alaska

There are no protected recreational areas within the Western Behm Canal portion of the Study Area, but Behm Canal is near the Misty Fjords National Monument and approximately 10 miles south of the major cruise ship stopover in Ketchikan, Alaska. From 2008 through 2018, between 828,000 and 1,073,000 passengers visited Ketchikan annually, with the total increasing every year since 2014 and peaking in 2018 (Ketchikan Visitors Bureau, 2019). In 2018, the port reported over 500 port calls by 40 cruise vessels, which only visit Ketchikan between April and September (Ketchikan Visitors Bureau, 2019). Visitors to Ketchikan can charter a fishing vessel or a float plane to access more remote marine areas.

Areas of Western Behm Canal near the SEAFAC are used for water-based recreation, and at least some of those participants are likely to be tourists. As noted above, several open-water areas near the SEAFAC are considered to be heavy or moderate recreational boating and fishing areas. Clover Pass, which is immediately west of the SEAFAC, is one of the area's main boating and sport fishing areas and is highly regarded for its scenic value.

With its three marinas and three resorts, the area is also very popular with sport fishers for nearshore and open water fishing, as well as for diving (Ketchikan Gateway Borough, 2007). Some of the popular recreational areas in the immediate vicinity of the SEAFAC include

- Betton Island State Marine Park: Uses include kayaking, boating, beachcombing, SCUBA diving, camping, fishing, hunting, wildlife viewing, and commercial guide activity (Ketchikan Gateway Borough, 2007).
- Grant and Joe Islands State Marine Park: The park is well known as a kayak resting area and for picnicking and camping. This park is accessible by boat and float plane only, which makes it less accessible to visitors (Ketchikan Gateway Borough, 2007).

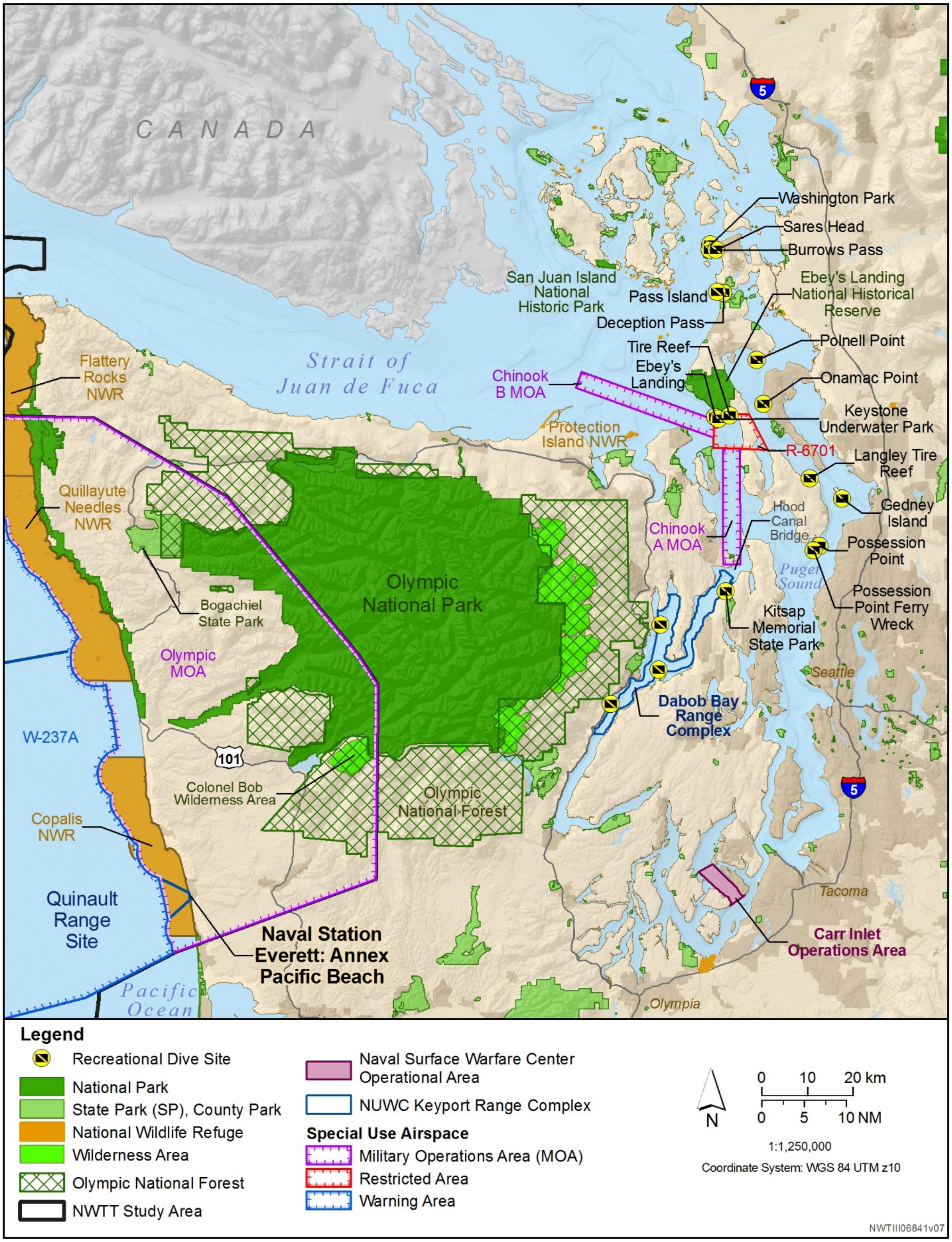

Figure 3.12-10: Recreational Areas in the Inland Waters Portion of the Study Area

3.12.3 Environmental Consequences

The 2015 NWTT Final EIS/OEIS analyzed training and testing activities currently occurring in the Study Area and considered all potential stressors related to socioeconomic resources. Stressors applicable to socioeconomic resources in the Study Area are the same stressors analyzed in the 2015 NWTT Final EIS/OEIS:

- **Accessibility** (to the ocean and the airspace)
- **Airborne acoustics**
- **Physical disturbance and strike** (aircraft, vessels and in-water devices, military expended materials)
- **Secondary** (availability of resources)

This section evaluates how and to what degree potential impacts on socioeconomic resources from stressors described in Section 3.0.1 (General Approach to Analysis) may have changed since the analysis presented in the 2015 NWTT Final EIS/OEIS was completed. Tables 2.5-1 through 2.5-3 list the proposed training and testing activities and include the number of times each activity would be conducted annually and the locations within the Study Area where the activity would typically occur under each alternative. The tables also present the same information for activities proposed in the 2015 NWTT Final EIS/OEIS so that the incremental changes in the proposed levels of training and testing can be easily identified. The annual number and location of activities that include various types of stressors that could impact socioeconomic resources are shown in Tables 3.0-9 through 3.0-22. Activities involving vessel movements (Table 3.0-12), for example, have the potential to impact accessibility.

3.12.3.1 Accessibility (to the Ocean and the Airspace)

Navy training and testing activities have the potential to temporarily limit access to areas of the ocean and airspace for a variety of human activities associated with transportation and shipping, commercial and recreational fishing, and tourism and other recreational activities in the Study Area. Access is most often affected when the Navy establishes a temporary, localized, safety zone or buffer zone around certain activities and actively restricts non-military activities within the zone. Training and testing activities involving the use of vessels and other in-water devices and aircraft have the greatest potential to impact accessibility to areas of the ocean or airspace.

The Navy searched for and reviewed publicly available resources, including government documents and reports, scientific journals, and on-line databases for new socioeconomic data and information on activities occurring in the Study Area and published since 2015. New information on commercial fisheries and tourism was added to Section 3.12.2.2 (Commercial and Recreational Fishing) and Section 3.12.2.3 (Tourism and Recreation). Limiting access to areas that are popular for fishing and other activities conducted by the public is a factor potentially impacting recreational fishing, and tourism and related recreational activities. The data and supporting information presented in Section 3.12.2.2 (Commercial and Recreational Fishing) and Section 3.12.2.3 (Tourism and Recreation) describing economic indicators for ocean-related recreation and tourism show that trends for the industry have been positive in recent years and are likely to continue to show growth.

3.12.3.1.1 Impacts on Accessibility Under Alternative 1

3.12.3.1.1.1 Impacts on Accessibility Under Alternative 1 for Training Activities

Under Alternative 1, the number of proposed training activities involving the movement of vessels or the use of in-water devices would decrease compared with totals in the 2015 NWTT Final EIS/OEIS

(Table 3.0-12 and Table 3.0-13). Activities that include vessel movements would decrease by 1 percent in the Offshore Area and 11 percent in the Inland Waters compared with ongoing activities. As described in Section 3.12.2.1.1.2 (Inland Waters), Navy vessel movements made up less than 1 percent of all vessel movements in the Inland Waters in 2018. The change in the number of vessel movements under Alternative 1 would not appreciably change that percentage. There would also be an increase of 9 percent in the use of in-water devices in the Offshore Area and an increase from 1 to 59 events in the Inland Waters compared ongoing activities (Table 3.0-13). The activities would occur in the same locations and in a similar manner as analyzed previously.

The increase in the use of in-water devices is associated with unmanned underwater vehicle training and would not substantially increase potential impacts on accessibility. The vast majority of activities using in-water devices occur in the Offshore Area, and the level of activity offshore would not change substantially compared with ongoing activities. The increase in the number of training activities in the Inland Waters is a substantial change from the ongoing level of training. However, a very similar activity was analyzed as a testing activity in the 2015 NWTT Final EIS/OEIS, and the increase is more representative of a progression of the activity from a testing phase to a training phase rather than an increase in the overall number of events. Since potential limits on accessibility are not dependent on whether the activity is conducted as a training or testing activity, the impact on accessibility is expected to be approximately the same as with ongoing activities.

The number of annual events with aircraft movements in the Offshore Area (Table 3.0-11) would increase by 12 percent (from 6,311 to 7,047) and would increase from 100 to 143 events in the Inland Waters area. Training activities using aircraft are primarily conducted in offshore warning areas and in the Olympic MOA. The offshore warning areas do not overlap with commercial airways; however, the Olympic MOA overlaps airway route T257 and the Olympic ATCAA overlaps airway routes J54 and J501 (Figure 3.12-4). As described in Section 3.12.2.1.2.2 (Inland Waters), Navy air traffic made up 6.2 percent of all air traffic in Washington State in 2018. The change in the number of aircraft movements under Alternative 1 would not appreciably change that percentage. Relatively few events involving aircraft movements would occur in the Inland Waters area, consistent with the ongoing level of activity. Impacts on accessibility, if any were to occur, would likely temporarily affect general aviation and other small aircraft flying over the Inland Waters and Olympic Peninsula (Figure 3.12-5).

No impacts on commercial transportation and shipping are anticipated, because major shipping routes and airways are well defined, and training activities would avoid those areas. Potential impacts on commercial and recreational fishing and tourism and recreation are reduced by alerting the public of upcoming activities. When training activities are scheduled that require specific areas to be free of non-participating vessels and aircraft, the military requests that the USCG issues NTMs and the FAA issues NOTAM to allow the public to plan accordingly and ultimately to ensure the safety of military personnel and the public. Notifications are provided on a weekly basis of upcoming closures, often forecasting several weeks in advance, for the Quinault Range site. At least a two-week notice is given for a planned activity. When necessary, ocean areas and airspace used by the military are restricted for short periods of time (typically on the order of hours) to allow a training activity to be conducted with minimal potential for interruptions and risks to public safety. Once the activity is complete, the ocean or airspace is available for use by the public, except for areas where a permanent danger zone or restricted area has previously been designated (e.g., Dabob Bay restricted area; see 33 CFR 334.1260)

Furthermore, the military follows standard operating procedures to visually scan an area to ensure that non-participants (i.e., civilian vessels and aircraft) are not present. If non-participants are present, the military delays, moves, or postpones the activity. Refer to Section 2.3.3 (Standard Operating Procedures) for additional information on standard operating procedures. Appendix A (Navy Activities Descriptions) lists standard operating procedures that are implemented for each activity.

There has been no appreciable change to the existing environmental conditions as described in the 2015 NWTT Final EIS/OEIS, and the results of the analysis of impacts from limitations on accessibility to the ocean and airspace on transportation and shipping, commercial and recreational fishing, and tourism and related forms of recreation, as summarized in this section, would remain negligible.

As stated in the 2015 NWTT Final EIS/OEIS and summarized in this section, because the potential impacts on accessibility from the proposed training activities under Alternative 1 would remain negligible, there would be no disproportionately high and adverse human health or environmental effects on any minority populations and low-income populations or disproportionately high environmental health risks or safety risks to children.

3.12.3.1.1.2 Impacts on Accessibility Under Alternative 1 for Testing Activities

Under Alternative 1, the number of proposed testing activities involving the movement of vessels or the use of in-water devices would increase compared with totals in the 2015 NWTT Final EIS/OEIS (Table 3.0-12 and Table 3.0-13). Activities that include vessel movements would increase by 56 percent (from 181 to 295) in the Offshore Area, remain about the same in the Inland Waters, and increase 5 percent in Western Behm Canal compared with totals the 2015 NWTT Final EIS/OEIS (Table 3.0-12). As described in Section 3.12.2.1.1.2 (Inland Waters), Navy vessel movements made up less than 1 percent of all vessel movements in the Inland Waters in 2018. The change in the number of vessel movements under Alternative 1 would not appreciably change that percentage.

There would also be a slight increase of 4 percent in the use of in-water devices in the Offshore Area and also in the Inland Waters (no increase in Western Behm Canal) compared with Alternative 1 (Table 3.0-13). Nearly all activities would occur in the same locations and in a similar manner as analyzed previously. One exception is the Mine Countermeasure and Neutralization activity, which was not analyzed in the 2015 NWTT Final EIS/OEIS. This activity would use explosives two times per year and last between 1 and 10 days each time the activity is conducted. The activity would occur no closer than 3 NM from shore (all other activities using explosives would occur more than 50 NM from shore). While other activities using explosives are unlikely to impact fisheries, a Mine Countermeasure and Neutralization event has the potential to disrupt commercial and recreation fishing activities and offshore tourism (e.g., charter fishing) given that it would require a temporary closure closer to shore. The USCG would issue an NTM in advance of the closure to alert fishers and other boaters of the upcoming event, as is done with other activities. The Mine Countermeasure and Neutralization activity would not occur over hard bottom substrate, reducing or eliminating potential impacts on fisheries that target species which rely on hard bottom habitat.

Testing activities using aircraft are primarily conducted in offshore warning areas, which do not overlap with commercial airways (Figure 3.12-4). Testing activities involving aircraft movements in the Offshore Area would increase from 113 to 260, decrease in the Inland Waters from 456 to 61, and would remain at 4 annual events in Western Behm Canal (Table 3.0-11). Aircraft movements in the Offshore Area are primarily conducted in warning areas, which do not overlap with commercial or general aviation airways. The Olympic MOA overlaps airway route T257 and the Olympic ATCAA overlaps airway routes J54 and J501 (Figure 3.12-4). The majority of aircraft movements over the Inland Waters area are from aircraft transiting to the Offshore Area and inland airfields (see Tables 2.5-1, 2.5-2, and 2.5-3). The reduction in aircraft movements in the Inland Waters area would reduce the potential impacts on general aviation and other small aircraft flying over the Inland Waters and Olympic Peninsula (Figure 3.12-5). As described in Section 3.12.2.1.2.2 (Inland Waters), Navy air traffic made up 6.2 percent of all air traffic in Washington State in 2018. The change in the number of aircraft movements under Alternative 1 would not appreciably change that percentage. Overall, the changes in the use of vessels, in-water devices, and aircraft as described in Chapter 2 (Description of Proposed Action and Alternatives) and in the 2015 NWTT Final EIS/OEIS would not substantially change potential impacts on accessibility.

In Western Behm Canal, the Navy limits vessel traffic only when essential to the success of test events. Under Alternative 1, there would be a small increase of approximately 4 events annually compared to the 2015 Final EIS/OEIS (Table 2.5-2 in Chapter 2 [Description of Proposed Action and Alternatives]). Historically, the Navy has ensured that 89 percent of the peak tourism and fishing season is unaffected by restrictions, and the remaining 11 percent is only affected by requirements that transiting vessels reduce speed when testing is occurring, resulting in only brief delays. Navy activities that have the potential to conflict with other uses of Western Behm Canal, including commercial and recreational fishing, are minimized through specific provisions in 33 CFR Section 334, including short-duration closures and advanced public notification through NTMs. Navy activities have occurred in Western Behm Canal for approximately 20 years while minimizing impacts on other users.

No impacts on commercial transportation and shipping are anticipated, because major shipping routes and airways are well defined, and testing activities would avoid those areas. As noted in Section 3.12.2.2.1 (Offshore Area), commercial and recreational fisheries occur in the Offshore Area within defined areas along the coastline and typically during specific times of the year, depending on the fishery. Testing activities using explosives that occur within a fishery area and during a fishing season would require exclusive use of an area to safely conduct the activity. If the activity is scheduled to occur where target species are typically found and during a short fishing season, then significant impacts could occur.

Potential impacts on commercial and recreational fishing, and tourism and related forms of recreation are reduced by alerting the public of upcoming activities. When testing activities are scheduled that require specific areas to be free of non-participating vessels and aircraft, the military requests that the USCG issues NTMs and the FAA issues NOTAM to allow the public to plan accordingly and ultimately to ensure the safety of military personnel and the public. Notifications are provided on a weekly basis of upcoming closures, often forecasting several weeks in advance, in Dabob Bay and the Keyport Range site. A daily alert is also issued when an activity is planned. Advance notice of testing activities should allow fishers and other boaters to plan ahead of time to visit another area during the closure. Restrictions on access to certain areas due to planned testing activities may inconvenience fishers and other boaters or may result in a loss of revenue for businesses that are not able to access a popular area during a closure. When necessary, water space and airspace used by the military are restricted for short periods of time (typically on the order of hours) to allow a testing activity to be conducted with minimal potential for interruptions and risks to public safety. Once the activity is complete, the ocean or airspace is available for use by the public, except for areas where a permanent danger zone or restricted area has previously been designated (e.g., Dabob Bay restricted area; see 33 CFR 334.1260).

Furthermore, the military follows standard operating procedures to visually scan an area to ensure that non-participants (i.e., civilian vessels and aircraft) are not present. If non-participants are present, the military delays, moves, or postpones the activity. Refer to Section 2.3.3 (Standard Operating Procedures) for additional information on standard operating procedures. Appendix A (Navy Activities Descriptions) lists standard operating procedures that are implemented for each activity.

There has been no appreciable change to the existing environmental conditions as described in the 2015 NWTT Final EIS/OEIS, and the results of the analysis of impacts from limitations on accessibility to the ocean and airspace on transportation and shipping, commercial and recreational fishing, and tourism and related forms of recreation, as summarized in this section, would remain negligible. As stated in the 2015 NWTT Final EIS/OEIS and summarized in this section, because the potential impacts on accessibility from the proposed testing activities under Alternative 1 would remain negligible, there would be no disproportionately high and adverse human health or environmental effects on any minority populations and low-income populations or disproportionately high environmental health risks or safety risks to children.

3.12.3.1.2 Impacts on Accessibility Under Alternative 2

3.12.3.1.2.1 Impacts on Accessibility Under Alternative 2 for Training Activities

Under Alternative 2, the number of proposed training activities involving the movement of vessels or the use of in-water devices would increase compared with Alternative 1 and in the 2015 NWTT Final EIS/OEIS (Table 3.0-12 and Table 3.0-13). Activities that include vessel movements would increase by 9 percent in the Offshore Area and 25 percent in the Inland Waters compared with totals under Alternative 1. As described in Section 3.12.2.1.1.2 (Inland Waters), Navy vessel movements made up less than 1 percent of all vessel movements in the Inland Waters in 2018. The change in the number of vessel movements under Alternative 2 would not appreciably change that percentage.

There would also be a slight increase of 1 percent in the use of in-water devices in the Offshore Area and 24 percent in the Inland Waters compared with Alternative 1 (Table 3.0 13). The increases are similar compared with ongoing activities, given that the number of activities that involve vessel movement and in-water devices is only slightly less under Alternative 1 than it is in ongoing activities. The activities would occur in the same locations and in a similar manner as analyzed previously.

Activities with aircraft movements in the Offshore Area would increase by 13 percent (from about 6,300 to 7,100 annually) under Alternative 2 compared with the number of events proposed in the 2015 NWTT Final EIS/OEIS (Table 3.0-11). Activities with aircraft movements would increase by about 100 events annually compared with the number of events under Alternative 1. Training activities using aircraft are primarily conducted in offshore warning areas, which do not overlap with commercial airways (Figure 3.12-4), with the exception of aircraft activities occurring in the Olympic MOA. The Olympic MOA overlaps airway route T257 and the Olympic ATCAA overlaps airway routes J54 and J501. Activities with aircraft movements in the Inland Waters area would increase to 165 compared with 100 ongoing events and 143 events under Alternative 1. Relatively few events involving aircraft movements would occur in the Inland Waters area, consistent with the ongoing level of activity. Impacts on accessibility, if any were to occur, would likely temporarily affect general aviation and other small aircraft flying over the Inland Waters and Olympic Peninsula (Figure 3.12-5). Given the limited increase, potential impacts on general aviation and other small aircraft flying over the Inland Waters and Olympic Peninsula would be consistent with the analysis and conclusions presented in the 2015 NWTT Final EIS/OEIS. As described in Section 3.12.2.1.2.2 (Inland Waters), Navy air traffic made up 6.2 percent of all air traffic in Washington State in 2018. The change in the number of aircraft movements under Alternative 2 would not appreciably change that percentage. The slight increases in training events including vessel movements, aircraft movements, and in-water devices would have the same or similar impacts on socioeconomic resources described in Section 3.12.3.1.1.1 for Alternative 1.

No impacts on commercial transportation and shipping are anticipated, because major shipping routes and airways are well defined, and training activities would avoid those areas. Potential impacts on commercial and recreational fishing, and tourism and related forms of recreation are reduced by alerting the public of upcoming activities, as described in Section 3.12.3.1.1.1 for Alternative 1. The results of the analysis of impacts from limitations on accessibility to the ocean and airspace on transportation and shipping, commercial and recreational fishing, and tourism and related forms of recreation are the same as described in Section 3.12.3.1.1.1 for Alternative 1.

As stated in the 2015 NWTT Final EIS/OEIS and summarized in this section, because the potential impacts on accessibility from the proposed training activities under Alternative 2 would remain negligible, there would be no disproportionately high and adverse human health or environmental effects on any minority populations and low-income populations or disproportionately high environmental health risks or safety risks to children.

3.12.3.1.2.2 Impacts on Accessibility Under Alternative 2 for Testing Activities

Under Alternative 2, the number of proposed testing activities involving the movement of vessels or the use of in-water devices would increase compared with Alternative 1 and totals in the 2015 NWTT Final EIS/OEIS (Table 3.0-12 and Table 3.0-13). Activities that include vessel movements would increase by 4 percent in the Offshore Area, 12 percent in the Inland Waters, and 22 percent in Western Behm Canal compared with totals under Alternative 1. As described in Section 3.12.2.1.1.2 (Inland Waters), Navy vessel movements made up less than 1 percent of all vessel movements in the Inland Waters in 2018. The change in the number of vessel movements under Alternative 2 would not appreciably change that percentage.

There would also be a slight increase of 4 percent in the use of in-water devices in the Offshore Area and also in the Inland Waters (no increase in Western Behm Canal) compared with Alternative 1 (Table 3.0-13). The increases are even greater compared with ongoing activities, given that the number of activities that involve vessel movement and in-water devices is greater under Alternative 1 than it is in ongoing activities. Nearly all activities would occur in the same locations and in a similar manner as analyzed previously. One exception is the Mine Countermeasure and Neutralization activity, which was not analyzed in the 2015 NWTT Final EIS/OEIS. As under Alternative 1, this activity would use explosives two times per year and last between 1 and 10 days each time the activity is conducted. The use of explosives would occur no closer than 3 NM from shore (all other activities using explosives would occur more than 50 NM from shore). While other activities using explosives are unlikely to impact fisheries, a Mine Countermeasure and Neutralization event has the potential to disrupt commercial and recreation fishing activities and offshore tourism (e.g., charter fishing) given that it would require a temporary closure closer to shore. The USCG would issue an NTM in advance of the closure to alert fishers and other boaters of the upcoming event, as is done with other activities. The Mine Countermeasure and Neutralization activity would not occur over hard bottom substrate, reducing or eliminating potential impacts on fisheries that target species which rely on hard bottom habitat.

Testing activities using aircraft are primarily conducted in offshore warning areas, which do not overlap with commercial airways (Figure 3.12-4). Testing activities involving aircraft movements in the Offshore Area would increase from 113 to 260 compared with the number of events proposed in the 2015 NWTT Final EIS/OEIS and would be about the same as under Alternative 1 (Table 3.0-11). Testing activities with aircraft would decrease in the Inland Waters from 456 ongoing events to 61 events under Alternative 2, and would remain the same in Western Behm Canal (4 annual events). Potential impacts on general aviation and other small aircraft flying over the Inland Waters area and Olympic Peninsula would be consistent with analysis and conclusions under Alternative 1 and less likely to occur than during ongoing activities given the decrease in the number of annual events. As described in Section 3.12.2.1.2.2 (Inland Waters), Navy air traffic made up 6.2 percent of all air traffic in Washington State in 2018. The change in the number of aircraft movements under Alternative 2 would not appreciably change that percentage. The slight increases in testing activities including vessel movements, aircraft movements, and in-water devices would have the same impacts on socioeconomic resources described in Section 3.12.3.1.1.2 for Alternative 1.

No impacts on commercial transportation and shipping are anticipated, because major shipping routes and airways are well defined, and testing activities would avoid those areas. As noted in Section 3.12.2.2.1 (Offshore Area), commercial and recreational fisheries occur in the Offshore Area within specific areas along the coastline and typically during specific times of the year, depending on the fishery. Testing activities using explosives that occur within a fishery area and during a fishing season would require exclusive use of an area to safely conduct the activity. If the activity is scheduled to occur where target species are typically found and during a short fishing season, then significant impacts could occur.

Potential impacts on commercial and recreational fishing, and tourism and related forms of recreation are reduced by alerting the public of upcoming activities, as described in Section 3.12.3.1.1.2 for Alternative 1. The results of the analysis of impacts from limitations on accessibility to the ocean and airspace on transportation and shipping, commercial and recreational fishing, and tourism and related forms of recreation are the same as described in Section 3.12.3.1.1.2 for Alternative 1.

As stated in the 2015 NWTT Final EIS/OEIS and summarized in this section, because the potential impacts on accessibility from the proposed testing activities under Alternative 2 would remain negligible, there would be no disproportionately high and adverse human health or environmental effects on any minority populations and low-income populations or disproportionately high environmental health risks or safety risks to children.

3.12.3.1.3 Impacts on Accessibility Under the No Action Alternative

Under the No Action Alternative, the proposed training and testing activities would not occur. Limits on accessibility to the ocean and airspace as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing training and testing activities would result in fewer limits on accessibility within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for limiting accessibility by the public, but would not measurably improve accessibility to the ocean and airspace in the Study Area.

The same limitations on accessing portions of the Study Area designated as danger zones, restricted areas, and warning areas as described in the 2015 NWTT Final EIS/OEIS and in the CFR would still apply. Refer to 33 CFR (Navigation and Navigable Waters) Part 334 (Danger Zone and Restricted Area Regulations), 33 CFR 165.1401 (Safety Zones), 14 CFR 73.1 (Special Use Airspace) for specific regulations regarding these ocean areas and airspace.

Not conducting the proposed at-sea training and testing activities may have negative impacts on the socioeconomic resources of coastal areas in Washington State, Oregon, and Northern California. Communities located along inland waters in Washington State and southeast Alaska may also be impacted. The number of jobs and types of jobs, particularly in coastal communities, that depend on the support of Navy personnel residing or transiting through those communities may be impacted (see the beginning of Section 3.12.2 [Affected Environment] for a brief summary on the Navy's contribution to the economy). The Navy and Navy personnel are an important and often stabilizing contributor to the local and regional economies, and a reduced Navy presence could negatively impact certain businesses. For example, vessels and associated equipment used specifically for training and testing activities would no longer be needed if all training and testing ceased. Consequently, the civilian and Navy personnel supporting those activities may be relocated, reassigned, or have to find other employment. The secondary effects from reducing the number of personnel who support at-sea training and testing activities could include a decline in revenue for local businesses frequented by Navy personnel and their families, such as businesses in the food services, retail, and housing sectors. While more complex studies at the local level would need to be conducted to quantify potential socioeconomic impacts from ceasing training and testing activities, it is likely that many coastal communities with a Navy presence would be impacted.

3.12.3.2 Airborne Acoustics

Loud noises generated from military training and testing activities such as weapons firing, in-air explosions, and transiting aircraft have the potential to disrupt recreational activities such as wildlife viewing, boating, fishing, and scuba diving. In addition to local residents, tourists participate in these activities in the Study Area. Encountering loud noises, particularly those that occur suddenly and nearby, could interfere with the enjoyment of several types of recreational activities. Weapons firing and explosives use would only occur in offshore warning areas (i.e., W-237) far from the coast and far from activities occurring along the coast. Disturbance from continuous albeit less intense noises could also affect the enjoyment of an activity.

Airborne acoustics from military activities would occur over short periods of time (hours) and only when weapons firing and in-air explosions occur (offshore) or as aircraft transit through an area, including in the Olympic MOA, which overlies the western portion of the Olympic Peninsula. Military training and testing activities involving weapons firing and in-air explosions would only occur when the military can confirm the area is clear of non-participants (e.g., a recreational vessel). This procedure further reduces the likelihood that noise from these activities, which are taking place far from non-participants, would disturb residents or tourists engaged in recreational activities on the water. Activities involving weapons firing and explosives are not conducted in the Olympic MOA. Furthermore, with the exception of Air Combat Maneuver and Electronic Warfare Training – Aircraft activities occurring in the Olympic MOA, most naval training and testing activities involving aircraft occur more the 12 NM from shore and those that occur closer to shore are typically at least 3 NM offshore. Recreational activities are largely conducted within a few miles of shore, which would minimize any overlap and disturbance from noises generated far offshore. Refer to Tables 2.5-1, 2.5-2, and 2.5-3 for information on the locations of Navy activities that use aircraft or munitions. Detailed information on each training and testing activity, including location and the types of stressors associated with the activity (e.g., airborne acoustics), is presented in Appendix A (Navy Activities Descriptions).

The analysis presented in the 2015 NWTT Final EIS/OEIS concluded that training and testing activities could have moderate, intermittent impacts from airborne noise (referred to as airborne acoustics in this

Supplemental) on socioeconomic resources, depending on the proximity of the Navy activity to the resource participant. Explosive munitions and large-caliber, non-explosive munitions are the primary sources of weapons-related noise. All training and testing activities using explosives in the Offshore area would occur at least 50 NM from shore with the exception of the Mine Countermeasure and Neutralization testing activity, which would only occur up to two times per year and at least 3 NM from shore. Training and testing activities using large-caliber, non-explosive munitions would take place at least 20 NM from shore. Since the most intense concentration of offshore socioeconomic activities is within 3 NM of the coast, airborne acoustics from training and testing activities using large-caliber weapons and explosive munitions would not have a significant potential to impact socioeconomic resources. Refer to Section 3.0.3.1.4 (Weapons Noise) for a detailed discussion of the types of airborne acoustics generated by weapons use.

Airborne acoustics generated by aircraft overflights are the type of acoustic disturbance most likely to be encountered by those participating in activities related to socioeconomic resources, because military aircraft transiting to and from training and testing airspace areas often need to fly near populated areas, including the Olympic Peninsula, or need to conduct activities in the Olympic MOA. The two activities mentioned above, Air Combat Maneuver and Electronic Warfare Training – Aircraft, are the most frequently conducted activities in the Olympic MOA. In general, airborne acoustics from aircraft overflights only generate an acoustic disturbance at the moment it is heard, and noise from an overflight disturbance would only accumulate for the duration of a specific event. For example, as described in Appendix J (Airspace Noise Analysis for the Olympic Military Operations Area), multiple aircraft flying above the Olympic Peninsula would generate, on average, relatively low day-night average sound levels (37 dBA)[2] noise, because more than 95 percent of flight time would occur more than 10,000 ft. above MSL, placing the source of the noise, an aircraft, and the receptor, a person on the ground, thousands of feet apart. In a worst case scenario based on airspace restrictions with an individual located at an elevation of 4,000–4,500 ft. (approximately 0.09 percent of the land area under the Olympic MOA) and an EA-18G flying directly over that individual at an altitude of 6,000 MSL, the analysis shows that the maximum noise level would be 100.6 dBA, and noise at this level would last for an average of 0.12 second per flight. Experiencing aircraft noise even briefly at this level is unlikely to occur for a number of reasons. Most of the terrain beneath the Olympic MOA (more than 77 percent) is at an elevation of 1,000 ft. or less, thereby creating a buffer of at least 5,000 ft. between an individual on the ground and an aircraft at the lowest permissible altitude (6,000 ft. MSL). Additionally, the highest terrain areas on the Olympic peninsula are extremely remote, where few people are likely to be present. For more than 77 percent of the area, the maximum noise level anticipated would be 84.4 dBA. Aircraft flying at higher altitudes or not directly over an individual on the ground would generate less intense sound at ground level (i.e., the distance between the aircraft and the individual would be greater allowing for greater dissipation or spreading of sound). An aircraft entering or exiting the Olympic MOA does so at specific points (see Figure 3.12-5) and at a minimum altitude of 15,000 ft. MSL for entry and 14,000 ft. MSL for exit. At a ground elevation of 4,500 ft. MSL, the maximum anticipated noise level at the entry and exit points for any aircraft would be approximately 58.2 dBA. At sea level (i.e., 0 ft. MSL)

[2] dBA or A-weighted decibels is a measure of sound level (in decibels) that emphasizes the range of frequencies that human hearing is most sensitive to. A-weighting best replicates human hearing and is the most appropriate metric for the assessment of annoyance from aircraft noise. A-weighted sound levels form the basis of the day-night average sound level (DNL) metric, which is the best available metric to relate aircraft noise to long-term annoyance. Refer to Appendix J (Airspace Noise Analysis for the Olympic Military Operations Area) for a more detailed description of sound level metrics.

the maximum anticipated noise level would be approximately 51.1 dBA. See Appendix J (Airspace Noise Analysis for the Olympic Military Operations Area) for more details.

The disturbance from a single aircraft transiting over land or nearshore areas to conduct a training or testing activity in the Offshore Area would be brief, lasting only seconds. Individuals on the ground may be disturbed depending on a number of factors that can be variable or somewhat subjective (e.g., sensitivity to disturbance, proximity to other sources of noise) and difficult to quantify. Nevertheless, occasional disturbances from military aircraft have been occurring in this area for several decades and are not expected to have lasting impacts on broader socioeconomic resources (i.e., commercial transportation and shipping, air traffic, commercial and recreational fishing, and tourism and recreation). Aircraft movements that occur more than 3 NM from the coast are less likely to impact socioeconomic resources, and aircraft that fly at higher altitudes while over land and nearshore areas are also less likely to cause a significant impact on socioeconomic resources. Section 3.0.3.1.3 (Aircraft Noise) in this Supplemental provides a detailed discussion of the types of airborne acoustics generated by military aircraft.

In addition to the broader socioeconomic resources listed in the paragraph above, the less quantifiable social resource described generally as the enjoyment of a natural setting, like the Olympic National Park, may also be impacted by airborne acoustics. While noise levels can be measured and noise sources can be compared to each other using well-established metrics, the perception of a noise by individuals and their reaction to the same noise heard simultaneously may vary widely. While some visitors to a natural setting like the Olympic National Park may be disturbed by an aircraft overflight, others may not register the event or, if they do notice it, may not consider it to be significant.

In 2010, the National Park Service conducted an acoustic monitoring study within the Olympic National Park, measuring both natural sounds and noise generate by human activities (National Park Service, 2016). Noise sampling took place at five sites, with three of those sites (Hoh River Trail, Third Beach Trail, and Lake Ozette) beneath the Olympic MOA. The purpose of the noise monitoring effort was to characterize existing sound levels in the park and to use the data to estimate a natural ambient acoustic baseline in the park from sounds collected at the five sites, as well as identify the sources of recorded sounds. The study reported the percentage of time that measured noise levels exceeded four noise thresholds indicative of disturbance at each of the measurement locations for the winter season. The fourth and highest level, 60 dBA, provided a basis for estimating impacts on normal voice communications at 3 ft. Noise levels at Hoh River Trail and Third Beach Trail exceeded 60 dBA less than 1 percent of the time during daytime and nighttime monitoring. Noise levels at Lake Ozette exceeded 60 dBA just 1.2 percent of the time in daytime measurements and 1.4 percent of the time in nighttime measurements (National Park Service, 2016).

The data also show that natural sounds dominated between 7 a.m. and 7 p.m. at each of the three sites beneath the Olympic MOA. At the Hoh River Trail site, natural sounds were audible 83 percent of the time. Sounds from aircraft, including fixed-wing aircraft and helicopters, were audible 12 percent of the time, and other human sounds were audible 5 percent of the time. At Third Beach Trail, natural sounds were audible 91 percent of the time, and sounds from aircraft and other human activities were audible 5 percent and 4 percent of the time, respectively. At Lake Ozette, the most remote site, natural sounds were recorded 93 percent of the time. Aircraft sounds were audible 7 percent of the time and other human sounds less than 1 percent of the time.

Lake Crescent, which is located approximately 20 km east of the eastern edge of the Olympic MOA, was the site most affected by human sounds (primarily vehicle noise from the highway). Human-generated sounds dominated the sound spectrum 58 percent of the time. Noise from high-altitude jets were audible 7.2 percent of the time, and lower-altitude fixed-wing aircraft and helicopters were audible 0.3 percent of the time. Naturally occurring sounds were louder than human-generated sounds 35 percent of the time. (National Park Service, 2016). The data for the National Park Service study were collected in 2010 but are considered relevant to the Proposed Action, because the tempo of Navy training and testing activities involving aircraft is generally consistent with the baseline data, as presented in Section J.5.1 (Reference Missions) of Appendix J (Airspace Noise Analysis for the Olympic Military Operations Area).

The Navy also reviewed a recent study of aircraft noise on the Olympic Peninsula (Kuehne, 2019). The results of the study, which attempted to distinguish noise produced by Navy aircraft from noise produced by other (e.g., commercial) aircraft), was based on sound recordings at three sites on the Olympic Peninsula (two inside the MOA and one just east of the MOA). The study relied on human interpretation of the recordings to identify audible aircraft events and to classify events as military or commercial. The Navy's approach to analyzing noise impacts from aircraft operating in a MOA is to apply one of the FAA-approved models rather than relying on site-specific monitoring, which is not an FAA-approved methodology for detailed noise analysis. The noise model used in the Navy's analysis, MR_Nmap, is approved by the FAA for these types of analyses. Noise modeling allows the prediction of noise levels in support of analyzing impacts from proposed activities, such as the proposed training and testing activities. Noise modeling is the preferred and most common method of analyzing noise in the military environment. Short-term monitoring studies, such as the one conducted by Kuehne (2019), can provide a snapshot of noise detections at a specific site (or sites), but are limited in their ability to predict how future activities would impact a larger region over the long term.

In general, noise intensity or loudness decreases with distance from the sound source. In the case of aircraft overflights, noise levels perceived on the ground are expected to be higher at higher elevations. This correlation is supported by the results presented in the Navy's noise study in Appendix J (Airspace Noise Analysis for the Olympic Military Operations Area). A scenario similar to the examples described above but taken from the study illustrates how noise may be perceived by a visitor to the park. Suppose a hiker is beneath the Olympic MOA at a terrain height of 300 ft. (a likely situation given that 45 percent of the Olympic MOA overlays terrain between 0 and 500 ft.). In a worst-case scenario, if an EA-18G flew directly over the hiker at full power and at the lowest permissible altitude (6,000 ft. MSL), the hiker would be exposed to noise at 82.9 dBA. That is similar to the sound level the hiker might experience 5 meters from a busy roadway. However, as noted above, the sound of the jet would be at this intensity for only an instant as the jet flies directly overhead, decreasing rapidly as the jet flies away from the hiker. If the jet did not fly directly over the hiker (a more likely occurrence), then the highest noise experienced by the hiker would be less than 82.9 dBA, dissipating with increasing distance between the jet and the hiker.

While higher elevations in the Olympic National Park would receive higher noise levels, the areas with the highest elevations are located in the eastern half of the park; the MOA only overlays the western portion of the park, and in total, only approximately 27 percent of the entire park. Based on the data and analysis presented in the National Park Service noise study, aircraft overflight noise is only a very small portion of the sounds detectable in the Olympic National Park. An individual visitor may still be disturbed by an aircraft overflight; however, for the vast majority of the time, visitors are exposed to naturally occurring sounds, and to a lesser extent, noise from other human sources not associated with the Proposed Action, including noise from commercial and general aviation aircraft.

Military aircraft conducting training activities in the Olympic MOA would contribute to cumulative impacts from airborne noise on visitors to the Olympic National Park and on the Olympic Peninsula; however, the majority of aircraft overflights would continue to be from civilian aircraft, specifically commercial air carriers and general aviation aircraft. Flight data from the FAA collected from February of 2018 through February of 2019 in three regions over the Olympic Peninsula (a transition area, Olympic National Park, and the Olympic Peninsula and Puget Sound) indicate that the military conducts approximately 7 percent of all flights in the transition area east of the Olympic National Park where military aircraft enter and exit the Olympic MOA. Commercial air carriers make up approximately 71 percent and general aviation aircraft make up approximately 22 percent of flights in the transition area. Over the Olympic National Park, military flights make up approximately 25 percent of all flights, air carriers make up approximately 67 percent, and general aviation aircraft make up approximately 8 percent of all flights. Over the Olympic Peninsula and Puget Sound, military flights make up approximately 6 percent of all flights, air carriers make up approximately 74 percent, and general aviation aircraft make up approximately 20 percent of all flights.

While an increase in military flights over the Olympic Peninsula would contribute to impacts from airborne noise, 75 to 94 percent of flights over the region are conducted by commercial air carrier aircraft and general aviation aircraft. A proposed 13 percent increase in military flights would not substantially change the proportion of military flights over the Olympic Peninsula or substantially increase the potential for noise impacts on the Olympic Peninsula, including in the Olympic National Park.

Refer to Section 3.12.3.3 (Aircraft and Vessel Noise) in the 2015 NWTT Final EIS/OEIS for more information on the potential impacts of airborne acoustics (airborne noise) in the Study Area. Refer to Appendix J (Airspace Noise Analysis for the Olympic Military Operations Area) for more information on noise levels that visitors to the Olympic National Park and other areas beneath the Navy's Olympic MOA could experience.

3.12.3.2.1 Impacts on Airborne Acoustics Under Alternative 1

3.12.3.2.1.1 Impacts on Airborne Acoustics Under Alternative 1 for Training Activities

Under Alternative 1, the number of annual events with aircraft movements in the Offshore Area (Table 3.0-11) would increase by 12 percent (from 6,311 to 7,047) and in the Inland Waters area would increase from 100 to 143 events. Airborne acoustics are not expected to impact commercial transportation and shipping, because these types of activities are generally not sensitive to occasional noise from aircraft overflights, and shipping vessels would not be delayed by airborne acoustics. As described in Section 3.12.2.1.2.2 (Inland Waters), Navy air traffic made up 6.2 percent of all air traffic in Washington State in 2018. The change in the number of aircraft movements under Alternative 1 would not appreciably change that percentage. A slight increase in the number of activities with aircraft movements in the Inland Waters would increase potential impacts on commercial and recreational fishing, and tourism and related forms of recreation occurring inland and on adjacent land areas. However, these changes would not appreciably change the existing environmental conditions as presented in the 2015 NWTT Final EIS/OEIS, and the results of the analysis of impacts from airborne acoustics on commercial and recreational fishing, and tourism and related forms of recreation remain valid.

Aircraft overflights from Air Combat Maneuver training activities and Electronic Warfare Training – Aircraft activities occurring in the Olympic MOA have the potential to disturb land-based recreational and tourism activities (e.g., hiking) in the Olympic National Park and other areas on the Olympic Peninsula. While airborne acoustics from aircraft overflights are likely to be heard and may disturb some visitors to Olympic National Park, economic indicators representing tourism and recreational activities in the region, and annual visitation to the Park, have been trending upwards in recent years (although there was a decrease in visitation to the Park of almost 9 percent between 2017 and 2018) (see Section 3.12.2.3.1, Offshore Area). The Navy has been conducting aircraft activities in the Olympic MOA for decades, and those same economic indicators have been steadily increasing over much of that time (National Ocean Economics Program, 2018b, 2018c).

From 2015 through 2017, the average annual number of Navy EA-18G aircraft transits to and from the Olympic MOA was 2,224. Under Alternative 1, EA-18G transits to and from the Olympic MOA are proposed to increase by 300 per year, or 13 percent. This proposed increase equates to, on average, between one and two additional transits per day over a calendar year (excluding weekends and holidays).

As described in detail in the Airspace Noise Analysis for the Olympic Military Operations Area (Appendix J), visitors to the National Park, National Forest, and wilderness areas on the Olympic Peninsula would potentially be affected by and respond to individual flyover events by aircraft transiting to and from NAS Whidbey Island. The highest elevations along the flight transit routes between NAS Whidbey Island and the Olympic MOA range from approximately 4,500 to 8,000 ft. MSL. An EA-18G flying at an altitude of 10,000 ft. MSL directly over an 8,000 ft. peak could produce maximum noise levels of up to 97.2 dBA at ground level (i.e., at a distance of 2,000 ft.) (see Table J-17 of Appendix J, Airspace Noise Analysis for the Olympic Military Operations Area). Maximum noise levels would be lower at elevations below the highest peaks and ridgelines and where the aircraft is not directly overhead. The noise level also depends on the engine power used by the aircraft at the time of overflight. At ground level elevations near sea level (i.e., 0 ft. MSL), where the distance between the aircraft at an altitude of 10,000 ft. MSL and a receptor is approximately 10,000 ft., the maximum noise level would be 72.7 dBA (see Table J-17 of Appendix J, Airspace Noise Analysis for the Olympic Military Operations Area). Although instantaneous noise from overflights during transit would likely be higher than other noise sources on the ground, averaged over the day they would not be substantially above the range of commonly heard natural sounds in the Olympic National Park or nearby areas (National Park Service, 2016). At the Hurricane Ridge site (elevation 5,242 ft. above ground level), which is the closest site to the YETII navigation point, the daytime median ambient noise level was 24.4 dBA. After removing noise from all aircraft overflights, the median ambient noise level was reduced to 23.4 dBA, and noise from only natural sounds was measured at 23.1 dBA. To reduce the overflight noise in the Olympic National Park and surrounding areas, aircraft entering and exiting the MOA at the reporting points will transit in designated flight routes to the greatest extent practicable. For safety reasons, such as conflicts with other aircraft, aircraft preparing to enter or exit the MOA to conduct a training event may be directed off their flight path by FAA air traffic controllers.

Visitors to the National Park, National Forest, and wilderness areas on weekends or at night will rarely hear an EA-18G or other aircraft, because training flights typically occur Monday through Friday and during daylight hours. Visitors vacationing a week or more in the national park and other nearby lodging or camping areas may experience aircraft overflight noise on multiple occasions during weekdays while they are staying the park. As noted in the discussion above, the level of disturbance from multiple aircraft overflights would be variable and dependent on the individual's sensitivity to aircraft noise and circumstances on the ground, such as the presence of other noise sources, which are difficult to predict and quantify. An individual seeking a quiet, peaceful, and remote location away from other visitors and sources of anthropogenic noise is more likely to be disturbed by aircraft overflight noise than individuals camping or hiking in a group or visitors in a more heavily populated area of the park where other noise sources are present (e.g., road noise). As noted in Section 3.12.2.3.1 (Offshore Area), with the exception of camp areas in the Washington Islands Wilderness Area along the Pacific coast, the majority of camp areas in the Olympic National Park and other wilderness areas are located east of the Olympic MOA. Noise from aircraft conducting training activities in the MOA would not be directly over most camping areas, and noise experienced on the ground would be lower than peak levels discussed above in those areas. Aircraft conducting activities in the MOA would potentially fly directly over camp areas located in the Washington Islands Wilderness Area. Individuals in this area may experience multiple direct overflights when an activity is occurring in the northern half of the MOA. However, peak noise levels would not be experienced in coastal areas, even with a direct overflight, because the lower elevation of the coastal areas effectively increases the distance between an individual on the ground and an aircraft flying overhead.

While the perception of overflight noise and the level of disturbance experienced may vary based on the individual and circumstances on the ground at the time of the overflight, the metrics quantifying the level of noise received at ground level support the following conclusions: (1) the highest noise levels would be experienced only at the highest elevations in the park, which are not located beneath the MOA; (2) natural sounds are the predominantly occurring sounds in the Olympic National Park; and (3) peak noise levels would be brief (lasting only seconds) and would only occur when an individual is directly under the flight path of the aircraft.

For a more detailed analysis of airborne acoustics on the Olympic Peninsula, refer to Appendix J (Airspace Noise Analysis for the Olympic Military Operations Area), which concludes that noise exposure within the Olympic MOA and W-237, including noise from aircraft transiting from NAS Whidbey, is within the Department of Defense Noise Zone 1, with DNL below 65 dBA for the entire area studied. While use of the DNL metric to assess potential impacts to recreational or other experiences on the Olympic Peninsula does not capture the potential for annoyance during a relatively short (several hours or overnight) visit to a park or recreational area, it does provide a means to quantify and compare overall impacts resulting from average annual noise exposure at parks and recreational areas that were not included as points of interest in the noise analysis. Instantaneous or very brief noise levels greater than 65 dBA may be encountered in relatively small portions of the land area underlying the Olympic MOA. The highest noise levels (up to 100.6 dBA) would be encountered at elevations above 4,000 ft. MSL, which is less than 1 percent of the total area of the Park. These areas could be exposed to the highest noise levels for periods of 1 second or less per aircraft sortie. Very few, if any, visitors to the Park are likely to be at locations above 4,000 ft. MSL at the same time an aircraft flies directly overhead, exposing the visitor to the highest predicted noise levels.

As concluded in Section 3.12.3.3 (Aircraft and Vessel Noise) in the 2015 NWTT Final EIS/OEIS and summarized above in Section 3.12.3.2 (Airborne Acoustics), airborne acoustics (airborne noise) generated by training activities would be transient, of short duration, and localized at a particular location and for a particular receptor in that location. For most activities, aircraft and airborne noise would be far enough from areas popular with tourists and residents (i.e., more than 3 NM from shore) to have a negligible impact on people either on the water or on land such that socioeconomic resources (e.g., tourism and related industries) would not be impacted.

Some visitors to areas underlying the Olympic MOA (e.g., visitors to the Olympic National Park) may occasionally experience and be disturbed by aircraft overflight noise. While this may impact the enjoyment of the park or other outdoor areas for some people, analysis summarized above and described in Appendix J (Airspace Noise Analysis for the Olympic Military Operations Area) indicates that the disturbance would be transient, lasting only a few seconds per overflight at a particular location, and exceed 60 dBA less than 2 percent of the time during daytime and nighttime hours. For the majority of the daytime and nighttime, natural sounds are far more prevalent than anthropogenic sounds in the areas of the National Park beneath the Olympic MOA. Considering that trends in economic indicators have historically increased and are projected to continue to increase, disturbances from airborne acoustics on the Olympic Peninsula are expected to have a negligible impact on socioeconomic resources in the Study Area.

As stated in the 2015 NWTT Final EIS/OEIS and summarized in this section, because the potential impacts on socioeconomic resources from airborne acoustics under Alternative 1 would remain negligible, there would be no disproportionately high and adverse human health or environmental effects on any minority populations and low-income populations or disproportionately high environmental health risks or safety risks to children.

3.12.3.2.1.2 Impacts on Airborne Acoustics Under Alternative 1 for Testing Activities

Under Alternative 1, testing activities involving aircraft movements in the Offshore Area would increase from 113 to 258 events, decrease in the Inland Waters from 456 to 61 events, and would remain at 4 annual events in Western Behm Canal (Table 3.0-11). Airborne acoustics are not expected to impact commercial transportation and shipping, because these types of activities are generally not sensitive to occasional noise from aircraft overflights, and commercial shipping vessels would not be delayed by airborne acoustics. As described in Section 3.12.2.1.2.2 (Inland Waters), Navy air traffic made up 6.2 percent of all air traffic in Washington State in 2018. The change in the number of aircraft movements under Alternative 1 would not appreciably change that percentage.

Aircraft movements in the Offshore Area, with the exception of the Olympic MOA, are primarily conducted in offshore warning areas far enough from people and areas popular with tourists (e.g., more than 3 NM from shore) to have a negligible impact on most recreation and tourism-related activities. The majority of aircraft overflights in the Inland Waters area are from aircraft transiting to the Offshore Area and activities occurring in the Olympic MOA (see Tables 2.5-2 and 2.5-3). In spite of increases in some aircraft movements, airborne acoustics from aircraft overflights would not substantially increase potential impacts on commercial and recreational fishing, and tourism and related forms of recreation, because these changes would not appreciably change the existing environmental conditions as presented in the 2015 NWTT Final EIS/OEIS. As summarized in Section 3.12.3.2 (Airborne Acoustics) and in Section 3.12.3.3 (Aircraft and Vessel Noise) in the 2015 NWTT Final EIS/OEIS, airborne acoustics (noise) generated by testing activities would be temporary, of short duration, and localized.

Some visitors to areas underlying the Olympic MOA (e.g., Olympic National Park) may occasionally experience aircraft overflight noise. While this may impact the enjoyment of the park or other outdoor areas for some people, analysis summarized above and described in Appendix J (Airspace Noise Analysis for the Olympic Military Operations Area) indicates that the disturbance would be transient, lasting only a few seconds per overflight, and exceed 52 dBA less than 0.3 percent of the time. For the majority of the daytime and nighttime, natural sounds are more prevalent than anthropogenic sounds in the areas of the National Park beneath the Olympic MOA. Considering that trends in economic indicators have historically increased and are projected to continue to increase, disturbances from airborne acoustics on the Olympic Peninsula are expected to have a negligible impact on socioeconomic resources in the Study Area.

3.12.3.2.2 Impacts on Airborne Acoustics Under Alternative 2

3.12.3.2.2.1 Impacts on Airborne Acoustics Under Alternative 2 for Training Activities

Under Alternative 2, activities with aircraft movements in the Offshore Area would increase by 13 percent (from about 6,311 to 7,047 annually) compared with the number of events proposed in the 2015 NWTT Final EIS/OEIS (Table 3.0-11). Activities with aircraft movements would increase by about 100 events annually compared with the number of events under Alternative 1. Training activities using aircraft are primarily conducted in offshore warning areas, which do not overlap with commercial airways (Figure 3.12-4). The Olympic MOA overlaps airway route T257 and the Olympic ATCAA overlaps airway routes J54 and J501. Activities with aircraft movements in the Inland Waters area would increase to 165 compared with 100 ongoing events and 143 events under Alternative 1. As described in Section 3.12.2.1.2.2 (Inland Waters), Navy air traffic made up 6.2 percent of all air traffic in Washington State in 2018. The change in the number of aircraft movements under Alternative 2 would not appreciably change that percentage.

Aircraft overflights from Air Combat Maneuver training activities and Electronic Warfare Training – Aircraft activities occurring in the Olympic MOA have the potential to disturb land-based recreational and tourism activities (e.g., hiking) in the Olympic National Park. Relatively few events involving aircraft movements would occur in the Inland Waters area, consistent with the ongoing level of activity. Impacts from airborne acoustics would be temporary and dependent on the perceptions and sensitivity to noise of individuals primarily on the Olympic Peninsula. While airborne acoustics from aircraft overflights are likely to be heard and may disturb some visitors to the Olympic National Park, economic indicators representing tourism and recreational activities in the region, including in the National Park, have been trending upwards in recent years and are projected to continue to increase (see Section 3.12.2.3.1, Offshore Area). The Navy has been conducting aircraft activities in the Olympic MOA for decades, and those same economic indicators have been steadily increasing over much of that time (National Ocean Economics Program, 2018b, 2018c).

For a more detailed analysis of airborne acoustics on the Olympic Peninsula, refer to Appendix J (Airspace Noise Analysis for the Olympic Military Operations Area), which concludes that noise exposure within the Olympic MOA and W-237, including noise from aircraft transiting from NAS Whidbey is within the Department of Defense Noise Zone 1, with Day-Night Average Sound Levels below 65 dBA for the entire area studied. Small portions of the land area underlying the Olympic MOA, at elevations above 4,000 ft. MSL (less than 1 percent of the total area), could be exposed to greater noise levels for periods of 1 second or less per aircraft sortie. It is unlikely that many visitors to the National Park would be at locations above 4,000 ft. when aircraft are present and be exposed to higher noise levels. Some visitors to areas underlying the Olympic MOA (e.g., Olympic National Park) may occasionally experience aircraft overflight noise. While this may impact the enjoyment of the park or other outdoor areas for some people, analysis summarized above and described in Appendix J (Airspace Noise Analysis for the Olympic Military Operations Area) indicates that the disturbance would be transient, lasting only a few seconds per overflight, and exceed 60 dBA less than 2 percent of the time during daytime and nighttime hours.

For the majority of the daytime and nighttime, natural sounds are more prevalent than anthropogenic sounds in the areas of the National Park beneath the Olympic MOA (National Park Service, 2016). Considering that trends in economic indicators have historically increased and are projected to continue to increase, disturbances from airborne acoustics on the Olympic Peninsula are expected to have a negligible impact on socioeconomic resources in the Study Area.

As concluded in Section 3.12.3.3 (Aircraft and Vessel Noise) in the 2015 NWTT Final EIS/OEIS and summarized above in Section 3.12.3.2 (Airborne Acoustics), airborne acoustics (airborne noise) generated by at-sea training activities would be temporary, of short duration, localized, and generally far enough from areas popular with tourists and residents (i.e., more than 3 NM from shore) to have a negligible impact on socioeconomic resources. Airborne acoustics are not expected to impact commercial transportation and shipping, because these types of activities are generally not sensitive to occasional noise from aircraft overflights, and shipping vessels would not be delayed by airborne acoustics. The slight increases in training activities with aircraft movements would have the same impacts on commercial and recreational fishing, and tourism and related forms of recreation described in Section 3.12.3.2.1.1 for Alternative 1.

3.12.3.2.2.2 Impacts on Airborne Acoustics Under Alternative 2 for Testing Activities

Testing activities using aircraft are primarily conducted in offshore warning areas, which do not overlap with commercial airways (Figure 3.12-4). Testing activities involving aircraft movements in the Offshore Area would increase from 113 to 260 compared with the number of events proposed in the 2015 NWTT Final EIS/OEIS and would be essentially the same as under Alternative 1. Testing activities with aircraft would decrease in the Inland Waters from 456 ongoing events to 61, and would continue to be 4 annual events in Western Behm Canal (Table 3.0-11). As described in Section 3.12.2.1.2.2 (Inland Waters), Navy air traffic made up 6.2 percent of all air traffic in Washington State in 2018. The change in the number of aircraft movements under Alternative 2 would not appreciably change that percentage.

As summarized above in Section 3.12.3.2 (Airborne Acoustics), airborne acoustics generated by testing activities would be temporary, of short duration, localized, and generally far enough from people and areas popular with tourists (e.g., more than 3 NM from shore) to have a negligible impact. Some visitors to areas underlying the Olympic MOA (e.g., Olympic National Park) may occasionally experience aircraft overflight noise. While this may impact the enjoyment of the park or other outdoor areas for some people, analysis summarized above and described in Appendix J (Airspace Noise Analysis for the Olympic Military Operations Area) indicates that the disturbance would be transient, lasting only a few seconds per overflight, and exceed 60 dBA less than 2 percent of the time during daytime and nighttime hours. For the majority of the daytime and nighttime, natural sounds are more prevalent than anthropogenic sounds in the areas of the National Park beneath the Olympic MOA (National Park Service, 2016).

For a more detailed analysis of airborne acoustics on the Olympic Peninsula, refer to Appendix J (Airspace Noise Analysis for the Olympic Military Operations Area), which concludes that noise exposure within the Olympic MOA and W-237, including noise from aircraft transiting from NAS Whidbey is within the Department of Defense Noise Zone 1, with Day Night Average Sound Levels below 65 A-weighted decibels (dBA) for the entire area studied. Considering that trends in economic indicators have historically increased and are projected to continue to increase, disturbances from airborne acoustics on the Olympic Peninsula are expected to have a negligible impact on socioeconomic resources in the Study Area.

3.12.3.2.3 Impacts on Airborne Acoustics Under the No Action Alternative

Under the No Action Alternative, the proposed training and testing activities would not occur. Disturbances from airborne acoustic stressors as listed above would not be introduced into the marine environment or over the land areas, including the Olympic Peninsula. As described in Section 3.12.2.1.2.2 (Inland Waters), Navy aircraft flights only account for approximately 6.2 percent of all air traffic in Washington State. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing training and testing activities would result in fewer disturbances from airborne acoustics within the marine environment and over the Olympic Peninsula where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen but not eliminate the potential for disturbances from airborne acoustics, because other aircraft, including commercial, general aviation, and military, use the same airspace. Ceasing training and testing with aircraft may reduce the frequency or severity of disturbances from airborne acoustics experienced by some members of the public depending on their sensitivity to aircraft overflights, but would not significantly reduce average noise levels in the Study Area.

Not conducting the proposed at-sea training and testing activities may have negative impacts on the socioeconomic resources of coastal areas in Washington State, Oregon, and Northern California. Communities located along inland waters in Washington State and southeast Alaska may also be impacted. The number of jobs and types of jobs, particularly in coastal communities, that depend on the support of Navy personnel residing or transiting through those communities may be impacted. The Navy and Navy personnel are an important and often stabilizing contributor to the local and regional economies, and a reduced Navy presence could negatively impact certain businesses. For example, vessels and associated equipment used specifically for training and testing activities would no longer be needed if all training and testing ceased. Consequently, the civilian and Navy personnel supporting those activities may be relocated, reassigned, or have to find other employment. The secondary effects from reducing the number of personnel who support at-sea training and testing activities could include a decline in revenue for local businesses frequented by Navy personnel and their families, such as businesses in the food services, retail, and housing sectors. While more complex studies at the local level would need to be conducted to quantify potential socioeconomic impacts from ceasing training and testing activities, it is likely that many coastal communities with a Navy presence would be impacted.

3.12.3.3 Physical Disturbance and Strike Stressors

The evaluation of impacts on socioeconomic resources from physical disturbance and strike stressors focuses on direct physical encounters or collisions with objects moving through the water or air (e.g., vessels, aircraft, unmanned devices, and towed devices), dropped or fired into the water (e.g., explosive and non-explosive munitions, other military expended materials, and ocean bottom deployed devices), or resting on the ocean floor (e.g., anchors, mines, targets) that may damage or encounter civilian equipment. These stressors remain the same as analyzed in the 2015 NWTT Final EIS/OEIS.

Physical encounters that damage equipment and infrastructure could disrupt the collection (e.g., of fisheries resources) and transport of products, which could impact industry revenue or operating costs. Socioeconomic resources potentially impacted by encounters with military vessels, devices, and objects include commercial transportation and shipping, commercial and recreational fishing, and tourism and related forms of recreation.

As discussed above in Section 3.12.3.1 (Accessibility [to the Ocean and the Airspace]), the majority of recreational fishing and tourism and related forms of recreation in the Study Area takes place in nearshore waters (within 3 NM from shore), and the military conducts the training and testing activities involving munitions or other expended materials farther offshore, beyond 12 NM for activities using munitions. Therefore, most recreational fishing and tourism activities would not occur in close proximity to physical disturbance and strike stressors.

Larger commercial fishing vessels are more likely to go beyond 3 NM and approach areas where the military trains and tests and may be in close proximity to physical disturbance and strike stressors. To avoid conflicts with civilian vessels, the military follows standard operating procedures to visually scan an area to ensure that non-participants (i.e., civilian vessels and aircraft) are not present. If non-participants are present, the military delays, moves, or postpones the activity. Refer to Section 2.3.3 (Standard Operating Procedures) for additional information on standard operating procedures. Appendix A (Navy Activities Descriptions) lists standard operating procedures that are implemented for each activity to ensure the safety of civilians and military personnel.

Commercial shipping vessels transport goods internationally and would be expected to transit through offshore waters en route to domestic and foreign ports. Shipping vessels follow established routes which are avoided by the military during training and testing activities, and both military and civilian vessels in proximity to each other are expected to communicate their positions. In addition, the military provides advance notification of training and testing activities to the public through NTMs and other means of communication as described in Section 3.12.3.1 (Accessibility [to the Ocean and the Airspace]) and in the 2015 NWTT Final EIS/OEIS. For these reasons, a direct strike or collision with a shipping vessel is unlikely.

Additional information of physical disturbance and strike stressors and the potential for interactions with commercial fishing vessels and gear is described in Section 3.12.3.2 (Physical Disturbance and Interactions) of the 2015 NWTT Final EIS/OEIS.

3.12.3.3.1 Impacts from Physical Disturbance and Strike Under Alternative 1

3.12.3.3.1.1 Impacts from Physical Disturbance and Strike Under Alternative 1 for Training Activities

Under Alternative 1, physical disturbance and strike stressors that may impact socioeconomic resources include (1) vessels and in-water devices, (2) aircraft, and (3) military expended materials. These three categories represent the same stressors analyzed in the 2015 NWTT Final EIS/OEIS.

As discussed in Section 3.12.3.1 (Accessibility [to the Ocean and the Airspace]), the slight increases in training activities including vessel movements, aircraft movements, and in-water devices would not appreciably change from the existing environmental conditions as presented in the 2015 NWTT Final EIS/OEIS. Under Alternative 1, the number of military materials that would be expended during training activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from Tables 3.0-14 through 3.0-22 are combined, the number of items proposed to be expended under Alternative 1 is approximately 7 percent less than ongoing activities. The largest changes are in the number of explosive and non-explosive large-caliber projectiles and medium-caliber projectiles used under Alternative 1 (Table 3.0-14 and 3.0-16). The number of non-explosive large-caliber projectiles increases by about 6,000, and the number of medium-caliber projectiles decreases by about 16,000 (Table 3.0-14). The number of explosive large-caliber projectiles and explosive medium-caliber projectiles both decrease under Alternative 1 (390 to 172 annually for large caliber and 6,368 to 550 annually for medium caliber) (Table 3.0-16). The activities that expend military materials, including munitions, would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts on socioeconomic resources from physical disturbance and strike by military expended materials would be expected to be the same or slightly reduced.

Therefore, the conclusions presented in Section 3.12.3.2 (Physical Disturbance and Interactions) of the 2015 NWTT Final EIS/OEIS remain valid. Specifically, due to implementation of the Navy's standard operating procedures and the unlikely occurrence of physical interactions between military vessels, aircraft, and expended materials with civilian vessels and aircraft, the potential for impacts on socioeconomic resources from physical disturbance and strike interactions is negligible.

3.12.3.3.1.2 Impacts from Physical Disturbance and Strike Under Alternative 1 for Testing Activities

Under Alternative 1, physical disturbance and strike stressors that may impact socioeconomic resources include (1) vessels and in-water devices, (2) aircraft, and (3) military expended materials. These three categories represent the same stressors analyzed in the 2015 NWTT Final EIS/OEIS.

As discussed in Section 3.12.3.1 (Accessibility [to the Ocean and the Airspace]), the increases in testing activities including vessel movements, aircraft movements, and in-water devices would not appreciably change from the existing environmental conditions as presented in the 2015 NWTT Final EIS/OEIS. Under Alternative 1, the number of military materials that would be expended during testing activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from (Tables 3.0-14 through 3.0-22) are combined, the number of items proposed to be expended under Alternative 1 is approximately 12 percent less than ongoing activities. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts on socioeconomic resources from physical disturbance and strike by military expended materials would be expected to be the same or slightly reduced.

Therefore, the conclusions presented in Section 3.12.3.2 (Physical Disturbance and Interactions) of the 2015 NWTT Final EIS/OEIS remain valid. Specifically, due to implementation of the Navy's standard operating procedures and the unlikely occurrence of physical interactions between military vessels, aircraft, and expended materials with civilian vessels and aircraft, the potential for impacts on socioeconomic resources from physical disturbance and strike interactions is negligible.

3.12.3.3.2 Impacts from Physical Disturbance and Strike Under Alternative 2

3.12.3.3.2.1 Impacts from Physical Disturbance and Strike Under Alternative 2 for Training Activities

Under Alternative 2, physical disturbance and strike stressors that may impact socioeconomic resources include (1) vessels and in-water devices, (2) aircraft, and (3) military expended materials. These three categories represent the same stressors analyzed in the 2015 NWTT Final EIS/OEIS.

As discussed in Section 3.12.3.1 (Accessibility [to the Ocean and the Airspace]), training activities including vessel movements, aircraft movements, and in-water devices would remain generally consistent with those proposed under Alternative 1. The number of military materials that would be expended during training activities is generally equivalent to the number proposed for use under Alternative 1. When the amount of military expended materials from Tables 3.0-14 through 3.0-22 is combined, the number of items proposed to be expended under Alternative 2 is approximately 13 percent more than under Alternative 1 (and approximately 5 percent greater than in ongoing activities). As under Alternative 1, the largest changes are in the number of explosive and non-explosive medium-caliber projectiles (Tables 3.0-14 and 3.0-16). The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts on socioeconomic resources from physical disturbance and strike by military expended materials would be expected to be the same or slightly greater.

Therefore, the conclusions presented in Section 3.12.3.2 (Physical Disturbance and Interactions) of the 2015 NWTT Final EIS/OEIS remain valid. Specifically, due to implementation of the Navy's standard operating procedures and the unlikely occurrence of physical interactions between military vessels, aircraft, and expended materials with civilian vessels and aircraft, the potential for impacts on socioeconomic resources from physical disturbance and strike interactions is negligible.

3.12.3.3.2.2 Impacts from Physical Disturbance and Strike Under Alternative 2 for Testing Activities

Under Alternative 2, physical disturbance and strike stressors that may impact socioeconomic resources include (1) vessels and in-water devices, (2) aircraft, and (3) military expended materials. These three categories represent the same stressors analyzed in the 2015 NWTT Final EIS/OEIS.

As discussed in Section 3.12.3.1 (Accessibility [to the Ocean and the Airspace]), the increases in testing activities including vessel movements, aircraft movements, and of in-water devices would remain generally consistent with those proposed under Alternative 1. The number of military materials that would be expended during testing activities is generally consistent with the number proposed for use under Alternative 1. When the amount of military expended materials from Tables 3.0-14 through 3.0-22 are combined, the number of items proposed to be expended under Alternative 2 is approximately 16 percent more than under Alternative 1. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts on socioeconomic resources from physical disturbance and strike by military expended materials would be expected to be the same or slightly greater.

Therefore, the conclusions presented in Section 3.12.3.2 (Physical Disturbance and Interactions) of the 2015 NWTT Final EIS/OEIS remain valid. Specifically, due to implementation of the Navy's standard operating procedures and the unlikely occurrence of physical interactions between military vessels, aircraft, and expended materials with civilian vessels and aircraft, the potential for impacts on socioeconomic resources from physical disturbance and strike interactions is negligible.

3.12.3.3.3 Impacts from Physical Disturbance and Strike Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Physical disturbance and strike stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing training and testing activities would result in fewer physical disturbance and strike stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for physical disturbances and strikes, but would not measurably change the number of times the public is exposed to physical disturbance and strike stressors in the Study Area.

Not conducting the proposed at-sea training and testing activities may have negative impacts on the socioeconomic resources of coastal areas in Washington State, Oregon, and Northern California. Communities located along inland waters in Washington State and southeast Alaska may also be impacted. The number of jobs and types of jobs, particularly in coastal communities, that depend on the support of Navy personnel residing or transiting through those communities may be impacted. The Navy and Navy personnel are an important and often stabilizing contributor to the local and regional economies, and a reduced Navy presence could negatively impact certain businesses. For example, vessels and associated equipment used specifically for training and testing activities would no longer be needed if all training and testing ceased. Consequently, the civilian and Navy personnel supporting those activities may be relocated, reassigned, or have to find other employment. The secondary effects from reducing the number of personnel who support at-sea training and testing activities could include a decline in revenue for local businesses frequented by Navy personnel and their families, such as businesses in the food services, retail, and housing sectors. While more complex studies at the local level would need to be conducted to quantify potential socioeconomic impacts from ceasing training and testing activities, it is likely that many coastal communities with a Navy presence would be impacted.

3.12.3.4 Secondary Impacts

Secondary stressors resulting in indirect impacts on socioeconomic resources are discussed in Section 3.12.3.4 (Secondary Impacts) of the 2015 NWTT Final EIS/OEIS. A secondary stressor, as defined in this section, is a stressor that has the potential to affect a socioeconomic resource as a result of a direct effect on another non-socioeconomic resource. For example, if a training activity has the potential to affect certain types of fish, and those same fish are part of an economically important fishery, then the effect of the stressor on those fish species could have an indirect, or secondary, effect on the socioeconomic resource of commercial fishing.

The secondary stressor of resource availability pertains to the potential for loss of fisheries resources, including some invertebrates, within the Study Area, which is relevant to commercial, recreational, and traditional fishing practices as well as tourism. Additionally, impacts on marine mammal populations would have the potential to impact revenue for whale watching businesses if a substantial number of whales were to leave the area. Analysis in Sections 3.4 (Marine Mammals), 3.8 (Marine Invertebrates), and 3.9 (Fishes) determined, however, that no population-level impacts on marine species are anticipated from the proposed training and testing activities. For these reasons, there would be no secondary impacts on commercial and recreational fishing and tourism in the Study Area.

As discussed in Section 3.12.2.1.3 (Vehicle Traffic), openings of the Hood Canal Bridge can result in long delays and back-ups at the bridge, particularly during the summer tourism season when traffic is heaviest. The delays could result in a secondary impact on recreational activities and tourism on the Olympic Peninsula if visitors are unable to reach their destinations in a timely manner and choose to cancel their activity. While a training or testing activity may require a bridge opening to allow a Navy vessel to pass through the canal, occasional openings to accommodate Navy vessels are not likely to delay a significant portion of visitors to the Olympic Peninsula. Although delayed, many people would likely continue with their plans anyway. Also, tourists and local visitors planning recreational activities on the Olympic Peninsula are more likely to do so on weekends and holidays when openings to allow the passage of Navy vessels are less likely. Therefore, secondary impacts on recreational activities and tourism would be negligible.

3.12.3.4.1 Secondary Impacts Under Alternative 1 and Alternative 2

Analyses in Sections 3.4 (Marine Mammals), 3.8 (Marine Invertebrates), and 3.9 (Fishes) concluded that population level impacts on marine species from training and testing activities under Alternative 1 and

Alternative 2 are not anticipated. Based on these conclusions, secondary impacts on transportation or shipping, commercial or recreational fishing, or tourism are not anticipated.

There has been no appreciable change to the existing environmental conditions as presented in the 2015 NWTT Final EIS/OEIS, and the results of the analysis of impacts from secondary stressors on transportation and shipping, commercial and recreational fishing, and tourism remain the same.

3.12.3.4.2 Secondary Impacts Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Secondary stressors impacting resource availability as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing training and testing activities would result in fewer secondary stressors from the availability of resources within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for secondary stressors, but would not measurably improve the availability of resources associated with secondary impacts on socioeconomic resources in the Study Area.

Not conducting the proposed at-sea training and testing activities may have negative impacts on the socioeconomic resources of coastal areas in Washington State, Oregon, and Northern California. Communities located along inland waters in Washington State and southeast Alaska may also be impacted. The number of jobs and types of jobs, particularly in coastal communities, that depend on the support of Navy personnel residing or transiting through those communities may be impacted. The Navy and Navy personnel are an important and often stabilizing contributor to the local and regional economies, and a reduced Navy presence could negatively impact certain businesses. For example, vessels and associated equipment used specifically for training and testing activities would no longer be needed if all training and testing ceased. Consequently, the civilian and Navy personnel supporting those activities may be relocated, reassigned, or have to find other employment. The secondary effects from reducing the number of personnel who support at-sea training and testing activities could include a decline in revenue for local businesses frequented by Navy personnel and their families, such as businesses in the food services, retail, and housing sectors. While more complex studies at the local level would need to be conducted to quantify potential socioeconomic impacts from ceasing training and testing activities, it is likely that many coastal communities with a Navy presence would be impacted.

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3.13 Public Health and Safety

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3.13 Public Health and Safety

3.13.1 Affected Environment

For purposes of this Supplemental Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS), the region of influence for public health and safety remains the same as was identified in Section 2.1 (Description of the Northwest Training and Testing Study Area) of the 2015 Northwest Training and Testing (NWTT) Final EIS/OEIS (the NWTT Study Area). This includes the Puget Sound; the Strait of Juan de Fuca; the Southeast Alaska Acoustic Measurement Facility; and waters off the coasts of Washington, Oregon, and northern California (see Figure 1.1-1). However, each stressor may only affect portions of the total region of influence. For this reason, each stressor will specify the portions of the Study Area that are relevant to the analysis.

3.13.1.1 Overview

3.13.1.1.1 Sea Space

Sea space accessibility within the Study Area is the same as described in Section 3.13.2.1.1 (Sea Space) in the 2015 NWTT Final EIS/OEIS. Only select areas have activity restrictions or prohibitions on access to reserve capacity for training and testing activities performed by the United States (U.S.) Department of the Navy (Navy) in accordance with Title 33 Code of Federal Regulations Part 334 (Danger Zone and Restricted Area Regulations). Danger Zones and Restricted Areas within the Study Area include the Southeast Alaska Acoustic Measurement Facility and select portions of the Puget Sound, which can be viewed on nautical charts provided by the National Oceanic and Atmospheric Administration.

The Navy continues to request the U.S. Coast Guard to publish upcoming training and testing activities in their three channels for disseminating information to the public: the Notice to Mariners (NTM) (a weekly publication that notifies mariners of changes or deficiencies in navigational aids, new maps, channel depths, naval operations, and regattas), the Local NTM (a weekly publication that is more focused on particular areas, and the Marine Broadcast NTM (a radio broadcast that provides important information from the weekly NTM publications). These notices are posted prior to performing any activities that would require activating restrictions or establishing safety zones on the water as specified in Title 33 Code of Federal Regulations Subpart 72.01, and detailed in Section 3.13.2.1.1 (Sea Space) of the 2015 NWTT Final EIS/OEIS.

3.13.1.1.2 Airspace

Airspace accessibility within the Study Area is still the same as the 2015 NWTT Final EIS/OEIS, is still relevant, and can be viewed in Section 3.13.2.1.2 (Airspace) of the 2015 NWTT Final EIS/OEIS. Topics that were discussed in the previous EIS/OEIS included how weather conditions may determine whether pilots fly under visual flight rules or instrument flight rules, and how notices to airmen are published by the Federal Aviation Administration (FAA) and provide information on when and if special use airspace would be active. It is the responsibility of any licensed pilots to be knowledgeable and compliant with all types of airspace and of any notices to airmen that are in effect.

3.13.1.2 Safety and Inspection Procedures

As stated in Section 3.13.2.2 (Safety and Inspection Procedures) in the 2015 NWTT Final EIS/OEIS, the Navy complies with all applicable regulations and uses best practices, including standard operating procedures, to ensure public health and safety. This may be accomplished by utilizing communication and notification channels provided by the U.S. Coast Guard and the FAA as described above, considering the location when planning activities, and ensuring that training and testing areas are clear of nonparticipants before commencing.

3.13.1.3 Aviation Safety

Navy requirements outlined in the Office of the Chief of Naval Operations Instruction 3500.39D, *Operational Risk Management*, provide a process to maintain readiness in peacetime and achieve success in combat while safeguarding people and resources. The FAA is responsible for ensuring safe and efficient use of U.S. airspace by military and civilian aircraft and for supporting national defense requirements. In order to fulfill these requirements, the FAA has established safety regulations, airspace management guidelines, a civil-military common system, and cooperative activities with the U.S. Department of Defense. The primary safety concern with regard to military training flights is the potential for aircraft mishaps to occur, which could be caused by mid-air collisions with other aircraft or objects, weather difficulties, mechanical failures, pilot error, or bird/wildlife air strike hazards.

There is no generally recognized threshold of air safety that defines acceptable or unacceptable conditions. Instead, the focus of airspace managers is to reduce risks through a number of measures. These include, but are not limited to, providing and disseminating information to airspace users, requiring appropriate levels of training for those using the airspace, setting appropriate standards for equipment performance and maintenance, defining rules governing the use of airspace, and assigning appropriate and well-defined responsibilities to the users and managers of the airspace. When these safety measures are implemented, risks are minimized, even though they can never be eliminated.

3.13.1.4 Submarine Navigation Safety

Methods for preserving submarine navigation safety are discussed in the 2015 NWTT Final EIS/OEIS (Section 3.13.2.4, Submarine Navigation Safety) and remain applicable and valid.

3.13.1.5 Surface Vessel Navigational Safety

The Navy's methods for ensuring navigational safety for surface vessels are discussed in the 2015 NWTT Final EIS/OEIS (Section 3.13.2.5, Surface Vessel Navigational Safety) and involve practicing the fundamentals of safe navigation, posting lookouts to scan for navigational hazards, or utilizing support boats, radar, and other auxiliary equipment to determine that all safety criteria are met. These safety methods remain applicable and valid.

3.13.1.6 Sonar Safety

Surface vessel and submarine sonar use is described in the 2015 NWTT Final EIS/OEIS (Section 3.13.2.6, Sound Navigation and Ranging [Sonar] Safety). When applicable, the Navy adheres to Naval Sea Systems Command Instruction 3150.2, Appendix 1A, which provides guidance for protecting divers during active sonar use, including the use of buffer zones. Guidance for protecting divers remains applicable and valid.

3.13.1.7 Explosive Ordnance Detonation Safety

Methods for ensuring explosive detonations associated with training and testing activities are described in the 2015 NWTT Final EIS/OEIS (Section 3.13.2.7, Explosive Ordnance Detonation Safety) and remain applicable and valid. Procedures for safety planning related to underwater detonations include

- ensuring impact areas and targets are clear;
- coordinating with submarine operational authorities on the use of underwater ordnance;
- receiving permission from range safety officers or test safety officers before commencing firing;

- ensuring units and targets remain in their assigned areas and units fire in accordance with current safety instructions; and
- conducting detonation activities only during daylight hours.

As discussed in the 2015 NWTT Final EIS/OEIS, some training and testing activities use ordnance as shown in Table 2.4-1 and Table 2.4-2. The type of ordnance that would be used for the Proposed Action would be the same as identified in the 2015 NWTT Final EIS/OEIS. As such, the procedures for handling and storing of ordnance remain applicable and valid.

3.13.1.8 Weapons Firing and Ordnance Expenditure Safety

Safety procedures that are described in the 2015 NWTT Final EIS/OEIS (Section 3.13.2.8, Weapons Firing and Ordnance Expenditure Safety) are still applicable and valid. Safety continues to be a primary consideration for all training and testing activities. Before commencing any firing, the Navy uses standard procedures and best practices to ensure that hazard areas and buffer zones are clear of all nonparticipants.

3.13.1.9 Laser Safety

High-energy lasers were not analyzed in the 2015 NWTT Final EIS/OEIS; however, the Proposed Action in this Supplemental adds new testing activities for the development of high-energy laser weapon systems, identified in Table 2.3-2 and Section A.2.6.7 (Radar and Other System Testing) of Appendix A (Navy Activities Descriptions), and described in Section 3.0.3.3.2.2 (High-Energy Laser Weapons). High-energy lasers would be used during testing activities that involve system and component tests. Low-energy lasers, analyzed in the 2015 NWTT Final EIS/OEIS, are used for precision range finding, as target designation/illumination devices for engagement with laser-guided weapons, and for mine detection and mine countermeasures, as well as for non-lethal deterrent. The Office of the Chief of Naval Operations Instruction 5100.27B/Marine Corps Order 5104.1C, *Navy Laser Hazards Control Program*, prescribes Navy and Marine Corps policy and guidance in the identification and control of laser hazards to prevent damaging a person's eyes with low-energy lasers or physically harming a person with high-energy lasers. The Navy observes strict precautions and has written instructions in place for laser users to ensure that non-participants are not exposed to intense light energy. Laser safety procedures for aircraft require an initial pass over the target before laser activation to ensure that target areas are clear. During actual laser use, aircraft run-in headings are also restricted to avoid unintentional contact with personnel or non-participants. Personnel participating in laser training activities are required to complete appropriate laser safety courses that are approved by the Navy's Administrative Lead Agent and the Lead Navy Technical Laboratory (U.S. Department of the Navy, 2008).

3.13.2 Environmental Consequences

The 2015 NWTT Final EIS/OEIS analyzed training and testing activities currently occurring in the Study Area and considered all potential stressors related to public health and safety. Stressors applicable to public health and safety in the Study Area are the same stressors analyzed in the 2015 NWTT Final EIS/OEIS with the exception of explosive stressors (see Table 3.0-1). In the 2015 NWTT Final EIS/OEIS, explosives were addressed under acoustic stressors; however, for purposes of this analysis, explosives will be analyzed as a separate stressor. The following are stressors analyzed for public health and safety and include stressor description updates from the 2015 NWTT Final EIS/OEIS:

- **Underwater Energy** (sonar and underwater explosives)

- **In-Air Energy** (radar and lasers)
- **Physical Interactions** (aircraft, vessels, in-water devices/targets, munitions, seafloor devices)
- **Secondary** (impacts on water quality from explosives and explosives byproducts, metals, chemicals other than explosives, and other materials)

This section evaluates how and to what degree potential impacts on public health and safety from stressors described in Section 3.0 (Introduction) may have changed since the analysis presented in the 2015 NWTT Final EIS/OEIS was completed. Table 2.5-1, Table 2.5-2, and Table 2.5-3 in Chapter 2 (Description of Proposed Action and Alternatives) list the proposed training and testing activities and includes the number of times each activity would be conducted annually and the locations within the Study Area where the activity would typically occur under each alternative. In addition to the tables in Chapter 2, Table 3.0-2 through Table 3.0-22 show the amounts and locations that specific activities, such as lasers or sonar, would be utilized during training and testing activities. The tables also present the same information for activities proposed in the 2015 NWTT Final EIS/OEIS so that the proposed levels of training and testing can be easily compared. The Navy conducted a review of federal and state regulations and standards relevant to public health and safety and reviewed literature published since 2015 for new information that could inform the analysis presented in the 2015 NWTT Final EIS/OEIS. The review concluded that there are no new regulations or standards regarding public health and safety and no new information that would alter the impact conclusions for the 2015 NWTT Final EIS/OEIS.

The analysis presented in this section also considers standard operating procedures, which can be found in Chapter 5 (Mitigation) of the 2015 NWTT Final EIS/OEIS with updated and additional standard operating procedures being presented in Section 2.3.3 (Standard Operating Procedures) of this Supplemental, and mitigation measures that are presented in Chapter 5 (Mitigation). The Navy would implement these measures to avoid potential impacts on public health and safety from stressors associated with the proposed training and testing activities.

3.13.2.1 Underwater Energy

Sources of underwater energy can be found in training and testing activity descriptions in Appendix A (Navy Activities Descriptions), and are generally the same as those discussed in the 2015 NWTT Final EIS/OEIS (Section 3.13.3.1, Underwater Energy). In-water electromagnetic devices, active sonar, underwater explosions, vessel movements, aircraft overflights, mine warfare training devices, and unmanned underwater vehicles encompass the various sources of underwater energy that would be used. Only recreational swimmers and self-contained underwater breathing apparatus (SCUBA) divers who are underwater and within an unsafe distance (600–3,000 yards) of training and testing activities, as prescribed in the *U.S. Dive Manual* (U.S. Department of the Navy, 2011), would potentially be exposed to the underwater energy produced by these stressors.

The effect of active sonar on humans varies with the sonar frequency. Generally, mid- to low-frequencies have the greatest effect since they fall within the range of human hearing (20 hertz to 20 kilohertz). In addition to acoustic stressors, underwater explosions produce pressure waves that can cause physical injury depending on the size, type, and depth of the explosive charge and the distance between the person and the explosive. Electromagnetic energy sources and their potential impacts on public health and safety are discussed in the 2015 NWTT Final EIS/OEIS (Section 3.13.3.1, Underwater Safety) and remain applicable in this discussion. In addition, standard safety buffers that are specified in Department of Defense Instruction 6055.11, *Protecting Personnel from Electromagnetic Fields* (U.S. Department of Defense, 2009b), and Military Standard 464A, *Electromagnetic Environmental Effects:*

Requirements for Systems (U.S. Department of Defense, 2002), would continue to be implemented to ensure public safety.

3.13.2.1.1 Impacts from Underwater Energy Under Alternative 1

Impacts from Underwater Energy Under Alternative 1 for Training Activities

Under Alternative 1, the number of proposed training activities that would generate underwater energy would generally increase from the 2015 NWTT Final EIS/OEIS (see Chapter 2, Description of Proposed Action and Alternatives, Table 2.5-1). Standard operating procedures, which are described in Section 2.3.3 (Standard Operating Procedures) and include clearing ranges prior to training activities, are in place to ensure that military activities do not overlap with non-military activities (e.g., boating, swimming, scuba diving, and fishing). Since the only potential receptors of underwater energy stressors are recreational swimmers and divers, training activities that could affect public health and safety are often held far from popular swimming and dive areas, reducing the potential for exposure. In addition, the NTMs posted by the U.S. Coast Guard alert the public of scheduled events so that they can avoid being in the same areas. The military's safety procedures would ensure that the potential for training activities to impact public health and safety under Alternative 1 would be unlikely. Therefore, increases shown in Tables 2.5-1, 2.5-2, and 2.5-3 for training activities proposed under Alternative 1 do not change the impact conclusions presented in the 2015 NWTT Final EIS/OEIS. As stated in the 2015 NWTT Final EIS/OEIS and summarized in this section, the potential impacts on public health and safety from the proposed training activities under Alternative 1 would remain negligible.

Impacts from Underwater Energy Under Alternative 1 for Testing Activities

Under Alternative 1, the number of proposed testing activities that would generate underwater energy would generally increase from the 2015 NWTT Final EIS/OEIS (see Chapter 2, Description of Proposed Action and Alternatives, Tables 2.5-2, and 2.5-3). Standard operating procedures, which are described in Section 2.3.3 (Standard Operating Procedures) and include clearing ranges prior to testing activities, are in place to ensure that military activities do not overlap with non-military activities (e.g., boating, swimming, and fishing). Since the only potential receptors of underwater energy stressors are recreational swimmers and divers, testing activities that could affect public health and safety are often held far from popular swimming and dive areas, reducing the potential for exposure. In addition, the NTMs posted by the U.S. Coast Guard alert the public of scheduled events so that they can avoid being in the same areas. The military's safety procedures would ensure that the potential for testing activities to impact public health and safety under Alternative 1 would be unlikely. Therefore, increases shown in Tables 2.5-2 and 2.5-3 for testing activities proposed under Alternative 1 do not change the impact conclusions presented in the 2015 NWTT Final EIS/OEIS. As stated in the 2015 NWTT Final EIS/OEIS and summarized in this section, the potential impacts on public health and safety from the proposed testing activities under Alternative 1 would remain negligible.

3.13.2.1.2 Impacts from Underwater Energy Under Alternative 2

Impacts from Underwater Energy Under Alternative 2 for Training Activities

Under Alternative 2, the number of some proposed training activities that would produce underwater energy would increase as compared to Alternative 1. Increases shown in Tables 2.5-1 for training activities proposed under Alternative 2 do not appreciably change the impact conclusions presented in the 2015 NWTT Final EIS/OEIS. In general, sources of underwater energy stressors would become more frequent with the implementation of Alternative 2; however, standard operating procedures, which are described in Section 2.3.3 (Standard Operating Procedures), are in place to ensure that military activities do not overlap with recreational or commercial activities. Since the only potential receptors of underwater energy stressors are recreational swimmers and divers, training activities that could affect public health and safety are often held far from popular swim and dive areas, reducing the potential for exposure. The military's safety procedures would ensure that the potential for training activities to impact public health and safety under Alternative 2 would be unlikely. As stated in the 2015 NWTT Final EIS/OEIS and summarized in this section, the potential impacts on public health and safety from the proposed training activities under Alternative 2 would remain negligible.

Impacts from Underwater Energy Under Alternative 2 for Testing Activities

Under Alternative 2, the number of some proposed testing activities that would produce underwater energy would increase as compared to Alternative 1. Increases shown in Tables 2.5-2 and 2.5-3 for testing activities proposed under Alternative 2 do not appreciably change the impact conclusions presented in the 2015 NWTT Final EIS/OEIS. In general, sources of underwater energy stressors would become more frequent with the implementation of Alternative 2; however, standard operating procedures, which are described in Section 2.3.3 (Standard Operating Procedures), are in place to ensure that military activities do not overlap with recreational or commercial activities. Since the only potential receptors of underwater energy stressors are recreational swimmers and divers, testing activities that could affect public health and safety are often held far from popular swim and dive areas, reducing the potential for exposure. The military's safety procedures would ensure that the potential for testing activities to impact public health and safety under Alternative 2 would be unlikely. As stated in the 2015 NWTT Final EIS/OEIS and summarized in this section, the potential impacts on public health and safety from the proposed testing activities under Alternative 2 would remain negligible.

3.13.2.1.3 Impacts from Underwater Energy Under the No Action Alternative

Under the No Action Alternative, the proposed training and testing activities would not occur. Underwater energy stressors as described above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in less underwater energy within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing at-sea training activities under the No Action Alternative would lessen the potential for impacts on public health and safety from underwater energy stressors, but would not measurably improve the condition of public health and safety throughout the Study Area.

3.13.2.2 In-Air Energy

In-air energy stressors include sources of electromagnetic energy, such as radar, navigational aids, high-energy lasers, and electronic warfare systems, aircraft noise, surface explosions, and lasers. Current practices for protecting military personnel and the public are described in the 2015 NWTT Final EIS/OEIS (Section 3.13.3.2, Affected Environment) and remain applicable to this analysis. Important practices include abiding by minimum flight elevations, communicating to the public through notification channels when training and testing activities are scheduled, enforcing restriction areas and danger zones, and ensuring non-participants are clear of an area before using hazardous equipment. In addition, procedures for laser safety are described above in Section 3.13.1.9 (Laser Safety), as well as in Section 2.3.3.1 (High-Energy Laser Safety). Training and testing activities that involve electromagnetic energy and lasers are described in Appendix A (Navy Activities Descriptions). While there would be slight changes in the number of activities from what was described in the 2015 NWTT Final EIS/OEIS and high-energy lasers would be added to the action, the activities associated with the Proposed Action would generally be the same was what was analyzed in the 2015 NWTT Final EIS/OEIS.

High-energy lasers are used as weapons to disable surface targets; however, high-energy lasers would only be used during testing activities to test auxiliary systems. The Navy would operate high-energy laser equipment in accordance with procedures defined in the Office of the Chief of Naval Operations Instruction 5100.23H, Navy Safety and Occupational Health Program Manual (U.S. Department of the Navy, 2020). The Occupational Safety and Health Administration (OSHA) has detailed the biological effects that laser beams may have on humans (Occupational Safety and Health Administration, 2018). Risks include damage to the eyes or skin after immediate exposure. The level of damage is dependent on the strength of the beam. A comprehensive safety program exists for the use of lasers. Current Navy safety procedures protect individuals from the hazard of injuries caused by laser energy. Laser safety requirements for aircraft and vessels mandate verification that target areas are clear before commencing training. In the case of aircraft, during actual laser use, the aircraft run-in headings are restricted to preclude inadvertent lasing of areas where the public may be present.

As a stressor, loud noises and vibrations generated from Navy training and testing activities such as aircraft overflights and vessel activities have the potential to disrupt or potentially injure (i.e., hearing loss, even ruptured ear drums, etc.) people in the Study Area. The training and testing activities that introduce the most noise into the environment are those that involve aircraft flights. A detailed description of current noise conditions and noise levels that would result from the Proposed Action is available in Appendix J (Airspace Noise Analysis for the Olympic Military Operations Area). Long, repeated exposure to noises exceeding 85 dB has been found to result in noise-induced hearing loss (National Institute on Deafness and Other Communication Disorders, 2017). The louder the noise, the shorter the time necessary for the noise to result in noise-induced hearing loss. OSHA has established duration thresholds for various noise levels to protect people in the workplace from experiencing noise-induced hearing loss. According to OSHA, people can be exposed to 90 dB for eight hours a day without experiencing noise-induced hearing loss (Occupational Safety and Health Administration, 2008). OSHA has also determined that noises above 140 dB are not safe for any duration of time (Occupational Safety and Health Administration, 2008). Although OSHA standards are technically applicable to the workplace environment, they are useful as a measure of comparison to determine if noise will result in health impacts in other settings. Loud noise below the OSHA standards does not directly impact human health, but a possible secondary impact from loud noises and vibrations is elevated levels of stress, which can occasionally impact a person’s health by causing annoyance, impairing sleep, and impacting cognitive performance (Schomer, 2005; Stansfeld & Matheson, 2003; U.S. Department of Defense, 2009a). Regarding these non-auditory health effects, studies have been conducted to examine the nonauditory health effects of aircraft noise exposure, focusing primarily on stress response, blood pressure, birth weight, mortality rates, cardiovascular health, and impairment of cognitive performance in children. Exposure to noise levels higher than those normally produced by aircraft operating in the Olympic MOA can elevate blood pressure and also stress hormone levels. However, the response to such loud noise is typically short in duration: after the noise goes away, the physiological effects reverse, and levels return to normal. In the case of repeated exposure to aircraft noise, the connection is not as clear. The common factor in most studies is the chronic nature of noise that is required to result in any of the effects except for annoyance. Also, the chronic noise levels required for these effects are well in excess of the levels expected over the Olympic Peninsula as a result of Navy flight activities (Basner et al., 2014; Correia et al., 2013; Evans et al., 1998; Haralabidis et al., 2008; Schomer, 2005; Stansfeld & Matheson, 2003).

3.13.2.2.1 Impacts from In-Air Energy Under Alternative 1

Impacts from In-Air Energy Under Alternative 1 for Training Activities

Under Alternative 1, the number of proposed training activities that would produce in-air energy would generally increase as compared to the number of activities proposed in the 2015 NWTT Final EIS/OEIS (see Table 2.5-1). There are multiple ways to quantify noise. This analysis looks at the Day Night Average Sound Level (DNL) (an average noise level over a 24-hour period) and the instantaneous noise level (the noise level at a given instant in time). According to the noise analysis performed in Appendix J (Airspace Noise Analysis for the Olympic Military Operations Area), the maximum DNL that would occur underneath the Olympic Military Operations Area (MOA) under Alternative 1 is 36.7 decibels (dB). This is only a minor increase from the baseline DNL of 36.1 dB. DNLs of less than 65 dB are considered to be compatible with most land uses because although training would be audible at times, and consistent with OSHA standards, it would not cause noise-induced hearing loss.

Another noise metric that can provide additional supplemental information about the noise environment is the maximum noise level (L_{max}). For Special Use Airspace (SUA) noise analysis, the L_{max} metric provides the maximum noise level from the single loudest event potentially occurring somewhere within the SUA. However, an observer might not necessarily experience that event depending on where the observer was located in relation to the aircraft overflight. Because the flight activities within SUA are dispersed throughout the airspace, this means an observer would need to be directly below an aircraft as it flew at the lowest possible altitude at its highest power setting to experience the maximum level of noise. Alternative 1 would generate noises that are above the 90 dB level established by OSHA. This analysis looks at the duration and volume of those noises to determine if they would result in noise-induced hearing loss. The maximum instantaneous noise level (L_{max}) of 100.6 dB would not increase between the baseline and Alternative 1. Instead, there would only be an increase in the frequency of the maximum instantaneous noise level. In baseline conditions, the maximum instantaneous noise level would occur approximately four minutes over the course of a year, while the maximum instantaneous noise level would occur for approximately five minutes in Alternative 1. This means that all occasions of this 100.6 dB L_{max}, over a year and throughout the entire Olympic MOA would sum up to five minutes. This 100.6 dB level could only be experienced at the highest elevations where the aircraft would be closest to any observers. The five minutes a year is also not from a single event that would last five minutes, but rather numerous events, which are spread throughout the year. While this is a 25 percent increase from baseline conditions, the OSHA standard for exposure durations to noise levels of 102 dB is 1.5 hours per day before permanently affecting one’s hearing, which is significantly longer than would be experienced. In addition, the areas that these volumes would occur at are some of the most remote areas with the least human presence within the Olympic Mountains. It would be unlikely for anybody to be in the area at the time of these maximum levels.

The maximum instantaneous noise level that would be experienced in the majority of the area (more than 77 percent) underneath the MOA is 84.4 dB. Figure 3.13-1 indicates that 84.4 dB is similar to hearing a garbage disposal or a large truck driving 50 feet away. In general, the noise analysis presented in Appendix J (Airspace Noise Analysis for the Olympic Military Operations Area) indicates that instantaneous noise levels would exceed 89.7 dB for 198 minutes out of the year. However, OSHA has determined that noise levels of 90 dB would have to be experienced for approximately eight hours a day before resulting in noise-induced hearing loss. These noise levels are also only experienced in the higher elevation areas of the Olympic Mountains, which make up approximately 4.25 percent of the region.

Exposure to these volumes would never be long enough to result in noise-induced hearing loss according to OSHA standards (Occupational Safety and Health Administration, 2008).

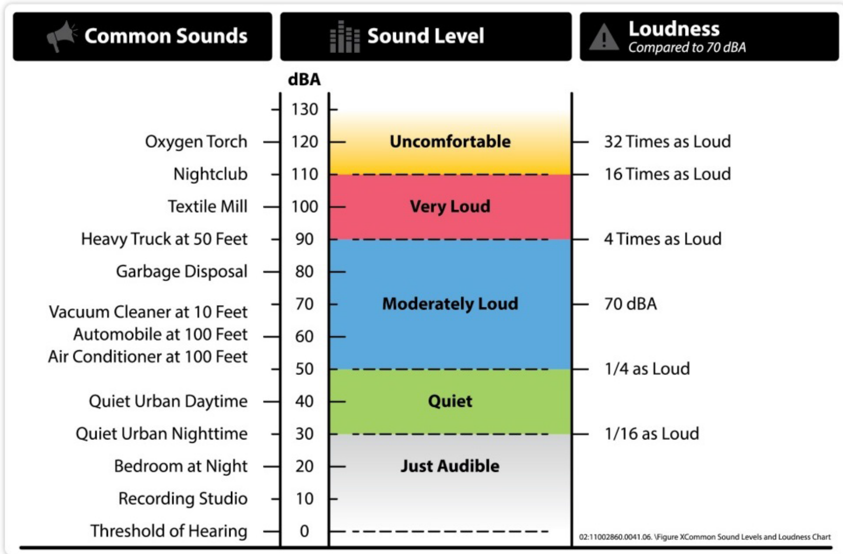

Figure 3.13-1: A-Weighted Sound Levels from Typical Sources

Although numerous studies examine the contribution of aircraft noise to health effects, there are no studies that definitively show a causal and significant relationship between aircraft noise and health. Such studies are difficult to conduct and interpret because of the large number of confounding factors that one should consider for their effects to be excluded from the analysis. The World Health Organization notes that there is still considerable variation among studies (World Health Organization, 2011). And, almost without exception, research studies conclude the need for additional research to determine if such a causal relationship exists. The European Network on Noise and Health (European Network on Noise and Health, 2013) in its summary report of 2013 concludes that "…while the literature on non-auditory health effects of environmental noise is extensive, the scientific evidence of the relationship between noise and non-auditory effects is still contradictory." In addition, no reports show a causal relationship between health effects and noise levels below 40 dB DNL, the level predicted beneath the Olympic MOA. As a result, it is not possible to state that there is sound scientific evidence that aircraft noise is a significant contributor to health disorders.

Increases in noise levels from the baseline would therefore not have a noticeable impact on public health and safety. In addition, standard operating procedures are in place to ensure that in-air energy stressors from training activities would not impact public health and safety. Therefore, the increases shown in Table 2.5-1 for training activities proposed under Alternative 1 do not appreciably change the impact conclusions presented in the 2015 NWTT Final EIS/OEIS. As stated in the 2015 NWTT Final EIS/OEIS and summarized in this section, the potential impacts on public health and safety from the proposed training activities under Alternative 1 would remain negligible.

Impacts from In-Air Energy Under Alternative 1 for Testing Activities

Under Alternative 1, the number of proposed testing activities that would produce in-air energy would generally increase as compared to the number of activities proposed in the 2015 NWTT Final EIS/OEIS (see Tables 2.5-2 and 2.5-3). In addition, high-energy lasers, which were not previously analyzed, would be used during testing activities. It is unlikely that the public would be exposed to high-energy lasers from testing activities because high-energy laser tests would occur either at sea, far from potential receptors, or in docked testing facilities that have restricted access and standard operating procedures for laser use that would further prevent participants and non-participants from coming into contact with a laser. Standard operating procedures described above would also prevent other in-air energy stressors from affecting public health and safety. Therefore, the general increase in the frequency of in-air energy stressors under Alternative 1 would not significantly change the impact conclusions presented in the 2015 NWTT Final EIS/OEIS (Section 3.13.3.2, In-Air Energy) and would not increase potential for testing activities to impact public health and safety. As stated in the 2015 NWTT Final EIS/OEIS and summarized in this section, the potential impacts on public health and safety from the proposed testing activities under Alternative 1 would remain negligible.

3.13.2.2.2 Impacts from In-Air Energy Under Alternative 2

Impacts from In-Air Energy Under Alternative 2 for Training Activities

Under Alternative 2, the number of proposed training activities that would produce in-air energy would increase as compared to Alternative 1 (see Table 2.5-1). Although there would be a minor increase in aircraft training activities within the MOA, the noise levels generated under Alternative 1 and Alternative 2 are roughly equivalent. Therefore, the impacts that noise would have on public health and safety would be similar to the impacts of Alternative 1. In addition, standard operating procedures are in place to ensure that in-air energy stressors from training activities would not impact public health and safety. Therefore, the increases shown in Table 2.5-1 for training activities proposed under Alternative 2 do not appreciably change the impact conclusions presented in the 2015 NWTT Final EIS/OEIS. As stated in the 2015 NWTT Final EIS/OEIS and summarized in this section, the potential impacts on public health and safety from the proposed training activities under Alternative 2 would remain negligible.

Impacts from In-Air Energy Under Alternative 2 for Testing Activities

Under Alternative 2, the number of proposed testing activities that would produce in-air energy would increase as compared to the number of activities proposed in the 2015 NWTT Final EIS/OEIS (see Tables 2.5-2 and 2.5-3). In addition, high-energy lasers, which is new in this Supplemental, would be used during testing activities. It is unlikely that the public would be exposed to high-energy lasers from testing activities because high-energy laser tests would occur either at sea, far from potential receptors, or in docked testing facilities that have restricted access and standard operating procedures for laser use that would further prevent participants and non-participants from coming into contact with a laser. Standard operating procedures described above would also prevent other in-air energy stressors from affecting public health and safety. Therefore, the general increase in the frequency of in-air energy stressors, standard operating procedures for electromagnetic energy and lasers would prevent personnel and non-participants from being exposed to these stressors. The military's safety procedures would ensure that the potential for training and testing activities to impact public health and safety under Alternative 2 would be unlikely. As stated in the 2015 NWTT Final EIS/OEIS and summarized in this section, the potential impacts on public health and safety from the proposed testing activities under Alternative 2 would remain negligible.

3.13.2.2.3 Impacts from In-Air Energy Under the No Action Alternative

Under the No Action Alternative, the proposed training and testing activities would not occur. In-air energy stressors as listed above would not be introduced into the environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in less in-air energy within the Study Area where training and testing activities have historically been conducted. Therefore, discontinuing at-sea training activities under the No Action Alternative would lessen the potential for impacts on public health and safety from in-air energy stressors, but would not measurably improve the condition of public health and safety throughout the Study Area.

3.13.2.3 Physical Interactions

As discussed in the 2015 NWTT Final EIS/OEIS (Section 3.13.3.3, Physical Interactions), military aircraft, vessels, targets, munitions, towed devices, seafloor devices, and other training and testing expended materials have the potential to directly encounter recreational, commercial, institutional, and governmental aircraft, vessels, and users such as swimmers, divers, and anglers. Instances of physical interactions that could pose the most risk to the safety of both civilians and Navy personnel include vessel collisions, aircraft collisions, munition discharge, and encountering unexploded ordnance. Methods for providing notice to non-participants of Navy training and testing activities, procedures for minimizing encounters with military expended materials, and a discussion of unexploded ordnance are all outlined in the 2015 NWTT Final EIS/OEIS (Section 3.13.3.3, Physical Interactions) as well as in Sections 3.13.1.1.1 (Sea Space), 3.13.1.1.2 (Airspace), and 3.13.1.2 (Safety and Inspection Procedures) of this Supplemental.

3.13.2.3.1 Impacts from Physical Interactions Under Alternative 1

Impacts from Physical Interactions Under Alternative 1 for Training Activities

Under Alternative 1, the number of proposed training activities that could lead to physical interactions between the Navy and non-participants would generally decrease as compared to the number of activities proposed in the 2015 NWTT Final EIS/OEIS (see Table 2.5-1). In addition, the standard operating procedures that are in place ensure that training activities would not lead to interactions between Navy vessels, aircraft, munitions, or other objects and non-participants. In addition, the communication channels that the Navy uses to inform the public of upcoming training events would alert non-participants of where and when training events would occur so that they may avoid these areas. While there is potential for unexploded ordnance, ordnance would end up on the ocean bottom, and would therefore be highly unlikely to be stumbled upon by anybody. Therefore, the increases shown in Table 2.5-1 for training activities proposed under Alternative 1 do not appreciably change the impact conclusions presented in the 2015 NWTT Final EIS/OEIS. As stated in the 2015 NWTT Final EIS/OEIS and summarized in this section, the potential impacts on public health and safety from the proposed training activities under Alternative 1 would remain negligible.

Impacts from Physical Interactions Under Alternative 1 for Testing Activities

Under Alternative 1, the number of proposed testing activities that could lead to physical interactions between the Navy and non-participants would generally increase as compared to the number of activities proposed in the 2015 NWTT Final EIS/OEIS (see Tables 2.5-2 and 2.5-3). However, the standard operating procedures that are in place ensure that testing activities would not lead to interactions between Navy vessels, aircraft, munitions, or other objects and non-participants. In addition, the communication channels that the Navy uses to inform the public of upcoming testing events would alert non-participants of where and when testing events would occur so that they may avoid these areas. While there is potential for unexploded ordnance, ordnance would either end up on closed off ranges or on the ocean bottom, and would therefore be highly unlikely to be stumbled upon by anybody. Therefore, the increases shown in Tables 2.5-2 and 2.5-3 for testing activities proposed under

Alternative 1 do not appreciably change the impact conclusions presented in the 2015 NWTT Final EIS/OEIS. As stated in the 2015 NWTT Final EIS/OEIS and summarized in this section, the potential impacts on public health and safety from the proposed testing activities under Alternative 1 would remain negligible.

3.13.2.3.2 Impacts from Physical Interactions Under Alternative 2

Impacts from Physical Interactions Under Alternative 2 for Training Activities

Under Alternative 2, the number of proposed training activities that could lead to physical interactions between the Navy and non-participants would generally increase as compared to Alternative 1 (see Table 2.5-1). However, the standard operating procedures that are in place ensure that training activities would not lead to interactions between Navy vessels, aircraft, munitions, or other objects and non-participants. In addition, the communication channels that the Navy uses to inform the public of upcoming training events would alert non-participants of where and when training events would occur so that they may avoid these areas. While there is potential for unexploded ordnance, ordnance would end up on the ocean bottom, and would therefore be highly unlikely to be stumbled upon by anybody. Therefore, the increases shown in Table 2.5-1 for training activities proposed under Alternative 2 do not appreciably change the impact conclusions presented in the 2015 NWTT Final EIS/OEIS. As stated in the 2015 NWTT Final EIS/OEIS and summarized in this section, the potential impacts on public health and safety from the proposed training activities under Alternative 2 would remain negligible.

Impacts from Physical Interactions Under Alternative 2 for Testing Activities

Under Alternative 2, the number of proposed testing activities that could lead to physical interactions between the Navy and non-participants would generally increase as compared to Alternative 1 (see Tables 2.5-2 and 2.5-3). However, the standard operating procedures that are in place ensure that testing activities would not lead to interactions between Navy vessels, aircraft, munitions, or other objects and non-participants. In addition, the communication channels that the Navy uses to inform the public of upcoming testing events would alert non-participants of where and when testing events would occur so that they may avoid these areas. While there is potential for unexploded ordnance, ordnance would either end up on closed off ranges or on the ocean bottom, and would therefore be highly unlikely to be stumbled upon by anybody. Therefore, the increases shown in Tables 2.5-2 and 2.5-3 for testing activities proposed under Alternative 2 do not appreciably change the impact conclusions presented in the 2015 NWTT Final EIS/OEIS. As stated in the 2015 NWTT Final EIS/OEIS and summarized in this section, the potential impacts on public health and safety from the proposed testing activities under Alternative 2 would remain negligible.

3.13.2.3.3 Impacts from Physical Interactions Under the No Action Alternative

Under the No Action Alternative, the proposed training and testing activities would not occur. Physical interaction stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer physical interaction stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing at-sea training activities under the No Action Alternative would lessen the potential for impacts on public health and safety from physical interaction stressors, but would not measurably improve the condition of public health and safety throughout the Study Area.

3.13.2.4 Secondary Stressors

As discussed in the 2015 NWTT Final EIS/OEIS (Section 3.13.3.4, Secondary Impacts), public health and safety has the potential to be impacted if sediment or water quality were degraded. Section 3.1 (Sediments and Water Quality) considered the impacts on marine sediments and water quality of explosives and explosives byproducts, metals, chemicals other than explosives, and other materials (marine markers, flares, chaff, targets, and miscellaneous components of other materials). In addition, public health and safety could be impacted by a contaminated food supply, which can include fish located within the Study Area. Sections 3.9 (Fishes) and 3.12 (Socioeconomic Resources and Environmental Justice) discuss the impacts that the Proposed Action would have on fish and fisheries in the Study Area.

3.13.2.4.1 Impacts from Secondary Stressors Under Alternative 1

Impacts from Secondary Stressors Under Alternative 1 for Training Activities

Under Alternative 1, there would be a general increase in the number of proposed training activities that could release secondary stressors into the environment as compared to the number of activities proposed in the 2015 NWTT Final EIS/OEIS (see Table 2.5-1). According to the discussions presented in Sections 3.1 (Sediments and Water Quality), 3.9 (Fishes), and 3.12 (Socioeconomic Resources and Environmental Justice) increases shown in Table 2.5-1 for training activities proposed under Alternative 1 do not appreciably change the impact conclusions presented in the 2015 NWTT Final EIS/OEIS. Although a general increase in some activities and military expended materials would occur, the implementation of Alternative 1 would not significantly degrade sediment or water quality or contaminate the food supply. As stated in the 2015 NWTT Final EIS/OEIS and summarized in this section, the potential impacts on public health and safety from the proposed training activities under Alternative 1 would remain negligible.

Impacts from Secondary Stressors Under Alternative 1 for Testing Activities

Under Alternative 1, there would be a general increase in the number of proposed testing activities that could release secondary stressors into the environment as compared to the number of activities proposed in the 2015 NWTT Final EIS/OEIS (see Tables 2.5-2 and 2.5-3). According to the discussions presented in Sections 3.1 (Sediments and Water Quality), 3.9 (Fishes), and 3.12 (Socioeconomic Resources and Environmental Justice) increases shown in Table 2.5-1 for testing activities proposed under Alternative 1 do not appreciably change the impact conclusions presented in the 2015 NWTT Final EIS/OEIS. Although a general increase in some activities and military expended materials would occur, the implementation of Alternative 1 would not significantly degrade sediment or water quality or contaminate the food supply. As stated in the 2015 NWTT Final EIS/OEIS and summarized in this section, the potential impacts on public health and safety from the proposed testing activities under Alternative 1 would remain negligible.

3.13.2.4.2 Impacts from Secondary Stressors Under Alternative 2

Impacts from Secondary Stressors Under Alternative 2 for Training Activities

Under Alternative 2, there would be a general increase in the number of proposed training activities that could release secondary stressors into the environment as compared Alternative 1 (see Table 2.5-1). According to the discussions presented in Sections 3.1 (Sediments and Water Quality), 3.9 (Fishes), and 3.12 (Socioeconomic Resources and Environmental Justice) increases shown in Table 2.5-1 for training activities proposed under Alternative 2 do not appreciably change the impact conclusions presented in the 2015 NWTT Final EIS/OEIS. Although a general increase in some activities and military expended materials would occur, the implementation of Alternative 1 would not significantly degrade sediment or water quality or contaminate the food supply. As stated in the 2015 NWTT Final EIS/OEIS and summarized in this section, the potential impacts on public health and safety from the proposed training activities under Alternative 2 would remain negligible.

Impacts from Secondary Stressors Under Alternative 2 for Testing Activities

Under Alternative 2, there would be a general increase in the number of proposed testing activities that could release secondary stressors into the environment as compared to Alternative 1 (see Tables 2.5-2 and 2.5-3). According to the discussions presented in Sections 3.1 (Sediments and Water Quality), 3.9 (Fishes), and 3.12 (Socioeconomic Resources and Environmental Justice) increases shown in Tables 2.5-2 and 2.5-3 for testing activities proposed under Alternative 1 do not appreciably change the impact conclusions presented in the 2015 NWTT Final EIS/OEIS. Although a general increase in some activities and military expended materials would occur, the implementation of Alternative 1 would not significantly degrade sediment or water quality or contaminate the food supply. As stated in the 2015 NWTT Final EIS/OEIS and summarized in this section, the potential impacts on public health and safety from the proposed testing activities under Alternative 2 would remain negligible.

3.13.2.4.3 Impacts from Secondary Stressors Under the No Action Alternative

Under the No Action Alternative, the proposed training and testing activities would not occur. Secondary stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in less secondary stressors within the Study Area where training and testing activities have historically been conducted. Therefore, discontinuing at-sea training activities under the No Action Alternative would lessen the potential for impacts on public health and safety from secondary stressors, but would not measurably improve the condition of public health and safety throughout the Study Area.

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4 Cumulative Impacts

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4 Cumulative Impacts

This chapter (1) defines cumulative impacts, (2) describes past, present, and reasonably foreseeable future actions relevant to cumulative impacts, (3) analyzes the incremental interaction the Proposed Action may have with other actions with coincidental effects, and (4) evaluates cumulative impacts potentially resulting from these interactions of the coincidental effects on the same environmental resource. For this Supplemental Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) (Supplemental), the approach to analysis of cumulative impacts has not changed significantly since the 2015 Northwest Training and Testing (NWTT) Final EIS/OEIS.

4.1 Definition of Cumulative Impacts

The approach taken in the analysis of cumulative impacts follows the objectives of the National Environmental Policy Act (NEPA), Council on Environmental Quality (CEQ) Regulations, and CEQ Guidance. Cumulative impacts are defined in 40 Code of Federal Regulations, Section 1508.7.

A cumulative impact is the impact on the environment which results from the incremental impact of the action when added to the other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 Code of Federal Regulations [CFR] section 1508.7). This analysis does not incorporate by reference the 2015 NWTT Final EIS/OEIS, but rather builds upon it for an updated look at cumulative impact potential.

4.2 Scope of Cumulative Analysis

The scope of the cumulative impacts analysis involves both the geographic extent of the effects and the temporal (relating to time) extent in which the coincidental effects could be expected to occur. For this Supplemental, the Study Area defines the geographic extent of the impacts analysis. In general, the Study Area includes those areas previously identified in Chapter 3 (Affected Environment and Environmental Consequences) for the respective resource areas, and is the same Study Area as described in the 2015 NWTT Final EIS/OEIS. The cumulative impacts analysis includes areas far outside of the Study Area used for this Supplemental, because it includes all actions that may add to impacts affecting the resources that were analyzed in this Supplemental (i.e., sediments and water quality, air quality, marine habitats, marine mammals, sea turtles, birds, marine vegetation, marine invertebrates, fishes, cultural resources, American Indian and Alaska Traditional Resources, socioeconomic resources and environmental justice, and public health and safety). The time frame for cumulative impacts centers on the timing of when an activity described as part of the Proposed Action occurs. For example, some activities are anticipated to occur once every other year for a few days. Therefore, the cumulative effects would center on the timing of that activity. Other activities are anticipated to occur on a more regular basis, such as aircraft maneuvers or electronic warfare activities. Therefore, the cumulative impacts from these activities would span a greater timeframe. The time frame for cumulative impacts also includes impacts from past federal and non-federal actions that may still be adding to impacts on a resource at present, as well as anticipated (reasonably foreseeable) actions in the future.

Another factor influencing the scope of cumulative impacts analysis involves identifying other actions to consider. In addition to identifying the geographic scope and time frame for the previously completed and currently ongoing actions, the analysis also includes the identification of “reasonably foreseeable” actions (i.e., anticipated future actions). For the purposes of this analysis, public documents prepared by federal, state, and local government agencies form the primary sources of information regarding reasonably foreseeable actions. Documents used to identify other actions include notices of intent for EISs and Environmental Assessments (EAs), management plans, land use plans, and other planning related studies. Naval Air Station Whidbey Island (NASWI) staff provided information on local and regional actions, as well as previously completed, currently ongoing, and reasonably foreseeable future actions at Ault Field and Outlying Landing Field Coupeville. Additionally, the NASWI staff completed the EA-18G "Growler" Airfield Operations at Naval Air Station Whidbey Island Complex EIS in September 2018. Finally, local websites for local news outlets were searched for articles pertaining to ongoing and future actions that would need to be included in this analysis.

Multiple Navy actions are ongoing within the Pacific Northwest Region; however, each NEPA document addresses a specific Proposed Action, separated from other actions by its purpose and need, independent utility, timing, and geographic location. Some NEPA documents are stand-alone documents; others tier off of and/or expand the analyses of other existing NEPA documents. NEPA documents for at-sea training (e.g., the 2015 NWTT Final EIS/OEIS) focus on training and testing activities occurring within a range complex and/or Military Operating Area and involve different types of aircraft, ships, and range complex enhancements. However, NEPA documents that analyze a specific type of aircraft operation at a military airfield (in this case, the Growler) are focused in and around that airfield and its facility needs. While the Navy has analyzed, and is currently analyzing, various other projects in the area, those projects are not preconditions for Growler operations at the NASWI complex. Growler operations at the NASWI complex are not a precondition for larger military readiness activities on range complexes in the Pacific Northwest. Even in the absence of these Growler operations, military training in the Pacific Northwest would continue independently from this Proposed Action, as analyzed in the documents referenced in Section 1.6 (The Environmental Planning Process). Each of the documents includes the results of a cumulative impact analysis that was conducted at the time the document was prepared; thus, the combined impacts of all of these activities are being captured in multiple documents.

4.3 Past, Present, and Reasonably Foreseeable Actions

This section focuses on past, present, and reasonably foreseeable future actions that occur within or potentially impact resources analyzed in the Study Area. Using the first fundamental question included in Section 4.1 (Definition of Cumulative Impacts), in determining which projects to include in the cumulative impacts analysis, a preliminary determination was made regarding each past, present, or reasonably foreseeable action as to whether a relationship exists such that the affected resource areas of the Proposed Action (included in this Supplemental) might interact with the affected resource area of a past, present, or reasonably foreseeable action. If no such potential relationship exists, the action was not carried forward into the cumulative impacts analysis. In accordance with CEQ guidance (Council on Environmental Quality, 2005), these actions considered but excluded from further cumulative effects analysis are not catalogued here because the intent is to focus the analysis on the meaningful actions relevant to inform decision making. Actions included in this cumulative impacts analysis were determined to affect resource areas that the Proposed Action would also affect and are listed and briefly described in Table 4.3-1. Table 4.3-2 focuses on other major environmental stressors or trends that tend to be widespread and arise from routine human activities and multiple past, present, and future actions.

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures[1]	***Project Timeframe C = Construction O = Operation*** X = Other		
				Past	Present	Future
Military Mission, Testing, and Training Activities						
Airfield Vegetation Management	Naval Air Station Whidbey Island	Conduct long-term vegetation management (both on and off-Base) to control visual obstructions and pests affecting airfield operations. This project, when considered with the Proposed Action, would not cumulatively impact resources.				O
Bangor Transit Protection Program (TPP) Pier and Support Facilities (P-907)	Naval Base (NAVBASE) Kitsap Bangor	The Draft Environmental Assessment for this project was released in December 2019. The Navy is proposing to construct and operate a Transit Protection Program (TPP) Pier and upland support facilities for berthing TPP blocking vessels and maintaining TPP vessels at NAVBASE Kitsap, Washington (U.S. Department of the Navy, 2019a). This project would include pile driving activities and, when considered with the Proposed Action, could add to the cumulative impacts on air quality, sediments and water quality, marine habitats, marine vegetation, marine invertebrates, fishes, birds, and marine mammals.				C/O
Canadian Training and Testing, including activities at Canadian Forces Maritime Experimental and Test Ranges (CFMETR)	Nanoose Bay, Canada	Canadian forces train and test in Nanoose Bay, as well as the surrounding area the overlaps resources in the Inland Waters portion of the Study Area. Activities at the CFMETR include weapon and torpedo testing that involves aircraft, submarines, and surface ships. These activities are funded and performed by the Royal Canadian Navy,		O	O	O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures1	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
		civilian members of the Department of National Defense, and the U.S. Navy (NanaimoNewsNOW Staff, 2017). This project, when considered with the Proposed Action, could add to the cumulative impacts on air quality, sediments and water quality, marine habitats, marine vegetation, marine invertebrates, fishes, birds, marine mammals, cultural resources, American Indian and Alaska Native Traditional resources, and socioeconomic resources.				
CVN 65 Reactor Disposal/ Facility work at Port of Benton (P-458)	Port of Benton, Washington	Develop/Upgrade dry dock infrastructure to support existing and future workload. This project, when considered with the Proposed Action, could add to the cumulative impacts on biological, cultural, and socioeconomic resources.				C/O/X
EA-18G Growler Airfield Operations	NASWI Complex	The ROD was signed and released in March 2019 for the Navy's proposed action to home base 36 additional EA-18G (Growler) aircraft at NASWI, station additional personnel and their family members at the NAS Whidbey Island complex and in the surrounding community, construct and renovate facilities at Ault Field, increase airfield operations at both Ault Field and Outlying Landing Field (OLF) Coupeville, and change the distribution of field carrier landing practice (FCLP) to 20% occurring at Ault Field and 80% occurring at OLF Coupeville. The Navy announced the preparation of an EIS in September 2013. In October 2014, the Navy revised the scope of the EIS and invited the public to comment. The Draft EIS was available for public review November 2016 to February 2017. The Navy	The Navy has adopted all practicable means to avoid or minimize environmental harm. Efforts to reduce noise impacts on the community are detailed in Appendix H to the Final EIS and include limiting noise, land use planning and management, and noise abatement operational procedures. One of the Navy's most significant mitigations is the commitment to employ PLM (a.k.a. Magic Carpet) technology, which, when	O	O	

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures1	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
		held public meetings on December 5–9, 2016. The Final EIS was released in Fall 2018. The ROD was signed in March 2019. These proposed operations, when considered with the Proposed Action, could add to the cumulative impacts on air quality, birds, noise, socioeconomic resources, cultural resources, and American Indian and Alaska Native Traditional resources.	combined with a reduction in the number of pilots per squadron, reduced the number of proposed aircraft operations under the preferred alternative as identified in the Draft EIS by 30%. The Navy remains committed to implementing the measures identified in Appendix H to the Final EIS to minimize auditory, visual, and atmospheric effects of flight operations on the surrounding community. As discussed in Appendix H, there have been noise abatement and mitigation measures in place at the Whidbey Island complex for decades, which have been optimized to move aircraft operations away from population centers. These measures will continue to be implemented. Amongst these noise mitigation measures included in Appendix H are: continuing to inform the public of upcoming FCLP			

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures1	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
			schedules and other events that may increase noise impacts; continuing to restrict high power jet aircraft turns prior to noon on Sundays and daily between 10:00 pm and 7:30 am; continuing to review operational procedures for changes that reduce noise while supporting safe, effective mission execution; and, continuing to collaborate with the community on compatible land-use planning initiatives under the AICUZ and REPI programs. With respect to mitigating impacts to the perceptual qualities of five historic landscapes located within the Central Whidbey Island Historic District, the Navy will provide $867,000.00 to the National Park Service (NPS) to support Ferry House preservation projects that meet the Secretary of the Interior standards for preservation. In addition, the Navy will provide up to $20,000.00 to			

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures1	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
			the NPS for the design, construction, and installation of interpretive historical signs at appropriate locations. The Navy will also seek partnership opportunities through the REPI program by working with the community to identify potential projects and communicating its support for those projects to decision-making officials in the DoD. Finally, the Navy is willing to collaborate with stakeholders to evaluate the benefits of designating historic landscapes within the APE as Sentinel Landscapes (U.S. Department of the Navy, 2019c).			
EA-18G Growler Biological Opinion Revision	NASWI Complex	The Navy and USFWS have reinitiated consultation to revise the USFWS Biological Opinion for the Growler operations, in order to better address impacts to marbled murrelets. This project, when considering the Proposed Action, could add to the cumulative impacts on birds.				X/O
Electromagnetic Measurement Ranging System	NAVBASE Kitsap	The Navy constructed and operates an Electromagnetic Measurement Ranging System located on NAVBASE Kitsap Bangor lands and adjacent				C/O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures1	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
	Bangor Hood Canal	waters in Hood Canal (Hood Canal Military Operating Area North) Bangor, Washington. This system, when considered with the Proposed Action, may cumulatively impact biological resources in the Study Area. Currently, the project is on hold. No NEPA analyses have been completed, and no construction has occurred.				
Environmental Assessment (EA) for Electronic Warfare Range	Naval Station Everett Annex Pacific Beach and Olympic Peninsula	The Navy published the Pacific Northwest Electronic Warfare Final EA in August 2014. The EA analyzed impacts of the Navy using a fixed transmitter site and up to three mobile transmitter trucks in U.S. Forest Service (USFS) lands. The Navy issued a Finding of No Significant Impact on August 28, 2014, and the USFS issued a FONSI on July 31, 2017. On October 5, 2017, the USFS issued a road permit that approved the Navy's permit to drive and operate the mobile transmitter trucks on existing USFS roads for a 5-year period.		O	O	O
Establishment and Modification of Oregon Military Training Airspace	Offshore Area	The U.S. Air Force has completed the NEPA process for the proposed establishment and modification of Oregon Military Training Airspace EIS. The additional airspace is over the Pacific Northwest surf/sub-surf operating area and includes new areas such as W-570 B, C, D, and W-570 A. Other changes to airspace established the Redhawk Military Operations Area (MOA) and EEL MOA A-D, and increased the size of Juniper and Hart MOAs, as well as added Juniper Low, C, and D MOAs. The Oregon Air National Guard is the primary user of W-93 and W-570 special use airspace		O	O	O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures1	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
		in the Offshore Area. Oregon Air National Guard flights in W-93 and W-570 are primarily air combat maneuver training flights. These flights occur throughout the year and include the use of chaff and flares in W-570. On rare occasions, self-defense flares may be used during training. This airspace, when considered with the Proposed Action, could add to the cumulative impacts on air quality, birds, and cultural resources. As of December 7, 2017, the updated airspace was established.				
Explosives Handling Wharf Maintenance (EHW-1)	NAVBASE Kitsap Bangor	The Navy is continuing a construction project to conduct necessary repairs and maintenance on the EHW-1 facility. This multiyear project involves removal and replacement of deteriorated steel or concrete piles. NMFS has issued an incidental Harassment Authorization (IHA) to the Navy to incidentally harass, by Level B harassment, five species of marine mammals incidental to pile driving and removal associated with the project. This is the third such incidental harassment authorization for similar work on the same structure. Phased repair of this structure is expected to continue until 2024. This project, when considering the Proposed Action, could add to the cumulative impacts on sediments and water quality, air quality, marine habitats, marine mammals, sea turtles, marine vegetation, marine invertebrates, fishes, birds, and cultural resources.	Mitigation measures for this action include marine mammal zones of influence or mitigation zones to prevent Level A harassment, visual monitoring, sound attenuation devices, acoustic measurements, timing restrictions (to avoid migratory ESA-listed species), the soft-start procedure (a warning or innate noise before beginning pile driving), and daylight construction. There are also mitigation measures to protect fish and the marbled murrelet.	C/O	C/O	C/O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures1	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
Explosives Handling Wharf Maintenance (EHW-2)	NAVBASE Kitsap Bangor	The Navy completed a construction project for necessary repairs and maintenance on the EHW-2 facility. This multiyear project involved removal and replacement of deteriorated steel or concrete piles. NMFS issued an incidental harassment authorization to the Navy for Level B harassment of five species of marine mammals incidental to pile driving and removal associated with the project. Additionally, the project included replacement of structural elements such as decking and pile caps, installation of cathodic protection, repair of a concrete wetwell, and recoating of the tops of fender piles and steel mooring fittings (U.S. Department of the Navy, 2012a). This project was completed in 2015 and would not contribute to impacts when considered with the Proposed Action.		C	O	O
Fender Pile Removal and Replacement, Pier 4	NAVBASE Kitsap Bremerton	The Navy wrote an EA on Fender Pile Removal and Replacement at Pier 4. The base serves as homeport for a nuclear aircraft carrier and other Navy vessels, and contains a shipyard that is capable of overhauling and repairing all types and sizes of ships by alteration, construction, deactivation, and dry-docking. Pier 4 was completed in 1922 and needed substantial maintenance to support ship repair and other activities to maintain Navy vessels. The Navy removed approximately 80 deteriorating timber fender piles and replaced them with steel fender piles. This project, when considered with the Proposed Action, could add to the cumulative impacts on any of the resources discussed in this Supplemental as the	Minimization measures were implemented and included an Incidental Harassment Authorization from the NMFS; the issuance criteria required that the unintentional taking of marine mammals authorized by an IHA would have a negligible impact on the species or stock and, where relevant, would not have an unmitigable adverse impact on the availability of	C		

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures1	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
		impacts to water resources, noise, and biological resources would be temporary and not significant.	the species or stock for subsistence uses.			
Gulf of Alaska EIS/OEIS and Supplements	Gulf of Alaska	The Navy has prepared two iterations of this EIS/OEIS and is preparing a third to assess the potential environmental impacts associated with at sea training in the GOA Temporary Maritime Activities Area (TMAA) Study Area. This project, when considered with the Proposed Action, could add to the cumulative impacts on any of the resources discussed in this Supplemental especially regarding the impacts to fishes and marine mammals.	The analysis presented in the 2015 GOA Final Supplemental EIS/OEIS indicates that Alternative 1 will include the implementation of standard operating procedures and all practicable mitigation and monitoring measures by the Navy to avoid or reduce environmental impacts, including those identified in the GOA Final Supplemental EIS/OEIS, the NMFS Biological Opinion (April 19, 2017), and the NMFS Final Rule and LOA issued under the MMPA on April 21, 2017. Mitigation measures and monitoring requirements will be implemented for Navy activities which could potentially impact the following resources: • Marine Mammals: Mitigation measures and annual exercise and monitoring reporting requirements are identified in	O	O	O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures1	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
			the GOA Final Supplemental EIS/OEIS, the NMFS Biological Opinion, and the MMPA LOA. In addition to existing procedural mitigation measures, such as the use of lookouts, the Navy has agreed to implement geographic mitigation measures while training in the TMAA. The Navy will establish a North Pacific Right Whale Cautionary Area where the use of surface ship hull-mounted mid-frequency sonar or explosives will not occur in the June to September timeframe. • Fish: Given concerns raised by the Kodiak area Tribes during Government-to-Government consultation, the Navy has affirmed a geographic restriction that the use of explosives will not occur in Portlock Bank during Navy training events in the TMAA (U.S. Department of the Navy, 2017).			

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures1	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
Hawaii and Southern California Training and Testing (HSTT) EIS/OEIS	Hawaii and Southern California	The Navy has prepared two iterations of this EIS/OEIS and is preparing the third to assess the potential environmental impacts associated with two categories of military readiness activities: training and testing. The water-based training covered in the HSTT EIS/OEIS is considered at-sea training and does not include land-based components. In the EIS/OEIS, the Navy assesses military readiness activities that could potentially impact human and natural resources, especially marine mammals, sea turtles, and other marine resources. The range of alternatives includes a No Action Alternative and other reasonable courses of action. The Final HSTT EIS/OEIS third iteration was released in October 2018. Resource areas include air quality, biology (marine species), and public health and safety. The emission of criteria pollutants resulting from activities in the Study Area would not cause a violation or contribute to an ongoing violation of the National Ambient Air Quality Standards. This project, when considered with the Proposed Action, could add to the cumulative impacts on marine mammals, sea turtles, fishes, and birds.	Procedural mitigation is mitigation that the Navy will implement whenever and wherever an applicable training or testing activity takes place within the Study Area. Procedural mitigation generally involves (1) the use of one or more trained Lookouts to diligently observe for specific biological resources within a mitigation zone, (2) requirements for Lookouts to immediately communicate sightings of specific biological resources to the appropriate watch station for information dissemination, and (3) requirements for the watch station to implement mitigation until certain recommencement conditions have been met. Mitigation areas are geographic locations within the Study Area where the Navy will implement additional measures to (1) avoid or reduce impacts on biological	O	O	O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures1	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
			or cultural resources that are not observable by Lookouts from the water's surface (i.e., resources for which procedural mitigation cannot be implemented); and (2) in combination with procedural mitigation, to effect the least practicable adverse impact on marine mammal species or stocks and their habitat. The Navy completed an extensive assessment of the Study Area to develop its mitigation areas. For Phase III, this included reanalyzing existing Phase II mitigation areas; assessing additional habitat areas suggested by the public, NMFS, other governmental agencies, and non-governmental organizations; and considering other habitats identified internally by the Navy.			
Hood Canal Bedlands Encroachment	Hood Canal	The Navy and Washington Department of Natural Resources signed a restrictive easement on July 7, 2014. The Navy paid $720,000 for the easement,		X	X	X

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures1	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
Protection Easement		which precludes construction in the easement area. The easement covers 4,804 acres (ac.) of aquatic land, from -18 feet (ft.) mean lower low water down to 70 ft. mean lower low water. All 4,804 ac. overlays designated critical habitat for ESA-listed salmonid species. The restrictive easement area also protects large tracts of wild stock geoduck and extensive eelgrass habitat. The easement will protect the area for 55 years. The Department of Natural Resources will continue to manage the land under its aquatic lands program. To date, NBK has also completed a Bedlands restrictive easement on both shorelines surrounding the Dabob Bay Range Complex. 7,285 acres of aquatic lands covering 100 miles of shoreline surrounding the Dabob Bay Range Complex are protected from incompatible marine development for the next 55 years. Phase 1 was completed in 2014 and Phase 2 was completed in 2018. The Hood Canal REPI partnership for Range sustainment is in the 7th year of execution. To date over 13,000 acres have been protected from incompatible development. In 2019, the first phase of the Thorndyke Bay easements will be executed. This project, when considered with the Proposed Action, could add to the cumulative impacts on biological resources and cultural resources in a positive manner through restricting construction and protecting various biological resources.				

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures1	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
Integrated Natural Resource Management Plan (INRMP)	Commander, Navy Region Northwest (CNRNW) Installations: NBK (Bangor, Bremerton, Keyport, and Zelatched Point); NASWI. NAVSTA Everett; Pacific Beach Annex; NAVMAG Indian Island; and SEAFAC	INRMPs were revised for multiple CNRNW INRMPs between fiscal year 2012 and 2018. The Sikes Act, U.S. Department of the Navy Policy, and DoD instruction require that annual and 5-year reviews for operation and effect of INRMPs occur with federal and state partners. The Navy, USFWS, and state wildlife agencies participate in these reviews. NMFS is also invited to participate. The INRMP is generally updated every 5 years, and management actions prescribed in it are implemented to contribute to the conservation and rehabilitation of installation natural resources. These projects, when considered with the Proposed Action, could add to the cumulative impacts on biological resources in a positive manner through the conservation and rehabilitation efforts.	Minimization and mitigation measures pertaining to natural resource management are described in the INRMPs.	O	O	O
Land-Water Interface (P-983)/Service Pier Extension (P-834) Supplemental SEAWOLF Class Service Pier Extension	Naval Base Kitsap Bangor, Silverdale, WA	Construct an extension of the Service Pier. This project, when considered with the Proposed Action, could add to the cumulative impacts on biological resources, cultural resources, and socioeconomic resources.				C/O
Manchester Fuel Tank Replacement (P-856)	Naval Base Kitsap	Construct aboveground fuel storage tanks and replace current system of underground storage tanks. This project, when considered with the Proposed Action,				C/O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures1	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
		could add to the cumulative impacts on biological resources and socioeconomic resources.				
Marine Structure Maintenance and Pile Replacement Activities	NAVBASE Kitsap Bangor, Bremerton, Keyport, Manchester, Zelatched Point and Naval Station Everett	Navy proposes to conduct maintenance and repair activities of marine waterfront structures at six Navy locations within Navy Region Northwest. The Navy released the Final EA in June 2019, and NMFS approved the Navy's MMPA permit application in April 2019. The repairs, maintenance, and replacement of piles will continue through 2022. This project, when considered with the Proposed Action, could add to the cumulative impacts on biological resources (specifically marine mammals), cultural resources, air quality, and noise.	General best management practices, mitigation, and minimization measures may be implemented for all in-water repair and replacement activities. Additional minimization measures have been added to protect marine mammals, ESA-listed species, and designated critical habitats. These measures include vibratory installation of piles where possible, noise attenuation and performance measures for impact pile driving, and marine mammal monitoring.			C/O
Naval Health Clinic Oak Harbor, Whidbey Island, Washington (P-262)	Oak Harbor, Washington	Construct new facility to serve as medical clinic, dental clinic, and birthing center. This project, when considered with the Proposed Action, does not have the potential to cumulatively impact resources.				C
Naval Magazine (NAVMAG) Indian Island Ammunition Wharf	NAVMAG Indian Island	Environmental analysis and consultation have begun for proposed pile repair and replacement at an ammunition wharf on Indian Island. This project, when considered with the Proposed Action, has the potential to cumulatively impact marine habitats,				C

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures1	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
		marine vegetation, marine invertebrates, marine mammals, sea turtles, fishes, and birds.				
Naval Special Operations Training	Puget Sound and Coastal Southwestern Washington	The Navy proposes to conduct small unit, intermediate and advanced land and cold-water maritime training for Navy Special Operations personnel. The training would occur in selected nearshore lands and in the inland waters of Puget Sound, including Hood Canal, as well as the southwestern Washington coast, with the permission of willing property owners. Training would comply with federal and state laws and be consistent with existing non-military use. The public outreach meetings were held in May 2017 for the development of an EA. The EA was finalized in 2019 and a FONSI was signed in December 2019. This project, when considered with the Proposed Action, could add to the cumulative impacts on biological resources, cultural resources, and socioeconomic resources.	The Navy agreed to take the following five actions with Washington State Historic Preservation Officer (SHPO) to minimize the potential to disturb archaeological sites: 1. Reopening of consultation per 36 CFR 800.5(d)(1) if necessitated by a change in the undertaking; 2. A review by a qualified Cultural Resource professional as defined in 36 CFR Part 61 of new and renewed real estate agreements for new information; 3. Implementation of the Inadvertent Discovery Plan (IDP), to be attached to the Memorandum of Agreement as an appendix; 4. Providing sensitivity to cultural resources training to all participants in the program, and; 5. Submittal of an annual report to the SHPO confirming that adverse			O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures1	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
			effects by the program are being avoided.			
P-188 Replace Fuel Pipeline	NASWI	In 2014 the Navy replaced an existing 55-year-old, 5-mile-long cross-island pipeline and pumping system that transfers fuel from the Seaplane Base to Ault Field at NASWI. The pipeline finished under budget and ahead of schedule in 2014 and would not cumulatively impact resources, when considered with the Proposed Action.		C	O	O
P-8A Multi-Mission Aircraft	NASWI	Homebasing of 12 P-8A Multi-Mission Maritime Aircraft (MMA) squadrons and one Fleet Replacement Squadron is proposed to occur to replace the current maritime patrol aircraft, the P-3C Orion, at existing maritime patrol homebases. The action will result in the homebasing of six fleet squadrons (42 aircraft) at NASWI, Washington. Informal consultation with the USFWS in accordance with section 7(a)(2) of the ESA for the Proposed Action concluded with a letter of concurrence from the USFWS on May 13, 2013. The Record of Decision (ROD) was signed in June 2014, and the transition to the P-8A aircraft was completed in May 2020. Most recently Boeing installed a new P-8A Poseidon training center at NASWI that contains simulators to help transition the aircrews effectively and efficiently prior to operating the P-8A MMA. The first P-8A MMA arrived on the base in October 2016. This project, when considered with the Proposed Action, could add to the cumulative impacts on air quality, birds, socioeconomic resources, noise, American Indian, and cultural resources.		O	O	O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures1	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
P-993 Pier and Support Facilities for Transit Protection System at U.S. Coast Guard Air Station/Sector Field Office	U.S. Coast Guard (USCG) Air Station/ Sector Field Office Port Angeles	This project consisted of the construction of a 22,303 square foot pier and 8,300 square foot building for an Alert Forces Facility (single-story sleeping and administration building); a Ready Service Armory (an ammunition and weapons storage facility); diesel fuel, marine storage tank, and distribution system; and site improvements including utilities, parking, lighting, security improvements, and landscaping at the USCG AIRSTA/SFO Port Angeles to support the USCG Maritime Force Protection Unit mission. The Transit Protection System (TPS) pier is designed to provide full hotel services (electricity, potable water, sewer, Internet, phone, fire protection, pier lighting, and fueling lines) and dedicated mooring for up to seven TPS vessels. Construction of the project started in the summer of 2016 was completed in 2018. The new pier and support facilities would has a design life of 50 years (U.S. Department of the Navy, 2015a). This project, when considered with the Proposed Action, could add to the cumulative impacts on biological resources, noise, cultural resources, American Indian, and socioeconomic resources.	The construction included mitigation measures to protect marine mammals and habitat in the project area.	C	O	O
Port Security Barrier (PSB)	NAVBASE Kitsap Bremerton	This project would extend the existing floating fence approximately 1,000 feet to the shoreline, enclosing approximately 6.5 acres of water. The PSB is presently connected to the end of Pier 7, and extension of the PSB will reduce the safety risk to individuals that may otherwise enter the highly industrialized and very active naval shipyard. Extension of the PSB is pending				C

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures1	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
		issuance of a permit by the U.S. Army Corps of Engineers. This project, when considered with the Proposed Action, could add to the cumulative impacts on sediments and water quality, air quality, marine habitats, marine mammals, sea turtles, birds, marine vegetation, marine invertebrates, fishes, and cultural resources.				
Readiness and Environmental Protection Integration Program/ Encroachment Protection Partnering Agreement Transactions	Hood Canal	Under the Readiness and Environmental Protection Integration Program, the Navy has established a multi-year agreement with The Trust for Public Lands, Washington Department of Natural Resources, and Jefferson Land Trust. To date, the Navy and its partners have purchased protective easements on 5,149 ac. of upland and shoreline properties around Hood Canal, including protection of approximately 2 miles of the riparian corridor along the Dosewallips River. The Navy purchased a restrictive easement to maintain 3,607 ac. of working forest as a buffer and permanently protect these lands from development. These areas provide protection for designated critical habitat for ESA-listed salmonid species. Additional Readiness and Environmental Protection Initiative transactions are underway within the agreement area around Hood Canal. This project, when considered with the Proposed Action, beneficially and cumulatively impacts biological resources, and American Indian and commercial fishing.		X	X	X

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures1	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
Seismic Retrofit of Building 431	NAVBASE Kitsap Bremerton	The Navy performed repair and construction for seismic upgrades and renovation of a ship maintenance machine shop facility, which is within the coastal zone. The project included seismic retrofit renovation of all architectural, mechanical, and electrical systems, demolishing portions of the building interior and hazardous material remediation. This project, when considered with the Proposed Action, would not cumulatively impact resources.		C	C	
Ship Maintenance and Waterfront Operations	Naval Station Everett (NSE) (P-173)	Construct new Ship Maintenance and Waterfront Operations Facility, demolish and consolidate substandard and inadequate temporary facilities, and relocate ship support operations to waterfront. This project, could add to the cumulative impacts on biological, cultural, and socioeconomic resources.				C/O
Surveillance Towed Array Sensor System Low Frequency Active Sonar	Pacific Ocean, Atlantic Ocean, Indian Ocean, and the Mediterranean Sea	The Navy utilizes Surveillance Towed Array Sensor System (SURTASS) Low Frequency Active Sonar systems onboard several T-AGOS class vessels in the western and central North Pacific Ocean, not including polar waters, and the southwestern Indian Ocean. The Navy has been operating SURTASS since 2002 and plans to continue into the reasonably foreseeable future (U.S. Department of the Navy, 2019b). Navy is operating under a LOA signed by NMFS August 12, 2019. In general, the operation of SURTASS Low Frequency Active Sonar has low to moderate potential to affect marine mammals, sea turtles, and fishes. Anticipated impacts on turtles include ESA harassment, including	Monitoring (visual, passive acoustic, and active acoustic) and enforcing delay/suspension protocols. Use of "fish finder" (High Frequency/Mid Frequency-3 sonar) detects, locates, and tracks marine mammals and, to an extent, sea turtles, that may pass close enough to the SURTASS Low Frequency Active sonar's transmit array to enter the mitigation zone.	O	O	O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures1	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
		non-auditory, auditory, behavioral, masking, or physiological stress impacts when turtles are in close proximity. Impacts on marine mammals are anticipated to be Level B harassment, including auditory or behavioral impacts. The underwater sound produced by this activity may contribute to the cumulative impacts on marine mammals and sea turtles in the Study Area (U.S. Department of the Navy, 2012b).				
Transit Protection Program (TPP) Pier and Support Facilities	Naval Base Kitsap Bangor (P-907/P-932)	Build fixed-pile or floating pontoon main pier and finger piers at K/B Spit. This project, when considered with the Proposed Action, could add to the cumulative impacts on biological, cultural, American Indian, and socioeconomic resources.				C/O
USCG Training	California, Oregon, and Washington	The USCG conducts training throughout the Study Area. In California, District 11 conducts search and rescue, homeland security, law enforcement, marine safety, and aids to navigation missions in over 3.3 million square miles (mi.^{2}) of water. The District 13 Coast Guard unit is located in the Pacific Northwest along the coasts of Oregon and Washington. District 13 conducts the same operational duties as the units in District 11 and covers more than 460,000 mi.^{2} of the Pacific Ocean. These activities, when considered with the Proposed Action, could add to the cumulative impacts on sediments and water quality, air quality, marine habitats, marine mammals, sea turtles, birds, marine vegetation, marine invertebrates, fishes, and cultural resources.	USCG activities that were part of the Proposed Action in the 2015 NWTT Final EIS/OEIS and continue to be analyzed in this Supplemental under the Proposed Action include Maritime Security Operations, where USCG personnel participate. The following USCG activities are not part of the Proposed Action for this Supplemental and are analyzed only for their cumulative impact: 1. Small- and medium-caliber weapons firing from ships,	O	O	O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures1	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
			similar to that of the Navy's Gunnery Exercises (Surface-to-Surface). 2. Flight training in W-237A. This flight training includes low-altitude helicopter flights but does not include expenditure of munitions or any other materials. 3. Shipboard aircraft operations, such as deck landing qualification training. 4. Shipboard maneuvering and engineering training (e.g., abandon ship, anchoring, full power trials, man overboard, and flooding). 5. Search and rescue training.			
VAQ Electronic Attack Squadron Expeditionary Wing	NASWI	The Navy prepared an EA to analyze the transition of the Expeditionary Electronic Attack squadrons (VAQ) at NASWI from the aging EA-6B Prowler to the newer EA-18G Growler in the 2012–2014 timeframe. The 2012 EA analyzed retaining three expeditionary VAQ squadrons that operated Prowlers and their transition to Growler, in addition to relocating a reserve squadron to NASWI, and resulted in a finding of no significant impact. Training for these Growler aircrew was included as part of the Proposed Action in the NWTT Final EIS/OEIS (2015b). This transition, when		O	O	O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures1	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
		considered with the Proposed Action, could add to the cumulative impacts on air quality, birds, and cultural resources.				
Waterfront Improvements	NAVBASE Kitsap Bremerton	This proposed action would consist of two main projects: (1) development of a new Multi-Mission Dry Dock (M2D2) and (2) Reconstruction of existing Dry Dock 6. This project, when considered with the Proposed Action, could add to the cumulative impacts on sediments and water quality, air quality, marine habitats, marine mammals, sea turtles, birds, marine vegetation, marine invertebrates, fishes, and cultural resources.				C/O
Waterfront Service Craft Piers	Naval Station Everett (P-65)	Construct new pier(s) to replace Piers D and E (small craft berthing piers). This project, when considered with the Proposed Action, could add to the cumulative impacts on sediments and water quality, air quality, marine habitats, marine mammals, sea turtles, birds, marine vegetation, marine invertebrates, fishes, American Indian, and cultural resources.				C/O
Whidbey Island Extend Shoreline Erosion Protection System South	Whidbey Island	The Navy is constructing an extended shoreline erosion protection system on Whidbey Island near Ault field off of Saratoga Street and Lexington Street. These activities, when considered with the Proposed Action, could add to the cumulative impacts on sediments and water quality, air quality, marine habitats, and birds.			C	C

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures1	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
Non-Military Actions						
Local including part of the NWTT Study Area						
Aquaculture	Inland waters of the State of Washington	Aquaculture occurs in the State of Washington's inland waters and includes farming native Pacific salmon, clams, mussels, oysters, and other marine subsistence species. In addition to the aquaculture farms already in operation there are new farms that have been permitted to begin development and others that are in the permitting process under Washington's State Environmental Policy Act (SEPA) (Washington State Department of Ecology, 2019). An example of this is the Jamestown S'Klallam Tribe Dungeness Bay Oyster Farm which is in the permitting process to re-establish a 50-acre oyster farm in Dungeness Bay (Allen, 2019). These activities, when considered with the proposed action, could have cumulative effects on marine habitats, marine vegetation, and socioeconomic resources.	Aquaculture projects within inland waters of the State of Washington are subject to the state's SEPA review before approval. The applicant must also submit other documentation—such as a Shoreline Substantial Development and Conditional Use Permit—to assure the project abides by all state laws and is has a minimal environmental impact.	C/O/X	C/O/X	C/O/X
Bainbridge Ferry Terminal Overhead Loading Fixed Walkway Replacement	Bainbridge, Washington	This construction for the project is set to begin Spring 2021, it will replace the existing walkway with a new steel-fortified walkway anchored by concrete and steel columns walkway that will be safer during earthquake activity (Washington Department of Transportation, 2019a). This project, when considered with the Proposed Action, would not be likely to cumulatively impact resources in the Study Area.				C
Construction and Land Development on the Olympic Peninsula	Clallam, Jefferson, and Northern	In 2019 a number of residential, commercial, road and other development projects were permitted to be carried forward in the coming years in Clallam, Jefferson, and Northern Grays Harbor counties may		C/X	C/X	C/X

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures1	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
	Grays Harbor Counties	be impacted. In total, approximately 200 acres has been permitted for development in these counties, most of which will be residential; however, other projects include public recreational areas, commercial buildings, and gravel pits. Additionally, approximately 22 miles of road construction was permitted with a majority of the roads being for logging purposes (Washington State Department of Ecology, 2019). These projects, when considered with the Proposed Action, could have a cumulative effect on air quality, socioeconomic resources, and public health and safety.				
Ecosystem Management Plans	State of Washington	Throughout Washington State there are many ecosystem management plans in place including EISs, Shoreline Master Programs, and other environmental documents. These documents describe how to proceed with issues such as habitat improvements, cleaning up contaminated soils, coping with potentially rising sea levels, improving fish passage in waterways, beaver dam management, developing previously undeveloped lands, restoring wetlands, and other actions that encompass ecosystem management (Washington State Department of Ecology, 2019). These projects, when considered with the Proposed Action, could have a cumulative effect on all resource categories considered in this Supplemental EIS/OEIS.		X	X	X
Elwha River Restoration	Elwha River, Washington	In 2011, the largest dam removal in the U.S. began, and the Elwha Dam was removed, followed by the Glines Canyon Dam on the Elwha River. The removal		C	X	X

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures1	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
		of these dams has aided the restoration of the Elwha river ecosystem for salmon restoration, as well as watershed improvement (National Park Service, 2019). These activities, when considered with the Proposed Action, could add to the cumulative impacts on sediments and water quality, marine habitats, marine vegetation, marine invertebrates, and fishes.				
Inland Waters Construction	Inland waters	Construction projects have already begun, have been permitted to begin, or are under review to be permitted in Washington's inland waters. These types of projects include, but are not limited to, pier construction and renovation, bridge construction, breakwater repair, bulkhead removal and construction, and boat ramp renovation and construction. An example of this is the Brown pier, ramp, and float replacement and extension in Jefferson county (Washington State Department of Ecology, 2019). These activities, when considered with the Proposed Action, could add to the cumulative impacts on sediments and water quality, marine habitats, marine vegetation, socioeconomic resources, and public health and safety.	Construction projects within inland waters of the State of Washington are subject to the state's SEPA review before approval. The applicant must also submit other documentation—such as Joint Aquatic Resource Permits Applications and Habitat Assessments—to assure the project abides by all state laws and is has a minimal environmental impact.	C	C	C
Hood Canal In-Lieu Fee Mitigation Program	Hood Canal	The Hood Canal In-Lieu Fee Mitigation Program is a voluntary program sponsored by the Hood Canal Coordinating Council. Entities pursuing development on aquatic resources such as wetlands or shoreline habitats can purchase mitigation credits to offset unavoidable adverse impacts to these resources within the Hood Canal watershed. The primary goal of the program is to increase aquatic resource functions		X	X	X

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures1	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
		in the Hood Canal watershed. The program is intended to ensure no net loss through the preservation, enhancement, establishment, and restoration of ecological functions within target watersheds. This will be accomplished through the establishment and management of mitigation sites. The service area for the Hood Canal Coordinating Council In-Lieu Fee Program encompasses Hood Canal and those portions of Water Resource Inventory Areas 14, 15, 16, and 17 draining to Hood Canal, defined by a line extending from Foul Weather Bluff to Tala Point, south through the Great Bend to its terminus near the town of Belfair, Washington. The service area is divided into two components for the In-Lieu Fee Program. The first is the Freshwater Environment, which generally includes areas landward of the marine riparian zone, including freshwater and estuarine wetlands and streams up to and excluding any National Park or National Forest Lands. The second is the Marine/Nearshore Environment, which extends from the marine riparian area at the top of the coastal bluffs to the adjacent aquatic intertidal and subtidal zones. The mitigation strategy selected for each permitted impact will be based on an assessment of type and degree of disturbance to the landscape or drift cell. These activities, when considered with the Proposed Action, could add to the cumulative impacts on marine habitats and biological resources.				

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures1	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
Logging	Washington State (Olympic Peninsula)	Industrial logging began in Washington in the mid-1800s. Between 1900 and 1910, new laws were put in place to regulate clearcutting and create a state forest commission as well as a burn-permit system (Dundon, 2018). During the 1980s and 90s, a "timber war" including the implementation of environmental restrictions on logging led to a dramatic drop in the amount of public lands that were open to logging. Due to the increase in severity of wildfires, forest services are increasing the use of thinning forests and selective logging in order to decrease wildfire severity and maintain healthy forests (Siegler, 2019). Noise from logging may have the potential to impact terrestrial animals including birds. On the Olympic Peninsula in 2019, where noise from Navy overflights may be heard, the amount of land permitted for logging in the coming years was approximately 10,000 acres for approximately 18,000 MBF (thousand board feet) (Washington State Department of Ecology, 2019). Generally, these actions would have the potential to have cumulative impacts to air quality, birds, cultural resources, American Indian and Alaska Native Traditional Resources, socioeconomic resources, and public health and safety.		X	X	X
Marbled Murrelet Long-Term Conservation Strategy Final EIS	Washington State	The Washington Department of Natural Resources and USFWS developed an EIS to amend the DNR's State Trust Lands Habitat Conservation Plan (1997). The amendment will replace the interim conservation strategy for the marbled murrelet (*Brachyrampus marmoratus*) with a long-term conservation strategy		X	X	X

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures1	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
		(Washington Department of Natural Resources & U.S. Fish and Wildlife Service, 2019). This amendment would have the potential to have cumulative impacts to birds in the NWTT Study Area.				
Marine Spatial Plan for Washington's Pacific Coast	Washington's Pacific Coast	The Washington Department of Ecology created a Marine Spatial Plan, adopted in June 2018, which provided: a consistent way of evaluating future ocean use proposals; a new base of scientific information on coastal uses and resources; a framework to coordinate decisions for new ocean uses; and protections for sensitive ecological areas and fishing. This plan is a tool to assist state agencies and others in evaluating and engaging in proposals or new ocean uses and guide potential applicants as they develop those proposals (Washington Department of Ecology, 2017). These activities, when considered with the Proposed Action, could add to the cumulative impacts on marine habitats and marine biological species.		X	X	X
Marine Tourism/Whale Watching	Puget Sound	In April of 2018, the Pacific Whale Watch Association adopted new guidelines for marine tourism in the Puget Sound. These guidelines are meant to keep endangered whales, such as the Southern Resident Killer Whale population and humpback whales, safe around commercial and private boats. These guidelines include implementing a "slow zone" of 7 knots within 1 kilometer of whales; limiting viewing time to 1 hour in the vicinity of a group of whales, or limiting viewing time to 30 minutes if there are 10 or more vessels within 1 kilometer of the whales (Donaldson, 2018). These activities, when considered	Regulations under the ESA and MMPA prohibit vessels from approaching killer whales within 200 yards and from parking in the path of whales when in the Inland Waters of Washington State. Certain vessels are exempt from the prohibitions (76 Federal Register 20870). In 2018, the State of Washington adopted a law to	O	O	O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures1	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
		with the Proposed Action could benefit species in a positive manner due to the restrictions helping marine mammals to thrive. The impact on socioeconomics could be positive or negative as an increase in marine mammals could draw more tourism, while the increased regulations could cause the enjoyment of the whale watchers to decrease.	increase the viewing distance around whales to from 200 yards to 300 yards. In addition, boats are now forbidden from following closer than 400 yards behind a pod of endangered orcas (State Bill 5577).			
Mukilteo Multimodal Terminal Project	Mukilteo, Washington	This project for the new terminal began with a decontamination process in 2015, in-water work began in Fall 2019 and, in late 2020, the schedule shows that construction to begin removing the existing terminal would commence. This project would improve safety and accessibility for the public, improve efficiency and reliability of ferry operations, improve transit connections, reduce the ferry-related congestion, and provide public access to the waterfront (Washington Department of Transportation, 2019b). This project, when considered with the Proposed Action, could add to the cumulative impacts on marine habitat, sediments and water quality, and marine biological resources.		C	C	C/O
North Seattle Lateral Upgrade Project Northwest Pipeline LLC	Shonomish, WA	This project will upgrade the North Seattle natural gas mainline. The project is to remove and replace up to 5.85 miles of 8" diameter pipeline with 2" diameter pipeline. Upon completion, this would create a significant increase in the amount of natural gas this pipeline can transport (Schwalbe, 2019). This project, with respect to the Proposed Action, could have			X	C/O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures1	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
		cumulative impacts on socioeconomics and public health and safety.				
Olympic Class (144-Car) Ferries	Puget Sound	A fifth Olympic Class ferry, a hybrid-electric propulsion ferry, was approved for funding in Spring 2019. The new vessels would improve safety, efficiency, access, comfort, and operating costs (Washington Department of Transportation, 2019c). The new ferries use cleaner burning engines with low-emissions fuels, and they are designed with quieter machinery. The quieter machinery would be a positive effect for marine life, especially the Southern Resident Killer Whale. The new ferries would also improve public safety. This project, when considered with the Proposed Action, could add to beneficial cumulative impacts on air quality, marine mammals, and public health and safety.				O
Pacific Marine Energy Center South Energy Test Site	6 NM southwest of Newport, OR	The Oregon State University proposes to build a grid-connected offshore wave energy test site. It would be about 33 miles in area and is in the planning and permitting stages of development. The project is still undergoing geophysical surveys, finalizing locations of terrestrial project infrastructure, conducting cultural surveys, and completing draft license applications, as well as proposing future research. If successful they will finalize, design, receive permits for, and construct and commission the test site (Batten, 2017). This project could add to the cumulative impacts on biological resources, transportation, American Indian, and cultural resources.				C/O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures1	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
Pacific Northwest National Laboratory's research and development of renewable energy in Clallam Bay	Clallam Bay	This project includes researching the meteorological and aquatic physical parameters of Clallam Bay for the potential environmental and biological impacts of technologies that harvest renewable energy resources and small-scale pilot projects to test new means to harvest renewable energy resources. Sonar or lidar would be used in some cases to characterize and monitor resources. The research will support development of pilot renewable energy projects including solar, wind, wave, tidal, or other aquatic renewable energy resources (Ballard, 2019). This project could add to the cumulative impacts on all resource categories except for birds and public health and safety.			X	C/X
Pleasant Harbor Master Planned Resort	Black Point Peninsula	In November 2007, a programmatic Final EIS was issued in association with an Amendment to re-designate the 256 acres from rural residential to Master Planned Resort. The proposed Master Planned Resort is located south of Brinnon, Washington, on the Black Point Peninsula, on the western shore of the Hood Canal. Under Alternative 1, an 18-hole golf course, 890 residential units, 49,772 $ft.^2$ of commercial space, and resort-related amenities on a 231 ac. Site (with 33 ac. of natural area preserved and 2.2 million cubic yards of earthwork required for golf course grading) would be built. Alternative 2 consists of the golf course, 890 residential units, 52,650 ft. of commercial space with resort-related amenities, and 80 ac. of natural area preserved with 1 million cubic				C

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures1	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
		yards of earthwork for golf course grading. Finally, under the No Action Alternative, the Master Planned Resort would not be constructed. The Final Supplemental EIS was released in December 2015 (Jefferson County, 2015). Jefferson County government held meetings in 2016 with tribes in the area to understand their concerns with the proposed development. A Staff Report on the application for a Development Agreement and Development Regulations was received on January 4, 2016; the Planning Commission Public Hearing occurred on January 6, 2016; and on August 14, 2017, the Board of County Commissioners meeting watched a presentation on the Pleasant Harbor Master Planned Resort (Jefferson County, 2017). This project, with respect to the Proposed Action, could add to the cumulative impacts on biological resources, water quality, transportation, Native American, and socioeconomic resources.				
Puget Sound Partnership	Tacoma, Washington	The Puget Sound Partnership in Washington has many programs, related to the executive management team, external operations, adaptive systems, boards, communications, integrated planning, planning, ecosystem recovery, science and evaluation, internal operations, fiscal, and the Environmental Protection Agency (Puget Sound Partnership, 2019). This group, with respect to the Proposed Action, could add to the cumulative impacts on biological resources and sediments and water quality.		X	X	X

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures1	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
Rocky Brook Hydroelectric LP	Brinnon, WA	This project proposes to install new turbines, upgrade the current concrete spill over and install a new 20' outflow pipe at the power house. These upgrades will result in a decrease of the amount of water needed to power the turbines by up to 50%, and a new outflow structure to return the water to the source creek (Charnas, 2019). This project, with respect to the Proposed Action, could have a cumulative effect on socioeconomics.			X	C/O
San Juan Islands National Monument Proposed Resource Management Plan and Final Environmental Impact Statement	Lopez, Washington	This document, published in November 2019, describes and evaluates a range of potential management approaches for the San Juan Islands, as prepared by the BLM (Bureau of Land Management, 2019). These activities, with respect to the Proposed Action, could add to the cumulative impacts on biological and cultural resources.				X
Southern Resident Orca Task Force	Olympia, Washington	The Southern Resident Orca Task Force submitted their final report and recommendations summarizing the challenges threatening the Southern Residents and bringing important scientific focus to resources that may assist with the recovery of the whales. The report provides 49 recommendations that would have multiple benefits to water quality, ecosystem health, and salmon runs (Southern Resident Orca Task Force, 2019). These activities, with respect to the Proposed Action, could beneficially add to the cumulative impacts on sediments and water quality, marine		X	X	

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures1	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
		habitats and other biological resources, especially fishes and marine mammals.				
Tesoro Anacortes Refinery Clean Products Upgrade Project (CPUP) Vessel Traffic Assessment Technical Report	Fidalgo Bay, Skagit County, Washington	The Clean Products Upgrade Project, located approximately 70 miles north of Seattle, would include construction of an Aromatics Recovery Unit, installation of a new Marine Vapor Emission Control System, and on-shore facility upgrades and expansions. The Vessel Traffic Assessment Technical Report demonstrates vessel traffic levels in the study area and shows the current shipping plan and impacts to vessel traffic in the Salish Sea, impacts to vessel traffic days, and comprehensive vessel traffic management systems (CH2m, 2016). With respect to the Proposed Action, the project could add to the cumulative impacts on biological resources, sediments and water quality, transportation and noise, water resources, air quality, Native American, and cultural resources.	Existing passive and active mitigation measures were found to be adequate for the anticipated volume of vessel traffic associated with the proposed action and other anticipated development in the Study Area.	C	O	O
The Seattle Multimodal Ferry Terminal at Colman Dock Project	Seattle	Construction began in 2017 on the Seattle Multimodal Ferry Terminal and is expected to continue through 2023 (Washington Department of Transportation, 2017). With respect to the Proposed Action, the project could add to the cumulative impacts on biological resources, sediments and water quality, transportation and noise, with temporary impacts on water resources, air quality, and cultural resources.		C	C	C/O
Skookumchuck Wind Energy Project	Thurston County	This project proposes to expand the current O&M Facility and develop forest land for the Skookumchuck Wind Energy Project which will contain 38 wind			X	C/O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures1	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
		turbines with a 137-megawatt capacity. This project also includes development of necessary infrastructure, including a well and septic system (Smith, 2019). With respect to the Proposed Action, the project could add to the cumulative impacts on air quality, birds, and socioeconomics.				
Smith Island Dredging Project	Union Slough - Snohomish County, WA	This project includes the Union Slough 10-Year Maintenance Dredging Program in Union Slough near Smith Island proposed by Snohomish County Public Works. Over a 10-year period, the project proposes dredging up to 100,000 cubic yards of sediment to offset sediment accumulation resulting from the 2018 removal of portions of the Smith Island diking. Additional maintenance dredging would be scheduled as necessary (Highton, 2019). This project, with respect to the Proposed Action, could have cumulative effects on all resource categories except for cultural resources, and American Indian and Alaskan Native Traditional Resources.			X	O
Thorndyke Resources (Pit-to-Pier) Project	Hood Canal	This project, by Hood Canal Sand and Gravel LLC, has permits through Jefferson County, that were vested under Washington's land use laws March 29, 2003. In 2014 an updated application packet was submitted for the project that did not alter the project's vesting date. No final action has been taken on the applications for this project and those applications remain pending. The construction and operation of the pier on Hood Canal, which would be used exclusively for gravel loading operations, is a reasonably foreseeable future action. With respect to	There should be no adverse effect on the Navy's planned training and testing operations as a result of the project as the Navy has committed through its encroachment plan for the Hood Canal Facilities to coordinate with Thorndyke Resource, Jefferson County, Department of Homeland			C/O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures1	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
		the Proposed Action, the project could add to the cumulative impacts on biological resources, sediments and water quality, transportation and noise, with temporary impacts on water resources, air quality, and cultural resources.	Security, Department of Transportation, and the Army Corps of Engineers to ensure mutually safe operations.			
U.S. Army Corps of Engineers Tacoma Harbor Navigation Improvement Project	Tacoma, Washington	The U.S. Army Corps of Engineers released a Draft Feasibility Report and Environmental Assessment regarding the Tacoma Harbor Navigation Improvement Project in December 2019. The study looks at channel deepening opportunities in Tacoma Harbor for larger vessels through the Blair Waterway (Port of Tacoma, 2019). This project, considered with the Proposed Action, could add to the cumulative impacts to marine biological resources.				C/O
Washington State Ferries	North and South Puget Sound	Routine operation of approximately 14 ferry routes in the Puget sound mainly localized around Seattle and the San Juan Islands. There are 23 Washington state ferries that make almost 450 transits per day (Washington State Department of Transportation, 2018), equivalent to approximately 164,000 transits per year, that contribute to underwater ambient noise in the Inland Waters. These activities, when considered with the Proposed Action, could add to the cumulative impacts on air quality, and marine mammals, due to noise and vessel strikes.		O	O	O
Washington State's Marine Spatial Plan and EIS	Pacific Ocean adjacent to Washington State coastline	The Marine Spatial Plan Study Area consists of marine waters of the Pacific Ocean adjacent to Washington's coastline from the intertidal zone out to the continental slope. The plan provides information and guidance intended for use throughout the	Proposed mitigation would depend on the project chosen.		C/O	C/O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures1	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
		development of new ocean use proposal along the coast. It assists agencies, tribal governments, and others in evaluating and engaging in proposals for new ocean uses and guides potential applicants as they develop those proposals. The proposals for new ocean uses, if implemented, could add to the cumulative impacts on biological resources (marine species, habitat, and vegetation) and water quality.				
Wind Energy Project	Naval Radio Station Transmitter Jim Creek	Installation of 10 wind turbines on Wheeler Mountain and Blue Mountain. Turbine utility would be privately operated under 30-year lease. This project is currently on hold; however, if implemented in the future, these activities, when considered with the Proposed Action, could add to the cumulative impacts on air quality, and birds.				C/O
General Pacific Ocean/Global (including the NWTT Study Area)						
Academic Research	Global	Wide-scale academic research is conducted in the Study Area by federal entities, such as the Navy and National Oceanic and Atmospheric Administration/NMFS, as well as state and private entities and other partnerships. Although academic research aims to capture data without disturbing the ambient conditions of the ocean environment, vessels contribute to traffic, noise, and strike hazard; seismic activity contributes noise; and various other collection methods, such as trawling, could be disruptive to the ecosystems under observation. Impacts from academic research operations can be similar to the impacts expected from oil and gas airgun survey activities, which can		O	O	O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures1	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
		cause death in microscopic animals due to powerful sound wave creation. These sound waves can also kill or injure fishes and invertebrates. With respect to the Proposed Action, academic research could add to the cumulative impacts on noise and biological resources, including both marine species and marine habitats.				
Aquaculture	Oceans worldwide	Globally, 29% of stocks are fished at biologically unsustainable levels, and aquaculture helps meet demand and offsets stress to wild populations (National Marine Fisheries Service, 2015b). Aquaculture production reached an all-time high of 97 million metric tons in 2013 and is the fastest growing form of food production, at 6% per year globally. Forty-seven percent of aquaculture operations occur in the Pacific Ocean. Salmon and shellfish aquaculture have existed since the 1970s in the Puget Sound. In April of 2018, Washington passed HB 2957, to phase out non-native fish farming in Washington State by 2022; which will eliminate threats from Atlantic salmon net pen farming and protect native salmon populations. Aquaculture introduces excess fecal matter, fish pellets, and introduced chemicals into the environment which harms the marine ecosystem (Audubon Washington, 2018). The threats of aquaculture operations on wild fish populations include reduced water quality, competition for food, predation by escaped or released farmed fishes, the spread of disease and parasites, and reduced genetic diversity (Kappel,		C/O	C/O	C/O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures1	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
		2005). These threats become apparent when farmed fish escape and enter the natural ecosystem (Hansen & Windsor, 2006; Ormerod, 2003). The Marine Aquaculture Policy provides direction to enable the development of sustainable marine aquaculture (National Marine Fisheries Service, 2015b).				
Bureau of Ocean Energy Management (BOEM) Environmental Studies	Pacific Ocean	The BOEM conducts environmental studies in the pacific. Current studies in Washington include Archaeological and Biological Assessment of Submerged Landforms off the Pacific Coast; Potential Impacts of Submarine Power Cables on Crab Harvest; Cross-shelf Habitat Suitability Modeling; Analysis of Long-term Seabird Colony Legacy Data in the Pacific Northwest as a Regional Baseline; Seabird and Marine Mammal Surveys off the Northern California, Oregon, and Washington Coasts; Data Synthesis and High-resolution Predictive Modeling of Marine Bird Spatial Distributions on the Pacific OCS; Pacific Marine Assessment Partnership for Protected Species (PacMAPPS); Offshore Acoustic Bat Study Along Western U.S. Continental and Hawaiian Island Coastlines; and Over Water Migration Movements of Black Brant (Bureau of Ocean Energy Management, 2019). These activities, when considered with the Proposed Action, could add to the cumulative impacts on cultural resources and marine biological resources.		X	X	X
Commercial and General Aviation Activities	Global	Commercial and general aviation are retained for analysis and discussion due to associated noise and emissions from aviation activities and effects on		O	O	O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures1	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
		greenhouse gas on air quality and climate change. These activities, when considered with the Proposed Action, could add to the cumulative impacts on air quality, birds, cultural, Native American, and socioeconomic resources.				
Commercial Fishing (Section 3.12.2.2, Commercial and Recreational Fishing)	Pacific Ocean	Commercial and recreational fishing constitutes an important and widespread use of the ocean resources throughout the Study Area. Fishing can adversely affect fish populations, other species, and habitats. Potential impacts of fishing include overfishing of targeted species, bycatch, entanglement, and habitat destruction, all of which negatively affect fish stocks and other marine resources. Bycatch is the capture of fish, marine mammals, sea turtles, seabirds, and other nontargeted species that occur incidentally to normal fishing operations. Use of mobile fishing gear such as bottom trawls disturbs the seafloor and reduces habitat structural complexity. Indirect impacts of trawls include increased turbidity, alteration of surface sediment, removal of prey (leading to declines in predator abundance), removal of predators, ghost fishing (i.e., lost fishing gear continuing to ensnare fish and other marine animals), habitat destruction, and the generation of marine debris. Lost gill nets, purse seines, and long-lines may foul and disrupt bottom habitats and have the potential to entangle or be ingested by marine animals (i.e., microplastic ingestion by birds and fishes).	Various bycatch mitigation technologies, quotas, and seasonal restrictions required per the fishery-specific permit process. Operational regulations, seasonal restrictions, licensing, and quotas are used to mitigate negative effects of recreational fishing.	O	O	O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures1	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
		Fishing can also have a profound influence on individual targeted species populations. In a study of retrospective data, Jackson et al. (2001) analyzed paleoecological records of marine sediments from 125,000 years ago to present, archaeological records from 10,000 years before the present, historical documents, and ecological records from scientific literature sources over the past century. Examining this longer-term data and information, they concluded that ecological extinction caused by overfishing precedes all other pervasive human disturbance of coastal ecosystems, including pollution and anthropogenic climatic change. Fisheries bycatch has been identified as a primary driver of population declines in several marine species, including sharks, mammals, seabirds, and sea turtles (Wallace et al., 2010). For example, entanglement in nets from the Pacific Northwest coastal salmon fisheries has been shown to increase mortality in seabirds (Hamel et al., 2009). Habitat destruction caused by bottom trawling and other fishing methods also contributes to the negative effects of commercial and recreation fishing on multiple species, such as the North American groundfish (Melnychuk et al., 2013).				
Maritime Traffic (Commercial Transportation and Shipping)	Pacific Ocean	Portions of the Study Area are heavily traveled by commercial, recreational, and government marine vessels, with several commercial ports occurring in or near the Study Area. Section 3.12 (Socioeconomic		O	O	O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures1	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
		Resources and Environmental Justice) provides additional information for marine vessel traffic in the Study Area. Primary concerns for the cumulative impacts analysis include vessels striking marine mammals and sea turtles, introduction of non-native species through ballast water, and underwater sound from ships and other vessels. Therefore, maritime traffic could add to the cumulative impacts on marine mammals and sea turtles in the Study Area.				
National Data Buoy Center (NDBC)	Pacific Ocean and Coastal Areas of the United States	The NDBC has prepared a Programmatic EA to analyze the continued operation of the network of moored buoys and coastal stations of the NDBC program. The NDBC network of buoys includes Coastal Weather Buoys, land based Coastal-Marine Automated Network stations, Tropical Atmosphere Ocean Array, and Deep-ocean Assessment and Reporting of Tsunamis. The NDBC proposes to continue the use of these buoys and stations in order to provide quality in-situ marine observations in a safe and sustainable manner to understand and predict changes in weather, climate, oceans, and coasts (National Data Buoy Center, 2017).		O	O	O
Seismic Surveys	Global	Seismic surveys are typically accomplished by towing a sound source such as an airgun array that emits acoustic energy in timed intervals behind a research vessel. The transmitted acoustic energy is reflected and received by an array of hydrophones. This acoustic information is processed to provide information about geological structure below the		O	O	O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures1	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
		seafloor. The oil and gas industry uses seismic surveys to search for new hydrocarbon deposits. In addition, academic geologists use them to study plate tectonics and other topics. In Washington and the Pacific Northwest, seismic surveys are mostly used for collecting marine seismic reflection data to investigate the earthquake hazard in the region. The underwater sound produced by these surveys could add to the cumulative impacts on marine life, including marine mammals. For example, the potential exists to expose some animals to sound levels exceeding 180 decibels (dB) referenced to (re) 1 micropascal (μPa) root mean square, which would, in turn, potentially result in temporary or permanent loss of hearing (Bureau of Ocean Energy Management, 2011). All seismic surveys conducted by U.S. vessels are subject to the MMPA authorization process administered by the NMFS, as well as the NEPA process associated with issuing MMPA authorizations. Seismic surveys could add to the cumulative impacts on biological resources, including marine mammals, fishes, sea turtles, and invertebrates.				
Undersea Communication Cables	Oceans worldwide	Submarine cables provide the primary means of voice, data, and Internet connectivity between the mainland United States and the rest of the world (Federal Communications Commission, 2017). The Federal Communications Commission grants licenses authorizing cable applicants to install, own, and operate submarine cables and associated landing		C/O	C/O	C/O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures1	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
		stations in the United States. Cables are installed by specialized boats across flat ocean surfaces and dug into the seabed in shallow areas. Over 550,000 mi. of cables currently exist in the world's oceans. Potential impacts of installation and maintenance activities would include noise and vessel strike from boat traffic, and increased seafloor disturbance and sedimentation in localized areas where the cable is installed. Likewise, electromagnetic fields are generated by some cables that may be sensed by and affect the migration behavior of some fish, sharks, rays, and eels (Bureau of Ocean Energy Management, 2016). With respect to the Proposed Action, this project could add to the cumulative impacts on noise and biological resources, including both marine species and marine habitats.				

[1] Some projects/activities did not list specific impacts minimization measures (such as avoidance techniques, standard operating procedures, or industry best management practices) or mitigation requirements; either official documentation of project descriptions could not be obtained or did not specify these actions. In most cases, site-specific actions are to be developed as specific projects are developed.
Notes: EA = Environmental Assessment, EIS = Environmental Impact Statement, ESA = Endangered Species Act, MMPA = Marine Mammal Protection Act, NMFS = National Marine Fisheries Service, OEIS = Overseas Environmental Impact Statement, U.S. = United States, USFWS = U.S. Fish and Wildlife Service

Table 4.3-2: Ocean Pollution and Ecosystem Alteration Trends

Stressor	*Location*	*Description*
Climate Change (Section 3.2, Air Quality)	Global	Predictions of long-term negative environmental impacts due to climate change include sea level rise; changes in ocean surface temperature; changes in weather patterns with increases in the severity of storms and droughts; changes to local and regional ecosystems; ocean acidification; shrinking glaciers and sea ice; thawing permafrost; a longer growing season; and shifts in plant and animal ranges. Anthropogenic greenhouse gas emissions have changed the physical and chemical properties of the oceans, including a 1-degree Celsius temperature rise, increased carbon dioxide absorption, decreased pH, and alteration of carbonate chemistry (Poloczanska et al., 2016). Observations of species responses that have been linked to anthropogenic climate change are widespread, and trends include shifts in species distribution to higher latitudes and deeper locations, earlier onset of spring and later arrival of fall, and declines in calcification. Climate change is likely to impact the Study Area negatively and will contribute added stressors to all resources in the Study Area.
Noise	Global	Vessel noise from commercial shipping and general vessel traffic, oceanographic research, oil and gas exploration, underwater construction, and naval and other use of sound navigation and ranging are most likely to contribute to increases in ocean noise. Any potential for cumulative impact should be put into the context of recent changes to ambient sound levels in the world's oceans as a result of anthropogenic activities. Appendix D (Acoustic and Explosive Concepts) provides additional information about sources of anthropogenic sound in the ocean and other background information about underwater noise. This section describes the different types of effects that are possible and the potential relationships between sound stimuli and long-term consequences for individual animals and populations. A variety of impacts may result from exposure to sound-producing activities. The severity of these impacts can vary greatly between minor impacts that have no real cost to the animal, to more severe impacts that may have lasting consequences. The major categories of potential impacts are behavioral reactions, physiological stress, auditory fatigue, auditory masking, and direct trauma. With respect to the Proposed Action, noise can cumulatively add to the impacts on marine mammals, and sea turtles, in the Study Area.
Hypoxic Zones	Global	Hypoxia, or low oxygen, is an environmental phenomenon where the concentration of dissolved oxygen in the water column decreases to a level that can no longer support living aquatic organisms. Hypoxia occurs from the rapid growth and decay of algal blooms in response to excess nutrient loading (primarily nitrogen and phosphorus from agriculture runoff, sewage treatment plants, bilge water, and atmospheric deposition). Animals that encounter the Dead Zones flee, experience physiological stress, or suffocate (National Oceanic and Atmospheric Administration, 2016; Texas A&M University, 2011, 2014). Hypoxic zones can be natural phenomena but are occurring in increasing size and frequency due to human-induced nonpoint source water pollution (National Oceanic and Atmospheric Administration, 2016, 2017). In the northern part of the California Current System in the Offshore Area of the Study Area, a seasonal decline in oxygen concentrations and increasing hypoxia (dead zones) occurring over the summer upwelling season has increased over the past few years. With respect to the Proposed Action, hypoxia could add to the cumulative impacts on biological resources, water quality, and socioeconomic resources.

Table 4.3 2: Ocean Pollution and Ecosystem Alteration Trends (continued)

Stressor	*Location*	*Description*
Marine Debris (Section 3.1.3.2, Marine Debris)	Global	Marine debris is any anthropogenic object intentionally or unintentionally discarded, disposed of, or abandoned that enters the marine environment (National Marine Fisheries Service, 2006). Common types of marine debris include various forms of plastic and abandoned fishing gear. Marine debris degrades marine habitat quality and poses ingestion and entanglement risks to marine life and birds (National Marine Fisheries Service, 2006). Plastic debris is a major concern because it degrades slowly and many plastics float. The floating debris is transported by currents throughout the oceans and has been discovered accumulating in oceanic gyres (Law et al., 2010). Additionally, plastic waste in the ocean chemically attracts hydrocarbon pollutants such as polychlorinated biphenyl and dichlorodiphenyltrichloroethane, which accumulate up to one million times more in plastic than in ocean water (Mato et al., 2001). Fish, marine animals, and birds can mistakenly consume these wastes containing elevated levels of toxins instead of their prey. In the North Pacific Subtropical Gyre, it is estimated that the fishes in this area are ingesting 12,000–24,000 U.S. tons of plastic debris a year (Davison & Asch, 2011). Marine Debris is likely to impact the Study Area negatively and will contribute added stressors to all resources in the Study Area. With respect to the Proposed Action, marine debris could add to the cumulative impacts on biological resources, water quality, and socioeconomic resources.
Pollution (Section 3.1, Sediments and Water Quality)	Global	Common ocean pollutants are derived from land-based activities and include toxic compounds such as metals, pesticides, and other organic chemicals; excess nutrients from fertilizers and sewage; detergents; oil; plastics; and other solids. Pollutants enter oceans from non-point sources (stormwater runoff from watersheds), point sources (wastewater treatment plant discharges), other land-based sources (windblown debris), spills, dumping, vessels, and atmospheric deposition. Bilgewater is a mix of water, oily fluids, lubricants, and grease, cleaning fluids, and other wastes that are pumped out periodically from vessel holding tanks, either to a reception facility onshore or treated with a bilge oil-separator and discharged at sea. Discharging sewage within 3 NM of the coast is largely prohibited under the Clean Water Act. The main risk of oil or other petroleum product spills is from ships, whether carrying petroleum to and from ports or in fuel tanks and from pipelines and onshore facilities that transport and store oil and gas. With respect to the Proposed Action, pollution could add to the cumulative impacts on sediments and water quality, biological resources, air quality, socioeconomic resource, and public health and safety.

Notes: U.S. = United States, NM = nautical miles

4.4 Resource-Specific Cumulative Impacts

In accordance with CEQ Guidance (Council on Environmental Quality, 1997), the following cumulative impacts analysis focuses on impacts that are "truly meaningful." The level of analysis for each resource is commensurate with the intensity of the impacts identified in Chapter 3 (Affected Environment and Environmental Consequences) and the level to which impacts from the Proposed Action are expected to mingle with similar impacts from existing activities. A full analysis of potential cumulative impacts is provided for marine mammals, sea turtles, marine invertebrates, and fish. The rationale is also provided for an abbreviated analysis of the following resources: sediments and water quality, air quality, marine habitats, birds, marine vegetation, fishes, cultural resources, Native American and Alaska Native Traditional Resources, socioeconomic resources, and public health and safety.

4.4.1 Sediments and Water Quality

Based on the analysis in Section 3.1 (Sediments and Water Quality), which supplements the analysis presented in the 2015 NWTT Final EIS/OEIS, sediments and water quality would still be within applicable standards and guidelines that are established to protect sediments and water quality. Furthermore, the Proposed Action would not result in measurable changes in environmental conditions, including concentrations of metals or munitions constituents in water or sediments, nutrient loading, turbidity, dissolved oxygen, or pH (a measure of acidity). The conclusions of available research indicate that environmental risks from munitions constituents and metals in expended materials in aquatic environments are low, based on the following factors:

- The fate and transport of munitions constituents, including metals, in underwater environments is affected by numerous physical, chemical, and biological processes that typically combine to attenuate the concentrations of munitions constituents and their degradation products at a given site.
- Data from multiple underwater munitions sites indicate that munitions constituent concentrations in seawater and sediments are at detectable levels only in close proximity (1–2 m) from the munition or munitions fragments.
- Sampling data and modeling indicate that munitions constituent concentrations measure in the parts per billion range or lower. There is no significant toxicity to most marine species for munitions constituents at parts per billion concentrations. Therefore, based on toxicity studies conducted at sites with munitions, the concentrations of munitions constituents typically found in seawater and sediments are unlikely to have an adverse effect on marine species at the population and community level.
- The small areas of higher constituent concentrations are considered to pose a low risk to the surrounding benthic community, and the disturbance that would be caused by widespread remedial measures, such as removing the munitions, would pose a comparatively higher risk to the benthic environment.

Other projects proposed to occur within or near the Study Area may add to expended materials, such as Bangor Transit Protection Program Pier and Support Facilities (P-907); Canadian Training and Testing, including activities at Canadian Forces Maritime Experimental and Test Ranges; Explosives Handling Wharf Maintenance; Port Security Barrier; U.S. Coast Guard (USCG) Training; Waterfront Improvements at Naval Base Kitsap Bremerton; Waterfront Service Craft Piers at Naval Station Everett (P-65); Whidbey Island Extend Shoreline Erosion Protection System South; Elwha River Restoration; Inland Waters

Construction covered by the State of Washington; Mukilteo Multimodal Terminal Project; Puget Sound Partnership activities; Southern Resident Orca Task Force; The Seattle Multimodal Ferry Terminal at Colman Dock Project; Smith Island Dredging Project; Thorndyke Resources (Pit-to-Pier) Project; and Undersea Communication Cables; however, the Proposed Action would not contribute significantly to the cumulative expended materials in the Study Area. Therefore, the incremental contribution of the Proposed Action to cumulative impacts on sediments and water quality would be low, and further analysis of cumulative impacts is not warranted.

4.4.2 Air Quality

The incremental contribution of the Proposed Action to cumulative impacts would be low and would still be below applicable state, federal, and USEPA standards and guidelines based on the analysis presented in Section 3.2 (Air Quality) of this Supplemental and the reasons summarized below:

- All of the air emissions sources proposed in this Supplemental are mobile sources and do not impact the current attainment status.
- Few stationary offshore air pollutant emission sources exist within the Study Area and few are expected in the foreseeable future.
- International regulations by the International Maritime Organization required commercial shipping vessels to switch to lower-sulfur fuel near U.S. and international coasts beginning in 2012 (National Oceanic and Atmospheric Administration, 2011). In addition, the International Maritime Organization is set to impose a new 0.5 percent sulfur cap on marine fuel emissions (International Maritime Organization, 2017). The DoD has released the Operational Energy Strategy: Implementation Plan, which will reduce demand, diversify energy sources, and integrate energy consideration into planning (U.S. Department of Defense, 2012). Since then, the Navy has released the 2016 Operational Energy Strategy, which builds on the successes of the 2011 Operational Energy Strategy (U.S. Department of Defense, 2016).

Under this Supplemental, the contribution of proposed increases in training and testing under the Proposed Action would still be negligible based on the reasons presented in Section 3.2 (Air Quality). Vessel and construction-related activities associated with the additional projects could generate increased air emissions; however, air quality in the region would remain below *de minimis* levels due to the quick dispersive nature of emissions. Therefore, further analysis of cumulative impacts on air quality is not warranted.

4.4.3 Marine Habitats

The incremental contribution of the Proposed Action to cumulative impacts would be negligible based on the analysis presented in Section 3.3 (Marine Habitats) of this Supplemental, and the reasons summarized below:

- Most of the proposed activities that might affect marine habitats would occur in areas where hard bottom does not occur.
- Impacts on soft-bottom habitats would be confined to a limited area, and recovery would occur quickly.

Other projects proposed to occur within or near the Study Area, such as in-water construction, may add to impacts on marine habitats; however, the Proposed Action would not contribute significantly to the cumulative impacts on marine habitats in the Study Area. Therefore, further analysis of cumulative impacts on marine habitats is not warranted.

4.4.4 Marine Mammals

The analysis presented in the 2015 NWTT Final EIS/OEIS Section 3.4 (Marine Mammals) detailed the potential for impacts on marine mammals from the various stressors related to Navy training and testing activities. As discussed in Section 3.4.2 (Environmental Consequences) of this Supplemental, in general there have been no substantial changes to the activities analyzed in the 2015 NWTT Final EIS/OEIS that would change the conclusions reached regarding populations of marine mammals in the Study Area. Analysis of cumulative impacts on marine mammals was specifically addressed in the 2015 NWTT Final EIS/OEIS Section 4.4.6 (Marine Mammals).

In association with the 2015 NWTT Final EIS/OEIS, National Marine Fisheries Service (NMFS) determined that within the Study Area only acoustic stressors and explosive stressors could potentially result in harassment and/or the incidental taking of marine mammals from Navy training and testing activities (National Marine Fisheries Service, 2015a; National Oceanic and Atmospheric Administration, 2015) and that none of the other stressors would result in significant adverse impacts or jeopardize the continued existence of any Endangered Species Act (ESA) listed marine mammals (National Marine Fisheries Service, 2014). In addition, NMFS determined that the vast majority of impacts expected from sonar exposure and underwater detonations are behavioral in nature, temporary and comparatively short in duration, relatively infrequent, and specifically not of the type or severity that would be expected to be additive for the small portion of the stocks and species likely to be exposed, and they therefore would not contribute to cumulative impacts.

NMFS specifically incorporated the impacts from other past and ongoing anthropogenic activities (see Section 3.4.1.7, General Threats) into their negligible impact analyses pursuant to the Marine Mammal Protection Act (MMPA) and ESA (National Marine Fisheries Service, 2014; National Oceanic and Atmospheric Administration, 2015). The NMFS Biological Opinion included an explanation of how the results of NMFS' baseline and effects analyses in Biological Opinions relate to those contained in the cumulative impact section of the 2015 NWTT Final EIS/ OEIS (National Marine Fisheries Service, 2014, 2015a). NMFS found that Navy training and testing activities are not likely to jeopardize the continued existence of threatened or endangered species in the NWTT Study Area during any single year or as a result of the cumulative impacts of the 5-year authorization under the MMPA (ending in 2020). There has been no emergent science that would necessitate changes to conclusions reached by Navy or NMFS (as a cooperating agency) in association with the 2015 NWTT Final EIS/OEIS with regard to marine mammals. It has long been understood that the cumulative effects of stressors on marine organisms in general and marine mammal populations in particular is extremely difficult to predict (National Academies of Sciences Engineering and Medicine, 2017a). Recognizing the difficulties with measuring trends in marine mammal populations, the focus has been on indicators for adverse impacts, including health and other population metrics (Bradford et al., 2014; Murray et al., 2020; National Academies of Sciences Engineering and Medicine, 2017a, 2017b; Ward et al., 2009). This recommended use of population indicators is the approach Navy has presented in the previous environmental analyses of Navy training and testing activities; see in particular the 2015 NWTT Final EIS/OEIS Section 3.4.4.1 (Summary of Monitoring and Observations During Navy Activities) and the update to that information in this Supplemental (Section 3.4.3.4, Summary of Monitoring and Observations During Navy Activities Since 2015) and National Marine Fisheries Service (2015a). Since the 2015 analyses, neither the present nor the reasonably foreseeable actions detailed in Table 4.3-1 and Table 4.3-2 change the previous assessment that the Navy's contribution to any cumulative impacts on marine mammal populations would be negligible.

Based on the analysis presented in Section 3.4 (Marine Mammals) of this Supplemental, the findings from NMFS regarding cumulative impacts on marine mammals in the NWTT Study Area (National Marine Fisheries Service, 2014), and the reasons summarized above relating to the 2015 NWTT Final EIS/OEIS, the incremental contribution of the Proposed Action to cumulative impacts would be negligible. Therefore, further analysis of cumulative impacts on marine mammals is not warranted.

4.4.5 Sea Turtles

The analysis presented in the 2015 NWTT Final EIS/OEIS Section 3.5 (Sea Turtles) detailed the potential for impacts on sea turtles from the various stressors related to Navy training and testing activities. As discussed in Section 3.5.2 (Environmental Consequences) of this Supplemental, in general there have been no substantial changes to the activities analyzed in the 2015 NWTT Final EIS/OEIS that would change the conclusions reached regarding populations of sea turtles in the Study Area. Analysis of cumulative impacts on sea turtles was specifically addressed in the 2015 NWTT Final EIS/OEIS Section 4.4.7 (Sea Turtles).

Use of acoustic stressors (sonar and other active acoustic sources) and use of explosives have occurred since the 2015 completion of the NWTT Final EIS/OEIS Record of Decision and the 2015 NMFS Biological Opinion. There have been no known adverse effects to sea turtles, impacts on leatherback sea turtle prey items, or population impacts that were not otherwise previously analyzed or accounted for in the 2015 NWTT Final EIS/OEIS or the NMFS Biological Opinion pursuant to the ESA (National Oceanic and Atmospheric Administration, 2015) with regard to acoustic or explosive stressors. Therefore, because there have been no known adverse effects to sea turtles, use of acoustic stressors and explosives would not contribute to cumulative impacts.

There has been no emergent science that would necessitate changes to conclusions reached by Navy or NMFS (as a cooperating agency) in association with the 2015 NWTT Final EIS/OEIS. Since the 2015 analyses, neither the present nor the reasonably foreseeable actions detailed in Table 4.3-1 and Table 4.3-2 change the previous assessment that the Navy's contribution to any cumulative impacts on sea turtles would be negligible.

Based on the analysis presented in Section 3.5 (Sea Turtles) of this Supplemental, and the reasons summarized above relating to the 2015 NWTT Final EIS/OEIS, the incremental contribution of the Proposed Action to cumulative impacts would be negligible. Therefore, further analysis of cumulative impacts on sea turtles is not warranted.

4.4.6 Birds

The analysis presented in the 2015 NWTT Final EIS/OEIS Section 3.6 (Birds) detailed the potential for impacts on birds from the various stressors related to Navy training and testing activities. As discussed in Section 3.6.2 (Environmental Consequences) of this Supplemental, in general there have been no substantial changes to the activities analyzed in the 2015 NWTT Final EIS/OEIS that would change the conclusions reached regarding populations of birds in the Study Area. Analysis of cumulative impacts on birds was specifically addressed in the 2015 NWTT Final EIS/OEIS Section 4.4.8 (Birds).

Marine birds, including ESA-listed species (marbled murrelet and short-tailed albatross), in the Offshore Area are threatened by continued overfishing, pollution, shipping, and oil and gas development (Bureau of Ocean Energy Management, 2017; Melnychuk et al., 2013; Wisniewska et al., 2018). Many of these actions are currently present and are expected to increase in the future (U.S. Fish and Wildlife Service, 2016). Approximately 90 percent of the world's fisheries are already overfished, threatening the ocean life and habitat. The shipping industry is expected to increase as global trade grows, particularly trans-Pacific container ship trade. Increasing the size of ships carrying containers and cargo goods increase oil spills, dumping of trash, ballast water, and oily waste. Therefore, the aggregate impacts of past, present, and reasonably foreseeable future actions may have a significant effect on birds.

The Proposed Action could also result in injury and mortality to individual birds from underwater explosions, sonar, and strikes. Injury and mortality that might occur under the Proposed Action would be additive to injury and mortality associated with other actions. In the U.S. Fish and Wildlife Service (USFWS) 2016 and 2018 Biological Opinions on activities described in the 2015 NWTT Final EIS/OEIS, the USFWS determined that the relative contribution of military training activities to overall injury and mortality of marbled murrelets and short-tailed albatrosses would be low compared to other major threats to marine birds, such as pervasive plastic debris deposition in the marine environment, bycatch, point and non-point source pollution from land, and other sources of pollution from non-military activities (U.S. Fish and Wildlife Service, 2016). In August 2019, the Navy re-initiated consultation with USFWS on the impact of the Growler homebasing decision on marbled murrelets, and this re-initiation began before the initiation of the consultation for this Supplemental EIS/OEIS. The second Growler Biological Opinion therefore forms the baseline for the NWTT Biological Opinion for this species. The cumulative impacts considerations for this species, based upon the NWTT and Growler consultations, would be addressed in the Record of Decision for this Supplemental EIS/OEIS.

It is likely that distant shipping and aircraft noise (which is more pervasive and continuous) and sound associated with underwater explosions and sonar would overlap in time and space. However, there is no evidence indicating that the combined noise of shipping activities and aircraft noise, and sounds associated with underwater explosions and sonar use, would result in harmful additive impacts on birds.

The potential also exists for the impacts of ocean pollution and acoustic stressors associated with the Proposed Action to be additive or synergistic. It is possible that the response of a previously stressed animal would be more severe than the response of an unstressed animal. However, there are no data indicating that a seabird affected by ocean pollution would be more susceptible to stressors associated with the Proposed Action.

The analysis presented in the 2015 NWTT Final EIS/OEIS Section 3.6 (Birds) detailed the potential for impacts on birds from the various stressors related to Navy training and testing activities. As discussed in this Supplemental (Section 3.6.2, Environmental Consequences), in general there have been no substantial changes to the activities analyzed in the 2015 NWTT Final EIS/OEIS that would change the conclusions reached regarding populations of birds in the Study Area. Analysis of cumulative impacts on birds was specifically addressed in the 2015 NWTT Final EIS/OEIS, Section 4.4.8 (Birds).

In summary, based upon the analysis in Section 3.6 (Birds), and the reasons summarized above, the incremental contribution of the Proposed Action to cumulative impacts on bird populations would be low. Therefore, further analysis of cumulative impacts on birds is not warranted.

4.4.7 Marine Vegetation

Impacts on marine vegetation from projects, such as those that contribute to pollution or climate change, could result in long-term or widespread changes in secondary stressors to the environment that would change environmental conditions such as turbidity, salinity, pH, or water temperature that would impact marine vegetation. The incremental contribution of the Proposed Action to cumulative impacts would be negligible based on the analysis presented in Section 3.7 (Marine Vegetation) and the reasons summarized below:

- Most of the proposed activities would occur in areas where seagrasses and other attached marine vegetation do not grow.
- Impacts would be localized, recovery would occur quickly, and no population level impacts would be expected.
- The Proposed Action would not result in impacts that have been historically significant to marine vegetation. For example, the Proposed Action would not increase nutrient loading, which can cause algal blooms, decrease light penetration, and impact photosynthesis of seagrasses. Furthermore, the Proposed Action would not result in long-term or widespread changes in environmental conditions, such as turbidity, salinity, pH, or water temperature that could impact marine vegetation.
- The Proposed Action would have no effect on ESA-listed species of marine vegetation and would not result in the destruction or adverse modification of critical habitat.

Under this Supplemental, the contribution of proposed increases in training and testing under the Proposed Action would be low, based on the reasons presented above. However, these impacts are expected to be localized, recovery would occur quickly, and no population-level impacts would be expected. Therefore, further analysis of cumulative impacts on marine vegetation is not warranted.

4.4.8 Marine Invertebrates

Under this Supplemental, stressors from the Proposed Action would have no effect or would not significantly impact marine invertebrates. Based upon the analysis in Section 3.8 (Marine Invertebrates), the invertebrate mortality impacts of the Proposed Action under this Supplemental would be cumulative with other actions that cause mortality (e.g., commercial fishing). Under this Supplemental, stressors from the Proposed Action would have no effect or would not significantly impact marine invertebrates. The incremental contribution of the Proposed Action to cumulative impacts would be negligible. This is mainly due to marine invertebrates not being particularly susceptible to energy, entanglement, or ingestion stressors resulting from Navy activities, and none of the alternatives would result in or interact with impacts that have been historically significant to marine invertebrates, such as overfishing, nutrient loading, disease, or the presence of invasive species. Therefore, further analysis of cumulative impacts on marine invertebrates is not warranted.

4.4.9 Fishes

4.4.9.1 Impacts of the Proposed Action that May Contribute to Cumulative Impacts

Based on the analysis presented in Section 3.9 (Fishes) under this Supplemental and the analysis presented in the 2015 NWTT Final EIS/OEIS Section 3.9 (Fish), it is anticipated that the Proposed Action would affect fish species within the Study Area, including ESA-listed fish species. Fishes could be affected by acoustic stressors (sonar and other transducers, vessel noise, and weapons noise), explosives, energy stressors, physical disturbance or strikes (vessels and in-water devices, military expended materials, seafloor devices), entanglement (wires and cables, decelerators/parachutes), and ingestion of military expended materials. The majority of potential impacts include short-term behavioral and physiological responses. For example, fish species that are exposed to sonar and other transducers within their hearing range or that are within close proximity to vessel or weapons noise may experience brief periods of masking or behavioral reactions, such as startle or avoidance responses, or no reaction at all. Other stressors (such as explosives) could also result in injury or mortality to a relatively small number of individuals. As described in Section 3.9.3 (Environmental Consequences), long-term consequences for most individual fishes or populations are unlikely because exposures from the majority of stressors are intermittent, transient, and unlikely to repeat over short periods.

The general region of influence for fishes extends beyond the Study Area boundaries for some species because the Study Area represents only a portion of the available habitat during its lifecycle, such as anadromous species that spend part of their lifecycle in freshwater. Fishes are usually not distributed uniformly throughout the Study Area, but are typically associated with a specific habitat type (e.g., soft bottom, reef, or open water) or can utilize a variety of habitats at different life stages. The distribution and specific habitats in which an individual of a single fish species occurs may also be influenced by its size, sex, reproductive condition, and other factors such as water temperature and depth. The highest number and diversity of fishes typically occur where the habitat is most diverse; thus, coastal ecosystems tend to support a greater diversity of species than oceanic and deep-sea habitats (Moyle & Cech, 2004).

4.4.9.2 Impacts of Other Actions

The potential impacts of other actions that are relevant to the cumulative impact analysis for fish include the following:

- Mortality associated with vessel strikes, commercial fisheries, bycatch, and entanglement in fishing and other gear
- Injury associated with vessel strikes, bycatch, entanglement, and underwater sound
- Disturbance, behavioral modifications, and reduced animal fitness associated with underwater noise
- Reduced animal fitness associated with water pollution

Most of the other actions and considerations retained for analysis would include operation of marine vessels. Exceptions include the actions listed under environmental regulations and permitting. Stressors associated with marine vessel operations that are of primary concern for the cumulative impacts analysis includes vessel strikes and underwater noise. Many of the actions would also result in underwater noise from sources other than vessels, seismic surveys, and construction activities. Rather than discussing these stressors for individual actions, their aggregate impacts are considered below as "other environmental considerations" in the maritime traffic and ocean noise subsections. Similarly, many of the actions would result in water pollution. The aggregate impacts of water pollution and stressors from commercial and recreation fishing are discussed in the following paragraphs.

As stated in the 2015 NWTT Final EIS/OEIS and in Section 3.9 (Fish) in this Supplemental, with few exceptions, activities involving vessels and in-water devices are not intended to contact the seafloor. Except for bottom-crawling unmanned underwater vehicles, there is minimal potential for strike impact. Physical disturbance and strike stressors from vessels and in-water devices, military expended materials, and seafloor devices have the potential to affect all marine fish groups found within the Study Area, although some fish groups may be more susceptible to strike potential than others. In addition, the potential responses to physical strikes are varied, but include behavioral changes such as avoidance, altered swimming speed and direction, physiological stress, and physical injury or mortality.

Underwater noise can be a threat to marine fishes. Anthropogenic noise is generated from a variety of sources including commercial shipping, oil and gas exploration and production activities, commercial and recreational fishing (including fish-finding sonar, fathometers, and acoustic deterrent devices), recreational boating, whale watching activities and other marine transportation vessels such as ferries, marine and coastal development (i.e., construction of bridges, ferry terminals, windfarms, etc.), and research (including sound from air guns, sonar, and telemetry). Vessel noise in particular is a major contributor to anthropogenic noise in the ocean and is intensively produced in inland waters. Commercial shipping's contribution to ambient noise in the ocean increased by as much as 12 dB between approximately the 1960s and 2005 (Hildebrand, 2009; McDonald et al., 2008). Frisk (2012) confirmed the trend and reported that between 1950 and 2007 ocean noise in the 25 to 50 Hz frequency range increased 3.3 dB per decade, resulting in a cumulative increase of approximately 19 dB over a baseline of 52 dB (decibels re 1 μPa^2/Hz). The increase in noise is associated with an increase in commercial shipping, which correlates with global economic growth (Frisk, 2012). Miksis-Olds and Nichols (2016) found low-frequency ocean sound levels have decreased in the South Atlantic and Equatorial Pacific Oceans, similar to a trend of slightly decreasing low-frequency noise levels in the Northeast Pacific. In addition to vessels, other sources of underwater noise include pile-driving activity (Carlson et al., 2007; Casper et al., 2013a; Casper et al., 2012; Casper et al., 2013b; Dahl et al., 2015; Debusschere et al., 2014; Feist et al., 1992; Halvorsen et al., 2012; Popper et al., 2006; Ruggerone et al., 2008; Stadler & Woodbury, 2009), sonar (California Department of Transportation, 2001; Carlson et al., 2007; Mueller-Blenkle et al., 2010; Popper et al., 2006), seismic activity (Popper & Hastings, 2009), and offshore construction projects (Foderaro, 2015).

Noise can cause permanent injury in some marine animals (Popper et al., 2005). Physiological responses to noise have shown a variety of results. For example, the giant kelpfish (*Heterostichus rostratus*) exhibited acute stress response when exposed to intermittent recorded boat engine noise (Nichols et al., 2015). In another study, Holles et al. (2013) found that local, low-intensity noise from recreational boat engines has the capacity to disrupt settlement in coral reef fish larvae, which may lead to impacts on recruitment to adult populations.

Chemicals and debris are the two most common types of pollutants in the marine environment. Global oceanic circulation patterns result in the accumulation of a considerable amount of pollutants and debris scattered throughout the open ocean and concentrated in gyres and other places (Crain et al., 2009). Pollution initially impacts fishes that occur near the sources of pollution, but may also affect future generations from effects to reproduction and increased mortality across life stages.

Chemical pollutants in the marine environment that may impact marine fishes include organic pollutants (e.g., pesticides, herbicides, polycyclic aromatic hydrocarbons, flame retardants, and oil) and inorganic pollutants (e.g., heavy metals) (Pew Oceans Commission, 2003). High chemical pollutant levels in marine fishes may cause behavioral changes, physiological changes, or genetic damage (Goncalves et al., 2008; Moore, 2008; Pew Oceans Commission, 2003). Bioaccumulation is the net buildup of substances (e.g., chemicals or metals) in an organism from inhabiting a contaminated habitat or from ingesting food or prey containing the contaminated substance (Newman, 1998), or from ingesting the substance directly (Moore, 2008). Bioaccumulation of pollutants (e.g., metals and organic pollutants) is also a concern to human health because people consume top predators with high pollutant loads.

Marine debris is a widespread global pollution problem, and trends suggest that accumulations are increasing as plastic production rises (Rochman et al., 2013). Debris includes plastics, metals, rubber, textiles, derelict fishing gear, vessels, and other lost or discarded items. Derelict fishing gear include abandoned nets and lines that pose a threat to fishes. Due to body shape, habitat use, and feeding strategies, some fishes are more susceptible to marine debris entanglement than others (Musick et al., 2000; Ocean Conservancy, 2010). Entanglement in abandoned commercial and recreational fishing gear has caused declines for some marine fishes.

Microplastics (i.e., plastics less than 5mm in size) in the marine environment are well documented, and interactions with marine biota, including numerous fish species have been described worldwide (Lusher et al., 2016). Plastic waste in the ocean chemically attracts hydrocarbon pollutants such as polychlorinated biphenyl (PCB) and dichlorodiphenyltrichloroethane, which accumulate up to one million times more in plastic than in ocean water (Mato et al., 2001). Fishes can mistakenly consume these wastes containing elevated levels of toxins instead of their prey. Rochman et al., (2015) found marine debris in 28 percent of the individual fish examined and in 55 percent of all fish species analyzed.

Coastal development and increased human population activities in coastal areas, such as increased tourism, non-point source pollution and runoff, power plant entrainment, and degradation of nearshore water quality and seagrass beds, will continue to have impacts on fish.

Exploitation from commercial and recreational fishing is the single-biggest cause of changes in fish populations and communities (Moyle & Cech, 2004). Historic and current overfishing largely contributed to the listing of ESA-protected marine species (Crain et al., 2009; Kappel, 2005). Overfishing of a resource results from both legal and illegal fishing (poaching) and bycatch of resources in quantities above a sustainable level. By the end of 2015, 28 managed fish stocks in the U.S. were on the overfishing list and 38 stocks were on the overfished list, while the number of rebuilt fish stocks since 2000 increased to 39 (National Marine Fisheries Service, 2016b).

In recent decades, commercial fisheries have targeted the larger, predatory, and sometimes higher-priced fish species. Gradually, the fishing pressure could make the larger species more scarce, and fishing will move towards the smaller species (Pauly & Palomares, 2005). Other factors, such as fisheries-induced evolution and intrinsic vulnerability to overfishing, have been shown to reduce the abundance of some populations (Kauparinen & Merila, 2007). Fisheries-induced evolution is a change in genetic composition of the population that results from intense fishing pressure, such as a reduction in the overall size and growth rates of fishes in a population. Intrinsic vulnerability is when certain life history traits (e.g., large body size, late maturity age, low growth rate, low offspring production) result in a species being more susceptible to overfishing than others (Cheung et al., 2007).

Although these factors are a concern for fisheries worldwide, fisheries off the U.S. West Coast are managed conservatively, in keeping with the requirements of the Magnuson-Stevens Fishery Conservation and Management Act. Fish stocks within the Study Area that were historically overfished have recovered or are recovering from their overfished status and contributing to the overall trend of increasing abundance of U.S. marine fish stocks (National Marine Fisheries Service 2013, National Marine Fisheries Service 2014b).

4.4.9.3 Cumulative Impacts on Fish

The Proposed Action could also result in injury and mortality to individual fish from underwater explosions, sonar, and strikes. Injury and mortality that might occur under the Proposed Action would be additive to injury and mortality associated with other actions. However, the relative contribution to the overall injury and mortality would be low compared to other actions, such as bycatch, storm runoff, plastic debris, and other non-military activities (as discussed in Section 4.4.9.2, Impacts of Other Actions).

It is likely that distant shipping and aircraft noise (which is more pervasive and continuous) and sound associated with underwater explosions and sonar would overlap in time and space. However, there is no evidence indicating that the co-occurrence of shipping and aircraft noise, and sounds associated with underwater explosions and sonar use would result in harmful additive impacts on fish.

The potential also exists for the impacts of ocean pollution and acoustic stressors associated with the Proposed Action to be additive or synergistic. It is possible that the response of a previously stressed animal would be more severe than the response of an unstressed animal. However, there are no data indicating that a fish affected by ocean pollution would be more susceptible to stressors associated with the Proposed Action.

In summary, based upon the analysis in Section 3.9 (Fishes), the aggregate impacts of past, present, and other reasonably foreseeable future actions contributing multiple water quality, noise, and physical risks to fishes would likely continue to have significant effects on individual fishes and fish populations. However, Navy training and testing activities are generally isolated from other activities in space and time and the majority of the proposed training and testing activities occur over a small spatial scale relative to the entire Study Area, have few participants, and are of a short duration. Although it is possible that the Proposed Action could contribute incremental stressors to a small number of individuals, which would further compound effects on a given individual already experiencing stress, it is not anticipated that the Proposed Action has the potential to put additional stress on entire populations already in significant decline. Therefore, it is anticipated that the incremental contribution of the Proposed Action, when added to the impacts of all other past, present, and reasonably foreseeable future actions, would not result in measurable additional significant impacts on fishes in the Study Area or beyond.

4.4.10 Cultural Resources

4.4.10.1 Impacts of the Proposed Action That May Contribute to Cumulative Impacts

Based on the analysis presented in Section 3.10 (Cultural Resources) under this Supplemental and the analysis presented in the 2015 NWTT Final EIS/OEIS Section 3.10 (Cultural Resources), the Proposed Action could result in impacts on submerged prehistoric sites and previously unidentified submerged historic resources if certain training and testing activities are conducted where these resources occur. Stressors that could impact cultural resources include underwater explosions on or near the bottom, use of towed in-water devices, and use of ocean bottom deployed devices. Because cultural resources are considered nonrenewable resources, these impacts would be considered long-term and permanent.

The Navy avoids locations of known obstructions to prevent damage to sensitive Navy equipment and vessels and to ensure the accuracy of training and testing exercises. Known obstructions include some historic shipwrecks; however, it is unknown if all submerged obstructions, historic shipwrecks, or other cultural resources have yet been discovered in the Study Area.

4.4.10.2 Impacts of Other Actions

With a few exceptions, most of the other actions described in Table 4-1 that are not related to the Proposed Action, but retained for cumulative impacts analysis, would involve some form of disturbance to the ocean bottom. Exceptions include environmental regulations and planning actions, ocean pollution, and most forms of ocean noise. Actions that would disturb the ocean bottom could impact submerged cultural resources. For example, ocean bottom disturbance would occur from construction related activities such as ship anchoring, and installation of wind turbine piers. Any physical disturbance on the continental shelf and ocean floor could inadvertently damage or destroy submerged prehistoric sites and submerged historic resources.

The other actions that result in ocean bottom disturbance require some form of federal authorization or permitting. Requirements of the National Historic Preservation Act (NHPA) apply to actions in territorial waters. Therefore, for these actions in territorial waters, federal agency procedures have been implemented to identify cultural resources, avoid impacts, and mitigate if impacts cannot be avoided. For example, the Bureau of Ocean Energy Management, Regulation and Enforcement has procedures in place to identify the probability for the presence of submerged historic resources and the locations submerged prehistoric sites shoreward from the 148 ft. (45.1 m) isobath, and for project redesign and relocation to avoid identified resources (Minerals Management Service, 2007). Nonetheless, inadvertent impacts could occur if unidentified submerged cultural resources are present.

4.4.10.3 Cumulative Impacts on Cultural Resources

Impacts on submerged cultural resources from other actions would typically be avoided or mitigated through implementing federal agency programs. However, impacts could occur if mitigation measures cannot be implemented as intended or if inadvertent disturbance or destruction of unidentified resources occurs. Disturbance or destruction of a submerged prehistoric site would diminish the overall archaeological record and decrease the potential for meaningful research on Paleomarine traditions (6,500–5,000 Before Present) and early European explorers of the Northwest coast (1700s–1800s). Disturbance or destruction of a submerged historic site, including a shipwreck, could diminish the overall record for these resources and decrease the potential for meaningful research on these resources. Based upon the analysis in Section 3.10 (Cultural Resources), when considered with other actions (see Table 4.3-1 and Table 4.3-2), the Proposed Action would not contribute to and increase the cumulative impacts on submerged prehistoric and historic resources. Therefore, further analysis of cumulative impacts on cultural resources is not warranted.

The Olympic National Park was accepted as a World Heritage Site in 1981. Because most of the Olympic National Park is designated as wilderness, the natural soundscape is an important element and prevalent in much of the park. The National Park Service regards natural and cultural sounds as part of a web of resources that must be protected. Threats to natural soundscape come from development and other human activities inside and outside the park (National Park Service, 2008). Based on the analysis in the noise study for this Supplemental (Appendix J, Airspace Noise Analysis for the Olympic Military Operations Area), it is notable that the noise exposure for more than 91 percent of the area beneath the Olympic Military Operations Area (MOA) would be less than 35 A-weighted decibels (dBA). For the cumulative noise metrics, the noise modeling results show that the area underneath the Olympic MOA would experience a cumulative noise exposure of less than 37 dBA for both the reference (current) activities and the proposed activities. Flyover event noise levels during transit (less than one minute) would be higher than average background noise levels in the national park and wilderness areas. Although they are not substantially above the range of noise levels that can occur under natural conditions, they would still be additive to the baseline average of 35 dBA and the proposed aircraft activity average hovers around 36 dBA. The noise levels experienced within the MOA would not result in any risks to public health and safety. Other activities such as logging, construction, academic research, and recreation in the Olympic National Park contribute to cumulative impacts to the noise environment. When considered with other actions (e.g., logging, construction, recreation, transportation, and others; see Table 4.3-1 and Table 4.3-2), the contribution of the Proposed Action of this Supplemental EIS/OEIS to the Olympic National Park soundscape would be short term, intermittent, and temporary due to the nature of the activities as overflights. Therefore, because the area underneath the Olympic MOA would experience a cumulative noise exposure of less than 37 dBA for both the reference (current) activities and the proposed activities, cumulative impacts on key resources or the value of the Olympic National Park would not be significant.

4.4.11 Native American and Alaska Native Traditional Resources

4.4.11.1 Impacts of the Proposed Action that May Contribute to Cumulative Impacts

Based on the analysis presented in Section 3.11 (American Indian and Alaska Native Traditional Resources) under this Supplemental and the analysis presented in the 2015 NWTT Final EIS/OEIS Section 3.11 (American Indian and Alaska Native Traditional Resources), the Proposed Action could result in impacts on American Indian and Alaska Native protected tribal resources and other traditional resources by impeding, generally for brief duration, access to areas of co-use such as usual and accustomed (U&A) fishing grounds, which may prevent fishing in limited seasons. Stressors that could impact American Indian and Alaska Native Traditional resources include impeding access to U&A fishing grounds or traditional fishing areas, changes in the availability of marine resources or habitat, and loss of fishing gear.

The Navy has established protective measures to reduce potential effects on cultural and natural resources from training and testing exercises. While most of these protective measures focus on protection of the natural environment, they also benefit culturally valued natural resources, such as salmon and shellfish. Some of the protective measures include avoidance of known submerged obstructions, use of inert ordnance and passive tracking and acoustical tools, and avoidance of sensitive habitats to ensure that significant concentrations of sea life are not present.

The Navy strives to maintain safety and accommodate, to the extent possible, access to tribes' usual and accustomed areas in co-use navigable waters. The Navy provides the USCG with information on the locations of potentially hazardous training or testing activities at sea so the USCG can issue Notices to Mariners (NTMs). In some instances, the Navy has directly notified affected American Indian tribes and nations to ensure that their activities in usual and accustomed fishing areas can avoid any potentially hazardous training or testing locations at sea. Advance communication of intent directly and through NTMs issued by the USCG increases the ability of the Tribes and Navy to share use of the Study Area with less conflict, reducing the potential for lost or damaged Tribal fishing gear. Any claims for loss or damage to fishing gear related to Navy activities are addressed through the Navy's claims adjudication process. Information on admiralty claims can be found at the Navy Judge Advocate General's Corps website: http://www.jag.navy.mil/organization/code_11.htm. Reduced access to human activities in the ocean or inland waterways would be an impact if it directly contributed to loss of income, revenue, or employment, or if cultural knowledge is lost because tribal members cannot teach their children and grandchildren to fish in areas where they were taught by their ancestors.

4.4.11.2 Impacts of Other Actions

Actions that would disturb the ocean bottom could impact submerged American Indian and Alaska Native Traditional resources. For example, ocean bottom disturbance would occur from installing a piling in a former oyster bed of significance to a tribe or nation. Any physical disturbance on the continental shelf and ocean floor (including the Inland Waters and the Western Behm Canal) could inadvertently damage or destroy submerged fishing gear, or areas of traditional or cultural significance. Other actions that could impact American Indian and Alaska Native Traditional Resources include environmental regulations and planning actions, ocean pollution, and most forms of ocean noise.

The construction of the Seattle Multimodal Ferry Terminal at Colman Dock, has the potential to impact American Indian Traditional Resources. The other actions that result in ocean bottom disturbance require some form of federal authorization or permitting. Therefore, requirements of the NHPA apply to actions in territorial waters. Federal agency procedures have been implemented to identify American

Indian and Alaska Native Traditional resources, avoid impacts, and mitigate if impacts cannot be avoided. For example, traditional resources along with archaeological and architectural resources are protected by various laws and their implementing regulations: the NHPA of 1966 as amended in 2006, the American Indian Religious Freedom Act of 1978, and the Native American Graves Protection and Repatriation Act of 1990. Within state territorial waters (0–3 NM), the NHPA is the guiding mandate; within U.S. territorial waters (0–12 NM), the NEPA is the primary mandate. Areas beyond 12 NM are beyond the jurisdiction of NEPA, but they are covered by Executive Order 12114. Nonetheless, inadvertent impacts could occur if unidentified submerged tribal or traditional resources are present.

4.4.11.3 Cumulative Impacts on Native American and Alaska Native Traditional Resources

The success of American Indian tribal fisheries has been impacted by long-term changes in the environment that can reduce fish stocks due to impacted water quality, reduced habitat—especially spawning habitat for salmon runs, and increased commercial harvests. The Navy has an active consultation process in place and will continue to consult on a government-to-government basis with potentially affected American Indian tribes and nations regarding Navy activities that may have the potential to impact protected tribal treaty rights and resources. The Navy's other measures to prevent pollution from its own operations and sustain or improve habitat value help to offset some of the cumulative impacts. Pursuant to the Navy's government-to-government consultation with federally-recognized American Indian and Alaska Native tribes and nations, agreements (both formal and informal) regarding protocols or tribal mitigation measures may be developed to reduce or eliminate impacts on protected tribal treaty reserved rights and protected tribal resources.

4.4.12 Socioeconomic Resources

As stated in the 2015 NWTT Final EIS/OEIS, the Proposed Action could contribute to impacts on accessibility to nearshore areas popular for commercial and recreational fishing and some tourism activities that access the marine environment. However, limits on accessibility to these areas are not expected to significantly impact these resources, because restrictions would be temporary and of short duration (hours). To ensure public safety, access to waters within exclusion areas would be limited during military training and testing activities. The same limitations on accessing portions of the Study Area designated as restricted areas, and warning areas as described in the 2015 NWTT Final EIS/OEIS and in the CFR would still apply. Refer to 33 CFR (Navigation and Navigable Waters) Part 334 (Danger Zone and Restricted Area Regulations), 33 CFR 165.1401 (Safety Zones), and 14 CFR 73.1 (Special Use Airspace) for specific regulations regarding these ocean areas and airspace. In addition, the USCG has published a final rule establishing protection zones extending 500 yards (yd.) around all Navy vessels in navigable waters of the United States and within the boundaries of Coast Guard Pacific Area (32 CFR Part 761). All vessels must proceed at a no-wake speed when within a protection zone. Non-military vessels are not permitted to enter within 100 yd. of a U.S. naval vessel, whether underway or moored, unless authorized by an official patrol. Refer to Section 3.12.2.1.1.2 (Inland Waters) for more information on accessibility to areas of the Study Area.

When training or testing activities are scheduled that require specific areas to be free of non-participating vessels and aircraft, the military requests that the USCG issues an NTM and that the Federal Aviation Administration issues a notice to airmen (NOTAM), as applicable for the activity. These measures are intended to alert the public of pending training or testing activities and to ensure the safety of the public and military personnel. Providing advance notice of scheduled activities should allow members of the public to avoid unexpected delays or interruptions to their planned activities due to restrictions on accessing areas used for military activities.

4.4.12.1 Resource Trends

The maritime ports of Seattle and Tacoma (combined) were the nation's sixth-highest ranked port (out of 150) by value of shipments for international waterborne trade (imports + exports) in 2015. The port has not ranked as high since 2011, when it was fifth in the nation (American Association of Port Authorities, 2016). The volume of international trade at Seattle-Tacoma peaked in 2012 at nearly 20.5 million metric tons, declining to just under 19 million metric tons in 2015. While recent trends show a decline, the volume of goods in 2015 is approximately equivalent to pre-recession totals (U.S. Maritime Administration, 2015).

Recent trends in commercial fisheries landings are mixed. The value of commercial fisheries landings in the State of Washington declined from 2013 through 2016 (the latest year available), and the volume (measured in pounds) of commercial landings declined between 2013 and 2015 but increased by approximately 10 percent in 2016. Commercial landings in Oregon followed a similar trend from 2013 through 2016; however, both the volume and value of commercial landings in Oregon increased from 2015 to 2016 (National Marine Fisheries Service, 2016a). These trends suggest that the volume and value of fisheries landings in the State of Washington and Oregon may begin trending upwards in 2017.

Portions of the Olympic National Park and Olympic National Forest underlie the Olympic MOA (special use airspace) and are within the Study Area, and draw tourists into the State of Washington. Visitation increased each year from 2013 through 2017, reaching a peak of over 3.4 million people in 2017, declining to 3.1 million in 2018, and increasing again to 3.25 million in 2019 (National Park Service, 2020). Other economic sectors associated with the tourism industry have also been trending upwards. Airborne noise generated by aircraft overflights continues to be a concern for some visitors to the Olympic National Park (Rudzitis, 2018). While visitation to the park does not appear to be impacted, the enjoyment of the park by some visitors could be disturbed by aircraft overflights and may be temporarily interrupted. Tourism continues to be popular in the inland waters area including Puget Sound and Hood Canal (see Section 3.12.2.2.2, Inland Waters, for details). As described in Section 3.12.2.2.3 (Western Behm Canal, Alaska), tourism, primarily via larger cruise ships, continues to be seasonally popular in southeast Alaska waterways, although large cruise ships do not enter Behm Canal.

4.4.12.2 Impacts of Other Actions

Waterways in the Study Area are heavily traveled by commercial, recreational, and other vessels, including military and USCG vessels. Several major commercial ports are located in or near the Study Area, including the ports of Seattle and Tacoma in southern Puget Sound, and the Canadian ports of Vancouver and Victoria. Vessels transiting to and from U.S. and Canadian ports use the Strait of Juan de Fuca. Van Dorp and Merrick (2017) estimate that there are 8,300 transits of deep draft vessels through the Strait of Juan de Fuca annually, with 5,500 accessing Canadian Ports and the other 3,700 transiting through Puget Sound at Admiralty Inlet. Within Washington state waters, the USCG Vessel Traffic Service handles approximately 170,000 ferry transits annually. Commercial vessel traffic has the potential to limit access by the public to waterways, which would also include access by tourism related activities and businesses (e.g., whale watching vessels).

Several commercial airways traverse the Olympic Peninsula and Olympic National Park, connecting major airports in the region, including the Seattle-Tacoma International Airport, Portland International Airport, and the Olympia Regional Airport (see Figure 3.12-4 and Figure 3.12-5). There are also numerous smaller commercial and general aviation airports in the region, including on the Olympic

Peninsula. Airborne noise generated by commercial and private aircraft using airways traversing the Olympic National Park may disturb, or otherwise impact the enjoyment of, individuals visiting the park.

Aquaculture activities using inland waters in Puget Sound have been shown to impact social and economic resources in the Inland Waters portion of the Study Area, as demonstrated by the August 2017 spill of farmed Atlantic salmon off Cypress Island (Mapes, 2018). Initially, it was assumed that the escaped salmon were not able to feed and died from starvation. Subsequent findings contradicted that assertion, and Atlantic salmon continued to be caught by tribal fishermen through December 2017 (Cauvel, 2017; Mapes, 2018). The possibility of future spills of farmed salmon and the risk that they would pose to the survival of native salmon species led Governor Inslee to sign into law a ban on the farming of Atlantic Salmon in Washington State waters (Ryan, 2018). The State's remaining Atlantic salmon farms would cease operations by 2022, once their existing leases with the Washington Department of Natural Resources expire.

4.4.12.3 Cumulative Impacts on Socioeconomic Resources

Regarding cumulative impacts to the Olympic National Park from military, civilian, and private flights, data from the FAA indicates that the military makes up approximately 7 percent of flights within the transition area to and from the Olympic Military Operating Area, while air carriers make up approximately 71 percent of flights and general aviation makes up approximately 22 percent of the flights; over the Olympic National Park, the military flights make up approximately 25 percent of flights, while air carriers make up approximately 67 percent and general aviation makes up approximately 8 percent of flights; over the Olympic Peninsula and Puget Sound military flights make up approximately 6 percent of flights, while air carriers make up approximately 74 percent and general aviation makes up approximately 20 percent of flights. While an increase in military flights over the Olympic Peninsula would contribute to cumulative impacts from airborne noise, 75 to 94 percent of flights over the region are conducted by commercial air carrier aircraft and general aviation aircraft (FAA ATO NAS Analytics - AJV-W25, 2019). The approximately 13 percent increase in military flights under Alternative 1 and 2 would not substantially change the proportion of military flights over the Olympic Peninsula or substantially increase the potential for noise impacts on the Olympic Peninsula, including in the Olympic National Park. Furthermore, the analysis in Section 3.12 (Socioeconomic Resources and Environmental Justice) indicates that the impacts of the Proposed Action on socioeconomic resources would be negligible.

The Proposed Action is not expected to contribute to cumulative socioeconomic impacts. Cumulative impacts from intermittent and short-term impacts on accessibility to areas within the Study Area, physical disturbances and interactions, airborne acoustics that disturb people on the ground (e.g., in the Olympic National Park), and secondary impacts (e.g., to tourism) resulting from effects on marine species populations are not anticipated. No cumulative impacts on commercial transportation and shipping are anticipated, because major shipping routes and airways are well defined, and training and testing activities would avoid those areas. The Navy would continue to reduce or avoid impacts on commercial and recreational fishing and tourism and recreation by continuing to notify the public of upcoming activities that may limit accessibility to certain areas of the Study Area popular participants in these activities. Broader socioeconomic metrics generally indicate that the region is prospering economically. For example, data reported by the National Ocean Economics Program show that the tourism and recreation industry in Washington coastal counties increased steadily from 2010 to 2014 (National Ocean Economics Program, 2017). Short duration limits on accessibility, potentially impacting recreational and tourism related activities, are expected to be intermittent and have no long-term, cumulative impacts. Airborne acoustics from aircraft overflights in the Olympic MOA, potentially impacting recreational and tourism activities on the Olympic Peninsula, are expected to be brief (seconds) and discrete and are not expected to have long-term negative impacts on the enjoyment of the Olympic Peninsula, including Olympic National Park. Because much of the Proposed Action would take place at 12 NM or more offshore from northern California, and Oregon, and because the Proposed Action is not expected to contribute to cumulative socioeconomic impacts in any of the states included in the Study Area, no cumulative negative impacts on the economies of Northern California, Oregon, Washington, or southeast Alaska are anticipated.

4.4.13 Public Health and Safety

The analysis presented in Section 3.13 (Public Health and Safety) of this Supplemental demonstrates that the Proposed Action would not contribute incrementally to cumulative impacts on public health and safety. Other actions discussed in Table 4.3-1 and Table 4.3-2 are not expected to contribute incrementally to cumulative public health and safety impacts. Because the Proposed Action would not contribute to cumulative impacts, and other actions discussed in Table 4.3-1 and Table 4.3-2 are not expected to contribute to cumulative impacts, further analysis of cumulative impacts on public health and safety is not warranted.

4.5 Summary of Cumulative Impacts

The analyses presented in this chapter and Chapter 3 (Affected Environment and Environmental Consequences) indicate that the incremental contribution of the Proposed Action to cumulative impacts on sediments and water quality, air quality, marine habitats, marine vegetation, marine invertebrates, and public health and safety would not rise to a level of significance. Marine mammals, sea turtles, birds, fishes, cultural resources, Native American and Alaska Native Traditional resources, and socioeconomic resources are the primary resources of concern for this cumulative impacts analysis:

- Due to past and present activities, several marine mammal species, all sea turtles, three birds, and multiple fish species occurring in the Study Area are ESA-listed.
- These resources would be impacted by multiple present and reasonably foreseeable future actions.
- Explosive detonations and vessel strikes under the Proposed Action have the potential to disturb, injure, or kill marine mammals, sea turtles, birds, and fish.
- The use of sonar and other non-impulsive sound sources under the Proposed Action has the potential to disturb or injure marine mammals, sea turtles, birds, and fish.
- Impacts on American Indian traditional resources could occur during training and testing activities due to short-term reduced access to tribal usual and accustomed fishing grounds in the Inland Waters. Impacts from training and testing activities would not alter fishes and other marine species population levels or the availability of these resources for tribal use. Loss or damage to American Indian fishing equipment from vessel and in-water device strikes, and inadvertent snagging of military expended materials, could occur in the Offshore Area and in the Inland Waters, reducing fishing opportunities while fishing equipment is being replaced or repaired and increasing the amount of effort and resources required to catch the same amount of fish.
- The noise exposure within the Olympic MOA and W-237A is within the Department of Defense's Noise Zone 1, with Day Night Average Sound Levels below 65 A-weighted decibels, the federal threshold for significance, for the entire area studied (see Appendix J, Airspace Noise Analysis

for the Olympic Military Operations Area). Therefore, there would be no cumulative significant impact to jet noise over the Olympic National Park as a result of the impacts of the Proposed Action.

In summary, based on the analysis presented in Section 3.4 (Marine Mammals), 3.5 (Sea Turtles), 3.6 (Birds), 3.9 (Fishes), 3.10 (Cultural Resources), 3.11 (American Indian and Alaska Native Traditional Resources), and 3.12 (Socioeconomic Resources and Environmental Justice), the current aggregate impacts of past, present, and other reasonably foreseeable future actions are not significantly different than the assessment in the 2015 NWTT Final EIS/OEIS. No new information or circumstances are significant enough to warrant further cumulative impact review.

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5 Mitigation

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5 Mitigation

5.1 Introduction

This chapter describes the mitigation measures that the United States (U.S.) Department of the Navy (Navy) will implement to avoid or reduce potential impacts from the Northwest Training and Testing (NWTT) Supplemental Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) Proposed Action. This chapter has been updated in its entirety since Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the 2015 NWTT Final EIS/OEIS (U.S. Department of the Navy, 2015). As a cooperating agency for the Proposed Action, the U.S. Coast Guard will implement applicable mitigation measures developed by the Navy for the Proposed Action.

The Navy will also implement standard operating procedures specific to training and testing activities conducted under the Proposed Action. In many cases, standard operating procedures provide a benefit to environmental and cultural resources, some of which have high socioeconomic value in the Study Area. Standard operating procedures differ from mitigation measures because standard operating procedures are designed to provide for safety and mission success, whereas mitigation measures are designed specifically to avoid or reduce potential environmental impacts. An example of a standard operating procedure is that ships operated by or for the Navy have personnel assigned to stand watch at all times when underway. Watch personnel monitor their assigned sectors for any indication of danger to the ship and the personnel on board, such as a floating or partially submerged object or piece of debris, periscope, surfaced submarine, wisp of smoke, flash of light, or surface disturbance. The Navy also avoids known navigation hazards that appear on navigational charts, such as submerged wrecks and obstructions. As a standard collision avoidance procedure, watch personnel also monitor for marine mammals that have the potential to be in the direct path of the ship. The standard operating procedures to avoid collision hazards are designed for safety of the ship and the personnel on board. This is different from mitigation measures for vessel movement, which require vessels to maneuver to avoid marine mammals by specified distances to avoid or reduce the potential for physical disturbance and strike of marine mammals, as described in Section 5.3.4.1 (Vessel Movement). In this example, the benefit of the mitigation measure for vessel movement is additive to the benefit of the standard operating procedure for vessel safety. Standard operating procedures that apply to the Proposed Action and are generally consistent with those included in the 2015 NWTT Final EIS/OEIS are described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of that document. Standard operating procedures that apply to the Proposed Action and were not included in, or require a clarification from, the 2015 NWTT Final EIS/OEIS are discussed in Section 2.3.3 (Standard Operating Procedures) of this Final Supplemental EIS/OEIS.

In addition to the mitigation measures and standard operating procedures specific to the Proposed Action, the Navy has existing routine operating instructions (e.g., training manuals) and local installation instructions (e.g., Integrated Natural Resource Management Plans) that were developed to meet other safety and environmental compliance requirements or initiatives. For example, the Naval Air Training and Operating Procedures Standardization General Flight and Operating Instructions Manual (CNAF M-3710.7) contains naval air training procedures pertaining to safe operations of aircraft, which includes requirements to minimize the disturbance of wildlife. Aviation units are required to avoid noise-sensitive areas, such as breeding farms, resorts, beaches, national parks, national monuments, and national recreational areas when at altitudes less than 3,000 feet (ft.) above ground level except when in compliance with applicable Federal Aviation Administration or U.S. Navy-approved traffic patterns, routes, or special use airspace (e.g., military operations areas). They are also required to avoid disturbing wild fowl in their natural habitats and to avoid firing directly at large fish, whales, or other wildlife. These requirements are in addition to mitigation measures developed for the Proposed Action. The Navy will continue complying with applicable operating instructions and local installation instructions within the Study Area, as appropriate.

5.1.1 Benefits of Mitigation

The Chapter 3 (Affected Environment and Environmental Consequences) environmental analyses indicate that certain acoustic, explosive, and physical disturbance and strike stressors have the potential to impact certain biological or cultural resources. The Navy developed mitigation measures for those stressors and would implement the mitigation for either action alternative. The Navy considered the benefits of mitigation in the environmental analyses for both Alternative 1 and Alternative 2 of the Proposed Action in this Final Supplemental EIS/OEIS. In addition to analyzing mitigation measures pursuant to the National Environmental Policy Act (NEPA), the Navy designed its mitigation measures to achieve one or more benefits, such as the following:

- Effect the least practicable adverse impact on marine mammal species or stocks and their habitat, and have a negligible impact on marine mammal species and stocks (as required under the Marine Mammal Protection Act [MMPA]);
- Ensure that the Proposed Action does not jeopardize the continued existence of endangered or threatened species, or result in destruction or adverse modification of critical habitat (as required under the Endangered Species Act [ESA]);
- Avoid or minimize adverse effects on essential fish habitat (as required under the Magnuson-Stevens Fishery Conservation and Management Act); and
- Avoid adversely impacting shipwrecks (as required under the Abandoned Shipwreck Act and National Historic Preservation Act).

In addition to the benefits listed above, certain mitigation measures would also benefit other species in the Study Area, such as seabirds listed under the Migratory Bird Treaty Act. The Navy coordinated its mitigation with the appropriate regulatory agencies, including the National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS), and U.S. Fish and Wildlife Service (USFWS), through the consultation and permitting processes. The Navy Record of Decision will document all mitigation measures the Navy will implement under the Proposed Action. The NMFS Record of Decision, MMPA Regulations and Letters of Authorization, ESA Biological Opinion, and other applicable consultation documents will include the mitigation measures applicable to the resources for which the Navy has consulted. The suite of mitigation measures included in this Final Supplemental EIS/OEIS represents the maximum level of mitigation that is practical for the Navy to implement when balanced against impacts on safety, sustainability, and the ability to continue meeting mission requirements. Should the Navy require a change in how it implements mitigation based on national security concerns, evolving readiness requirements, or other factors (e.g., significant changes in the best available science), the Navy will engage the appropriate agencies and reevaluate its mitigation through adaptive management or the appropriate consultations. The Navy's adaptive management approach is discussed in Section 5.1.2.2.1.1 (Adaptive Management). This approach was coordinated with NMFS during the consultation and permitting processes and will be included in the MMPA Regulations and Letters of Authorization.

5.1.2 Compliance Initiatives

To disseminate its mitigation requirements to the appropriate personnel and meet other compliance requirements for the MMPA and ESA, the Navy will continue using the Protective Measures Assessment Protocol and its ongoing monitoring and reporting initiatives, as described in the sections below.

5.1.2.1 Protective Measures Assessment Protocol

To disseminate requirements to the personnel who are required to implement mitigation during training and testing activities, the Navy will continue inputting its mitigation measures into the Protective Measures Assessment Protocol and appropriate governing instructions. The Protective Measures Assessment Protocol is a software tool that serves as the Navy's comprehensive data source for at-sea mitigation. The software tool provides personnel with notification of the required mitigation measures and a visual display of the planned training or testing activity location overlaid with relevant environmental data (e.g., mapped locations of live hard bottom). Navy policy requires applicable personnel to access the Protective Measures Assessment Protocol during the event planning process. This helps ensure that personnel receive mitigation instructions prior to the start of training and testing activities and that mitigation is implemented appropriately.

5.1.2.2 Monitoring, Research, and Reporting Initiatives

Many of the Navy's monitoring programs, research programs, and reporting initiatives have been ongoing for more than a decade and will continue as a compliance requirement for the MMPA or ESA, or both. The Navy and NMFS use the information contained within monitoring, research, activity, and incident reports when evaluating the effectiveness and practicality of mitigation and determining if adaptive adjustments to mitigation may be appropriate. These reports also facilitate better understandings of the biological resources that inhabit the Study Area and the potential impacts of the Proposed Action on those resources.

5.1.2.2.1 Marine Species Research and Monitoring Programs

Through its marine species research and monitoring programs, the Navy is one of the nation's largest sponsors of scientific research on and monitoring of marine species. Detailed information on these programs is provided in Section 3.0.1.1.1 (Marine Species Monitoring and Research Programs). Navy research programs focus on investments in basic and applied research that increase fundamental knowledge and advance naval technological capabilities. Navy monitoring programs focus on the potential impacts of training and testing activities on biological resources. For example, the Navy Living Marine Resources Program is sponsoring an ongoing study on hearing and estimated acoustic impacts in three species of auk, which will help the Navy refine its assessment of potential impacts from training and testing activities on seabirds, including the marbled murrelet. The Navy has also sponsored several projects on seabird density and distribution to improve baseline knowledge about ESA-listed seabirds in the Study Area.

Other projects, such as those sponsored by the U.S. Navy's Marine Species Monitoring Program, primarily focus on marine mammals and sea turtles. Monitoring reports are available to the public on the U.S. Navy's Marine Species Monitoring webpage (https://www.navymarinespeciesmonitoring.us/). The Navy will post future reports online as they become available. Specific details regarding the content of the reports will be coordinated with the appropriate agencies through the consultation and permitting processes. Additional information about the U.S. Navy's Marine Species Monitoring Program, including its adaptive management and strategic planning components, is provided in the sections below.

5.1.2.2.1.1 Adaptive Management

Adaptive management is an iterative process of decision-making that accounts for changes in the environment and scientific understanding over time through a system of monitoring and feedback. Within the natural resource management community, adaptive management involves ongoing, real-time learning and knowledge creation, both in a substantive sense and in terms of the adaptive process itself (Williams et al., 2009). Adaptive management focuses on learning and adapting, through partnerships of natural resource managers, scientists, and other stakeholders. Adaptive management helps managers maintain flexibility in their decisions and provides them the latitude to change direction to improve understanding of ecological systems and achieve management objectives. Taking action to improve progress toward desired outcomes is another function of adaptive management.

The Navy's adaptive management review process and reporting requirements serve as the basis for evaluating performance and compliance. The process involves technical review meetings and ongoing discussions between the Navy, NMFS, the Marine Mammal Commission, and other experts in the scientific community. An example of a revision to the compliance monitoring structure as a result of adaptive management is the development of the Strategic Planning Process, which is a planning tool for the selection and management of monitoring investments (U.S. Department of the Navy, 2013). Through adaptive management, the Strategic Planning Process has been incorporated into the Integrated Comprehensive Monitoring Program, which is described below.

5.1.2.2.1.2 Integrated Comprehensive Monitoring Program

The Navy developed an Integrated Comprehensive Monitoring Program to serve as the overarching framework for coordinating its marine species monitoring efforts and as a planning tool to focus its monitoring priorities pursuant to ESA and MMPA requirements (U.S. Department of the Navy, 2010). The purpose of the Integrated Comprehensive Monitoring Program is to coordinate monitoring efforts across regions and to allocate the most appropriate level and type of monitoring effort for each range complex based on a set of standardized objectives, regional expertise, and resource availability. The Integrated Comprehensive Monitoring Program does not identify specific field work or individual projects. It is designed to provide a flexible, scalable, and adaptable framework using adaptive management and the Strategic Planning Process to periodically assess progress and reevaluate objectives.

The Integrated Comprehensive Monitoring Program is evaluated through the adaptive management review process to (1) assess progress, (2) provide a matrix of goals and objectives, and (3) make recommendations for refinement and analysis of monitoring and mitigation techniques. This process includes conducting an annual adaptive management review meeting where the Navy and NMFS jointly consider the prior year's goals, project results, and related scientific advances to determine if monitoring plan modifications are warranted to address program goals more effectively. Modifications to the Integrated Comprehensive Monitoring Program that result from annual adaptive management review discussions are incorporated by an addendum or revision to the Integrated Comprehensive Monitoring Program as needed. The Integrated Comprehensive Monitoring Program will be routinely updated as the program evolves and progresses.

The Strategic Planning Process serves to guide the investment of resources to most efficiently address Integrated Comprehensive Monitoring Program objectives and intermediate scientific objectives. Navy-funded monitoring projects relating to the impact of Navy training and testing activities on protected marine species are designed to accomplish one or more of the following top-level goals, as described in the Integrated Comprehensive Monitoring Program charter:

- Increase the understanding of the likely occurrence of marine mammals and ESA-listed marine species in the vicinity of the action (e.g., presence, abundance, distribution, density).
- Increase the understanding of the nature, scope, or context of the likely exposure of marine mammals and ESA-listed marine species to any of the potential stressors associated with the action (e.g., acoustics, explosives, physical disturbance and strike of military expended materials) through a better understanding of one or more of the following: (1) the nature of the action and its surrounding environment (e.g., sound-source characterization, propagation, ambient noise levels), (2) the affected species (e.g., life history, dive patterns), (3) the likely co-occurrence of marine mammals and ESA-listed marine species with the action (in whole or part), and (4) the likely biological or behavioral context of exposure to the stressor for the marine mammal and ESA-listed marine species (e.g., age class of exposed animals or known pupping, calving, or feeding areas).
- Increase the understanding of how individual marine mammals or ESA-listed marine species respond behaviorally or physiologically to the specific stressors associated with the action and in what context (e.g., at what distance or received level).
- Increase the understanding of how anticipated individual responses to individual stressors or anticipated combinations of stressors may impact either (1) the long-term fitness and survival of an individual, or (2) the population, species, or stock (e.g., through impacts on annual rates of recruitment or survival).
- Increase the understanding of the effectiveness of mitigation and monitoring.
- Improve the understanding and record of the manner in which the Navy complies with its Incidental Take Authorizations and Incidental Take Statements.
- Increase the probability of detecting marine mammals through improved technology or methods within mitigation zones to improve mitigation effectiveness and better achieve monitoring goals.

The Navy established a Scientific Advisory Group in 2011 with the initial task of evaluating current Navy monitoring approaches under the Integrated Comprehensive Monitoring Plan and existing MMPA Regulations and Letters of Authorization. The Scientific Advisory Group was also tasked with developing objective scientific recommendations that would form the basis for the Strategic Plan. While recommendations were fairly broad and not specifically prescriptive, the Scientific Advisory Group did provide specific programmatic recommendations that serve as guiding principles for the continued evolution of the Integrated Comprehensive Monitoring Program. Key recommendations included:

- Working within a conceptual framework of knowledge, from basic information on the occurrence of species within each range complex, to more specific matters of exposure, response, and consequences.
- Facilitating collaboration among researchers in each region, with the intent to develop a coherent and synergistic regional monitoring and research effort.
- Striving to move away from effort-based compliance metrics (e.g., completing a pre-determined amount of survey hours or days), with the intent to design and conduct monitoring projects according to scientific objectives rather than effort expended.

- Approaching the monitoring program holistically and selecting projects that offer the best opportunity to advance understanding of the issues, as opposed to establishing range-specific requirements.

5.1.2.2.1.3 Strategic Planning Process

The U.S. Navy's Marine Species Monitoring Program has evolved and improved as a result of adaptive management review and the Strategic Planning Process through changes that include:

- Recognizing the limitations of effort-based compliance metrics;
- Developing a strategic approach to monitoring based on recommendations from the Scientific Advisory Group;
- Shifting focus to projects based on scientific objectives that facilitate generation of statistically meaningful results upon which natural resources management decisions may be based;
- Focusing on priority species or areas of interest as well as best opportunities to address specific monitoring objectives to maximize return on investment; and
- Increasing transparency of the program and management standards, improving collaboration among participating researchers, and improving accessibility to monitoring data and results.

As a result of the changes outlined above due to the implementation of the Strategic Planning Process, the U.S. Navy's Marine Species Monitoring Program has undergone a transition. Intermediate scientific objectives now serve as the basis for developing and executing new monitoring projects across Navy training and testing areas in the Atlantic and Pacific Oceans. Implementation of the Strategic Planning Process involves coordination among fleets, system commands, Chief of Naval Operations Energy and Environmental Readiness Division, NMFS, and the Marine Mammal Commission with five primary steps:

- **Identify overarching intermediate scientific objectives.** Through the adaptive management process, the Navy coordinates with NMFS and the Marine Mammal Commission to review and revise the list of intermediate scientific objectives that guide development of individual monitoring projects. Examples include addressing information gaps in species occurrence and density, evaluating behavioral responses of marine mammals to Navy training and testing activities, and developing tools and techniques for passive acoustic monitoring.
- **Develop individual monitoring project concepts.** This step generally takes the form of soliciting input from the scientific community in terms of potential monitoring projects that address one or more of the intermediate scientific objectives. This can be accomplished through a variety of forums, including professional societies, regional scientific advisory groups, and contractor support.
- **Evaluate, prioritize, and select monitoring projects.** Navy technical experts and program managers review and evaluate monitoring project concepts and develop a prioritized ranking. The goal of this step is to establish a suite of monitoring projects that address a cross-section of intermediate scientific objectives spread over a variety of range complexes.
- **Execute and manage selected monitoring projects.** Individual projects are initiated through appropriate funding mechanisms and include clearly defined objectives and deliverables, such as data, reports, or publications.
- **Report and evaluate progress and results.** Progress on individual monitoring projects is updated through the U.S. Navy's Marine Species Monitoring Program webpage as well as annual monitoring reports submitted to NMFS. Both internal review and discussions with NMFS through the adaptive management process are used to evaluate progress toward addressing the

primary objectives of the Integrated Comprehensive Monitoring Program and serve to periodically recalibrate the focus of the monitoring program.

These steps serve three primary purposes: (1) to facilitate the Navy in developing specific projects addressing one or more intermediate scientific objectives; (2) to establish a more structured and collaborative framework for developing, evaluating, and selecting monitoring projects across areas where the Navy conducts training and testing activities; and (3) to maximize the opportunity for input and involvement across the research community, academia, and industry. This process is designed to integrate various elements, including

- Integrated Comprehensive Monitoring Program top-level goals,
- Scientific Advisory Group recommendations,
- Integration of regional scientific expert input,
- Ongoing adaptive management review dialog between NMFS and the Navy,
- Lessons learned from past and future monitoring of Navy training and testing, and
- Leveraging of research and lessons learned from other Navy-funded science programs.

The Strategic Planning Process will continue to shape the future of the U.S. Navy's Marine Species Monitoring Program and serve as the primary decision-making tool for guiding investments. Information on monitoring projects currently underway in the Atlantic and Pacific oceans, as well as results, reports, and publications, can be accessed through the U.S. Navy's Marine Species Monitoring Program webpage.

5.1.2.2.2 Training and Testing Activity Reports

The Navy developed a classified data repository known as the Sonar Positional Reporting System to maintain an internal record of underwater sound sources (e.g., active sonar) used during training and testing. The Sonar Positional Reporting System facilitates reporting pursuant to the Navy's MMPA Regulations and Letters of Authorization. Using data from the Sonar Positional Reporting System and other relevant sources, the Navy will continue to provide the USFWS and NMFS Office of Protected Resources with classified or unclassified (depending on the data) annual reports on the training and testing activities that use underwater sound sources. In its annual training and testing activity reports, the Navy will describe the level of training and testing conducted during the reporting period. Unclassified annual training and testing activity reports that have been submitted to NMFS can be found on the NMFS Office of Protected Resources and U.S. Navy's Marine Species Monitoring Program webpages.

5.1.2.2.3 Incident Reports

The Navy's mitigation measures and many of its standard operating procedures are designed to prevent incidents involving biological and cultural resources, such as aircraft strikes, vessel strikes, and impacts on submerged historic properties and seafloor resources. The Navy has been collecting data on such incidents (if they have occurred) for more than a decade and will continue doing so under the Proposed Action. To provide information on incidents involving biological or cultural resources, the Navy will submit reports to the appropriate management authorities as described below:

- **Bird Aircraft Strikes:** As described in Section 5.1.3 (Aircraft Safety) of the 2015 NWTT Final EIS/OEIS, bird strikes present an aviation safety risk for aircrews and aircraft. The Navy will report all aircraft strikes of birds per standard operating procedures.

- **Incidents Involving Marine Mammals, Sea Turtles, ESA-Listed Birds, and ESA-Listed Fish:** The Navy will notify the appropriate regulatory agency (e.g., NMFS, USFWS) immediately or as soon as operational security considerations allow if it observes the following that is (or may be) attributable to Navy activities: (1) a vessel strike of a marine mammal or sea turtle during training or testing; (2) a stranded, injured, or dead marine mammal or sea turtle during training or testing; or (3) an injured or dead marine mammal, sea turtle, or ESA-listed bird or fish species during post-explosive event monitoring. The Navy will provide relevant information pertaining to the incident (e.g., vessel speed). Additional details on these incident reporting requirements will be included in the Notification and Reporting Plan, which will be publicly available on the NMFS Office of Protected Resources webpage. The Navy will continue to provide the appropriate personnel with training on marine species incidents and their associated reporting requirements to aid the data collection and reporting processes (see Section 5.3.1, Environmental Awareness and Education). Information on marine mammal strandings is included in the *Marine Mammal Strandings Associated with U.S. Navy Sonar Activities* technical report (U.S. Department of the Navy, 2017c).
- **Cultural Resources:** In the event the Navy impacts a historic property, it will commence consultation with the appropriate Tribal Historic Preservation Officer, or State Historic Preservation Officer in accordance with 36 Code of Federal Regulations section 800.13(b)(3).

5.2 Mitigation Development Process

The Navy, in coordination with the appropriate regulatory agencies, developed its initial suite of mitigation measures for Phase I of environmental planning (2010–2015) and subsequently revised those mitigation measures for the 2015 NWTT Final EIS/OEIS in Phase II (2015–2020). For this Final Supplemental EIS/OEIS (which represents Phase III of environmental planning), the Navy worked collaboratively with the appropriate regulatory agencies to develop and refine its mitigation, which was finalized through the consultation and permitting processes. The mitigation development process involved reanalyzing existing mitigation measures implemented under the 2015 NWTT Final EIS/OEIS and analyzing new mitigation recommendations received from Navy and NMFS scientists, other governmental agencies, American Indian Tribes, the public, and non-governmental organizations during NEPA scoping, the 2019 NWTT Draft Supplemental EIS/OEIS public review, and the consultation and permitting processes. The Navy conducted a detailed review and assessment of each potential mitigation measure individually and then all potential mitigation measures collectively to determine if, as a whole, mitigation will effectively avoid or reduce potential impacts from the Proposed Action and will be practical to implement. The Navy operational community (i.e., leadership from the aviation, surface, subsurface, and special warfare communities; leadership from the research and acquisition community; and training and testing experts), environmental planners, and scientific experts provided input on the effectiveness and practicality of mitigation implementation. Navy Senior Leadership reviewed and approved all mitigation measures included in this Final Supplemental EIS/OEIS.

Mitigation measures that the Navy will implement under the Proposed Action are organized into two categories: procedural mitigation measures and mitigation areas. The sections below provide definitions of mitigation terminology, background information pertinent to the mitigation development process, and information about the mitigation effectiveness and practicality criteria. Section 5.5 (Measures Considered but Eliminated) and Appendix K (Geographic Mitigation Assessment) contain information on measures that did not meet the appropriate balance between being both effective as well as practical to implement, and therefore will not be implemented under the Proposed Action.

5.2.1 Procedural Mitigation Development

Procedural mitigation is mitigation that the Navy will implement whenever and wherever training or testing activities involving applicable acoustic, explosive, and physical disturbance and strike stressors take place within the Study Area. Procedural mitigation generally involves (1) the use of one or more trained Lookouts to observe for specific biological resources within a mitigation zone, (2) requirements for Lookouts to immediately communicate sightings of specific biological resources to the appropriate watch station for information dissemination, and (3) requirements for the watch station to implement mitigation until a pre-activity commencement or during-activity recommencement condition has been met.

Procedural mitigation primarily involves Lookouts observing for marine mammals and sea turtles. For some activities, Lookouts may also be required to observe for additional biological resources, such as ESA-listed seabirds, jellyfish aggregations, or floating vegetation. For example, the Navy implements procedural mitigation for several activities that have the potential to overlap the range of ESA-listed marbled murrelets or short-tailed albatross. In this chapter, the term "floating vegetation" refers specifically to floating concentrations of detached kelp paddies and *Sargassum*. Jellyfish aggregations and floating vegetation can be indicators of potential marine mammal or sea turtle presence because marine mammals and sea turtles have been known to seek shelter in, feed on, or feed among them. For example, young sea turtles have been known to hide from predators and eat the algae associated with floating concentrations of *Sargassum*. The Navy observes for additional biological resources prior to the initial start or during the conduct of certain activities to offer an additional layer of protection for marine mammals and sea turtles. While on watch, Lookouts employ visual search techniques, including a combination of naked-eye scanning and the use of hand-held binoculars or high-powered binoculars mounted on a ship deck, depending on the observation platform. After sunset and prior to sunrise, Lookouts and other Navy watch personnel employ night visual search techniques, which could include the use of night vision devices.

To consider the benefits of procedural mitigation to marine mammals and sea turtles within the MMPA and ESA impact estimates, the Navy conservatively factored mitigation effectiveness into its quantitative analysis process, as described in the technical report titled *Quantifying Acoustic Impacts on Marine Mammals and Sea Turtles: Methods and Analytical Approach for Phase III Training and Testing* (U.S. Department of the Navy, 2018). The Navy's quantitative analysis assumes that Lookouts will not be 100 percent effective at detecting all individual marine mammals and sea turtles within the mitigation zones for each activity. This is due to the inherent limitations of observing marine species and because the likelihood of sighting individual animals is largely dependent on observation conditions (e.g., time of day, sea state, mitigation zone size, observation platform) and animal behavior (e.g., the amount of time an animal spends at the surface of the water). This is particularly true for sea turtles, small marine mammals, and marine mammals that display cryptic behaviors (e.g., surfacing to breathe with only a small portion of their body visible from the surface). Throughout Section 5.3 (Procedural Mitigation to be Implemented), discussions about the likelihood that a Lookout would observe a marine mammal or sea turtle pertain specifically to animals that are available to be observed (i.e., on, above, or just below the water's surface). The benefits of procedural mitigation measures for species that were not included in the quantitative analysis process (e.g., birds, fish) are discussed qualitatively.

Data inputs for assessing and developing procedural mitigation included operational data described in Section 5.2.3 (Practicality of Implementation), the best available science discussed in Chapter 3 (Affected Environment and Environmental Consequences), published literature, data on marine mammal and sea turtle impact ranges obtained through acoustic modeling, data on bird hearing, marine species monitoring and density data, and the most recent guidance from NMFS and the USFWS. Background information on the data that were used to develop the ranges to effect is provided in Section 3.4 (Marine Mammals), Section 3.5 (Sea Turtles), and Section 3.6 (Birds). Additional activity or stressor-specific details, such as the level of effect to which a procedural mitigation measure is expected to mitigate and if a measure has been modified from the 2015 NWTT Final EIS/OEIS, is provided throughout Section 5.3 (Procedural Mitigation to be Implemented).

5.2.1.1 Lookouts

Lookouts perform similar duties as the standard watch personnel described in Section 5.1.2 (Vessel Safety) of the 2015 NWTT Final EIS/OEIS, such as personnel on the bridge watch team and personnel stationed for man-overboard precautions. Lookouts are designated the responsibility of helping meet the Navy's mitigation requirements by visually observing mitigation zones. The number of Lookouts designated for each training or testing activity is dependent upon the number of personnel involved in the activity (i.e., manning restrictions) and the number and type of assets available (i.e., equipment and space restrictions).

Depending on the activity, a Lookout may be positioned on a ship (i.e., surface ships and surfaced submarines), on a small boat (e.g., a rigid-hull inflatable boat), in an aircraft, on a pier, or on shore. Certain platforms, such as aircraft and small boats, have manning or space restrictions; therefore, the Lookout on these platforms is typically an existing member of the aircraft or boat crew who is responsible for other essential tasks (e.g., a pilot or Naval Flight Officer who is also responsible for navigation). Some platforms are minimally manned and are therefore either physically unable to accommodate more than one Lookout or divert personnel from mission-essential tasks, including safe and secure operation of propulsion, weapons, and damage control systems that ensure safety of the ship and the personnel on board. The number of Lookouts specified for each activity in Section 5.3 (Procedural Mitigation to be Implemented) represents the maximum number of Lookouts that can be designated for those activities without requiring additional personnel or reassigning duties. The "maximum" number of Lookouts is equivalent to the required number of Lookouts; therefore, the Navy would not use fewer Lookouts than what is specified in each mitigation table. The Navy is unable to position Lookouts on unmanned surface vehicles, unmanned aerial systems, unmanned underwater vehicles, and submerged submarines, or have Lookouts observe during activities that use systems deployed from or towed by unmanned platforms, except in limited circumstances when escort vehicles are already participating in the activity.

When Lookouts are positioned in a fixed-wing aircraft or rotary-wing aircraft (i.e., helicopter), mission requirements determine the flight parameters (altitude, flight path, and speed) for that aircraft. For example, most fixed-wing aircraft sorties occur above 3,000 ft., while most rotary-wing sorties associated with mine countermeasure activities occur at altitudes as low as 75–100 ft. Similarly, when Lookouts are positioned on a vessel, mission requirements determine the operational parameters (course and speed) for that vessel.

The Navy's passive acoustic devices (e.g., remote acoustic sensors, expendable sonobuoys, passive acoustic sensors on submarines) can complement visual observations for marine mammals when passive acoustic assets are already participating in an activity. The passive acoustic devices can detect vocalizing marine mammals within the frequency bands already being monitored by Navy personnel. Marine mammal detections from passive acoustic devices can alert Lookouts to possible marine mammal presence in the vicinity. Lookouts can use the information from passive acoustic detections to assist their visual observations of the mitigation zone. Based on the number and type of passive acoustic devices that are typically used, passive acoustic detections do not provide range or bearing to a detected animal in order to determine its location or confirm its presence in a mitigation zone. Therefore, it is not practical for the Navy to implement mitigation in response to passive acoustic detections alone (i.e., without a visual sighting of an animal within the mitigation zone). Additional information about passive acoustic devices is provided in Section 5.5.3 (Active and Passive Acoustic Monitoring Devices).

5.2.1.2 Mitigation Zones

Mitigation zones are areas at the surface of the water within which applicable training or testing activities will be ceased, powered down, or modified to protect specific biological resources from an auditory injury (permanent threshold shift [PTS]), non-auditory injury (from impulsive sources), or direct strike (e.g., vessel strike) to the maximum extent practicable. Mitigation zones are measured as the radius from a stressor. Implementation of procedural mitigation is most effective when mitigation zones are appropriately sized to be realistically observed during typical training and testing activity conditions.

The Navy customized its mitigation zone sizes and mitigation requirements for each applicable training and testing activity category or stressor. The Navy developed each mitigation zone to be the largest area that (1) Lookouts can reasonably be expected to observe during typical activity conditions (i.e., most environmentally protective); and (2) the Navy can commit to implementing mitigation without impacting safety, sustainability, or the ability to meet mission requirements. The Navy designed the mitigation zones for most acoustic and explosive stressors according to its source bins. As described in Section 3.0.3.1.1 (Sonar and Other Transducers), sonars and other transducers are grouped into classes that share an attribute, such as frequency range or purpose of use. Classes are further sorted by bins based on the frequency or bandwidth, source level, and when warranted, the application in which the source would be used. As described in Section 3.0.3.2.1.1 (Explosions in Water), explosives detonated in water are binned by net explosive weight. Mitigation does not pertain to stressors that do not have the potential to impact biological resources (e.g., *de minimis* acoustic and explosive sources that do not have the potential to impact marine mammals).

Discussions throughout Section 5.3 (Procedural Mitigation to be Implemented) about the level of effect that will likely be mitigated for marine mammals and sea turtles are based on a comparison of the mitigation zone size to the predicted impact ranges for the applicable source bins with the longest average ranges to PTS. These conservative discussions represent the worst-case scenario for each activity category or stressor. The mitigation zones will oftentimes cover all or a larger portion of the predicted average ranges to PTS for other comparatively smaller sources with shorter impact ranges (e.g., sonar sources used at a lower source level, explosives in a smaller bin). The discussions are primarily focused on how the mitigation zone sizes compare to the ranges to PTS; however, depending on the activity category or stressor, the mitigation zones are oftentimes large enough to also mitigate within a portion of the ranges to temporary threshold shift (TTS). TTS is a threshold shift that is recoverable. Background information on PTS, TTS, and marine mammal and sea turtle hearing groups is presented in the U.S. Department of the Navy (2017a) technical report titled *Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase III)*.

5.2.1.3 Procedural Mitigation Implementation

The Navy takes several courses of action in response to a sighting of an applicable biological resource in a mitigation zone. First, a Lookout will communicate the sighting to the appropriate watch station. Next, the watch station will implement the prescribed mitigation, such as delaying the initial start of an activity, powering down sonar, ceasing an explosive detonation, or maneuvering a vessel. If floating vegetation is observed in the mitigation zone prior to the initial start of an activity, the activity will either be relocated to an area where floating vegetation is not observed in concentrations, or the initial start of the activity will be delayed until the mitigation zone is clear of floating vegetation concentrations. There are no requirements to cease activities if vegetation floats into the mitigation zone after activities commence. For sightings of marine mammals, sea turtles, and seabirds within a mitigation zone prior to the initial start of or during applicable activities, the Navy will continue mitigating until one of the five conditions listed below has been met. The conditions are designed to allow a sighted animal to leave the mitigation zone before the initial start of an activity or before an activity resumes.

- The animal is observed exiting the mitigation zone;
- The animal is thought to have exited the mitigation zone based on a determination of its course, speed, and movement relative to the stressor source;
- The mitigation zone has been clear from any additional sightings for a specific wait period;
- For mobile activities, the stressor source has transited or has been relocated a distance equal to double that of the mitigation zone size beyond the location of the last sighting; or
- For activities using hull-mounted sonar, the ship concludes that dolphins are deliberately closing in on the ship to ride the ship's bow wave and are therefore out of the main transmission axis of the sonar (and there are no other marine mammal sightings within the mitigation zone).

To supplement the implementation of procedural mitigation, the Navy has agreed to undertake reporting initiatives for certain activities or resources based on previous consultations with NMFS and the USFWS, as summarized in Section 5.1.2.2 (Monitoring, Research, and Reporting Initiatives) and detailed where applicable in Section 5.3 (Procedural Mitigation to be Implemented).

5.2.2 Mitigation Area Development

Mitigation areas are geographic locations within the Study Area where the Navy will implement mitigation measures to (1) avoid or reduce potential impacts on biological resources located on the seafloor or submerged cultural resources; (2) in combination with procedural mitigation, to effect the least practicable adverse impact on marine mammal species or stocks and their habitat; or (3) in combination with procedural mitigation, ensure that the Proposed Action does not jeopardize the continued existence of endangered or threatened species, or result in destruction or adverse modification of critical habitat.

The Navy completed an extensive assessment of the NWTT Study Area to develop mitigation areas for the Proposed Action. The Navy reanalyzed existing mitigation areas implemented under the 2015 NWTT Final EIS/OEIS and assessed habitats suggested through comments received during NEPA scoping and on the 2019 NWTT Draft Supplemental EIS/OEIS, identified by NMFS or the USFWS during the consultation and permitting processes, and identified internally by the Navy. Biological effectiveness and operational assessments of mitigation areas the Navy developed for the Study Area are provided in Appendix K (Geographic Mitigation Assessment). The appendix includes background information and additional details for each of the areas considered. The Navy's mitigation areas are summarized in Section 5.4 (Mitigation Areas to be Implemented).

Mitigation areas are designed to help avoid or reduce potential impacts in key areas of importance. Therefore, mitigation benefits are discussed qualitatively in terms of the context of impact avoidance or reduction. The Navy considers a mitigation area to be effective if it meets the following criteria:

- **The mitigation area is a key area of biological or ecological importance or contains cultural resources:** The best available science suggests that the mitigation area contains submerged cultural resources (e.g., shipwrecks) or is particularly important to one or more species or resources for a biologically important life process (e.g., foraging, migration, reproduction) or ecological function (e.g., live hard bottom that provides critical ecosystem functions); and
- **The mitigation will result in an avoidance or reduction of impacts:** Implementing the mitigation will likely avoid or reduce potential impacts on (1) species, stocks, or populations of marine mammals based on data regarding their seasonality, density, and behavior; or (2) other biological or cultural resources based on their distribution and physical properties. Furthermore, implementing the mitigation will not shift or transfer adverse effects from one species to another (e.g., to a more vulnerable or sensitive species).

5.2.3 Practicality of Implementation

Mitigation measures are expected to have some degree of impact on the training and testing activities that implement them (e.g., modifying where and when activities occur, ceasing an activity in response to a sighting). The Navy is able to accept a certain level of impact on its military readiness activities because of the benefit that mitigation measures provide for avoiding or reducing potential impacts on environmental and cultural resources. The Navy's focus during mitigation assessment and development is that mitigation measures must meet the appropriate balance between being both effective as well as practical to implement. To evaluate practicality, the Navy operational community conducted an extensive and comprehensive assessment to determine how and to what degree potential mitigation measures would be compatible with planning, scheduling, and conducting training and testing activities under the Proposed Action in order to meet the Navy's Title 10 requirements.

5.2.3.1 Assessment Criteria

The purpose and need of the Proposed Action is to ensure that the Navy meets its mission to maintain, train, and equip combat-ready naval forces capable of winning wars, deterring aggression, and maintaining freedom of the seas. The Navy is statutorily mandated to protect U.S. national security by being ready, at all times, to effectively prosecute war and defend the nation by conducting operations at sea, as outlined in Title 10 section 8062 of the United States Code. The Navy's mission is achieved in part by conducting training and testing within the Study Area in accordance with established military readiness requirements. Training requirements have been developed through many years of iteration and adaptation and are designed to ensure that Sailors achieve the levels of readiness needed to properly respond to the multitude of contingencies they may face during military missions and combat operations. Activities are planned and scheduled in accordance with the Optimized Fleet Response Plan, which details instructions on manning distribution, range scheduling, operational requirements, maintenance and modernization plans, quality of work and life for personnel, achieving training capabilities, and meeting strategic readiness objectives.

To achieve the highest skill proficiency and most accurate testing results possible, the Navy conducts activities in a variety of realistic tactical oceanographic and environmental conditions. Such conditions include variations in bathymetry, topography, surface fronts, and sea surface temperatures. Training activities must be as realistic as possible to provide the experiences and stressors necessary to successfully execute all required military missions and combat operations. Degraded training would result in units being unqualified to conduct the range of military operations required by operational Commanders. The inability of such Commanders to meet national security objectives would result in not only the increased risk to life, but also the degradation of national security. Testing activities must be as realistic as possible for the Navy to conduct accurate acoustic research to validate acoustic models; conduct accurate engineering tests of acoustic sources, signal processing algorithms, and acoustic interactions; and to effectively test systems and platforms (and components of these systems and platforms) to validate whether they perform as expected and determine whether they are operationally effective, suitable, survivable, and safe for their intended use by the fleet. Testing must be completed before full-scale production or delivery to the fleet to ensure functionality and accuracy in military mission and combat conditions.

As described in Chapter 2 (Description of Proposed Action and Alternatives), the Navy requires access to sea space and airspace throughout the Study Area within pierside locations, nearshore areas, and large-scale open ocean areas of the high seas. Each area plays a critical role in the Navy's ability to plan, schedule, and effectively execute military readiness activities. The locations where training and testing occur must be situated in a way that allows the Navy to complete its activities without physical or logistical obstructions. The Navy requires extensive sea space so that individual training and testing activities can occur at sufficient distances so they do not interfere with one another. Some training and testing activities require continuous access to large and unobstructed areas, consisting potentially of tens or thousands of square miles. This provides personnel the ability to develop competence and confidence in their capabilities across multiple types of weapons and sensors, and the ability to train to communicate and operate in a coordinated fashion as required during military missions and combat operations. For example, some training exercises may require large areas of the littorals, open ocean, and nearshore areas for realistic and safe anti-submarine warfare training. The Navy also requires large areas of sea space because it trains in a manner to avoid observation by potential adversaries. Modern sensing technologies make training on a large scale without observation more difficult. A foreign military's continual observation of U.S. Navy training in predictable geographic areas and timeframes would enable foreign nations to gather intelligence and subsequently develop techniques, tactics, and procedures to potentially and effectively counter U.S. naval operations. Other activities may be conducted on a smaller and more localized scale, with training or testing at discrete locations that are critical to certain aspects of military readiness.

The locations for training and testing activities are selected to maximize efficiency while supporting specific mission and safety requirements, deconflict sea space and airspace, and minimize the time personnel must spend away from home. Training and testing locations are typically selected based on their proximity to homeports, home bases, associated training ranges, testing facilities, air squadrons, and existing infrastructure to reduce travel time and associated costs. Activities involving the use of rotary-wing aircraft typically occur in proximity to shore or refueling stations due to fuel restrictions and safety requirements. Testing events are typically located near systems command support facilities, which provide critical infrastructure support and technical expertise necessary to conduct testing. Logistical support of range testing can only efficiently and effectively occur when the support is co-located with the testing activities. These same principles also apply to pierside and at-sea testing that must occur in proximity to naval harbors. Testing event site locations and associated field activities were originally established to support specific Navy mission testing needs using a selection process that included testing requirements, cost of living, availability of personnel, and low level of crowding from industry and development.

During its assessment to determine how and to what degree the implementation of mitigation would be compatible with meeting the purpose and need of the Proposed Action, the Navy considered a mitigation measure to be practical to implement if it met all criteria discussed below:

- **Implementing the mitigation is safe:** Mitigation measures must not increase safety risks to Navy personnel and equipment, or to the public. When assessing whether implementing a mitigation measure would be safe, the Navy factored in the potential for increased pilot fatigue; accelerated fatigue-life of aircraft; typical fuel restrictions of participating aircraft; locations of refueling stations; proximity to aircraft emergency landing fields, critical medical facilities, and search and rescue resources; space restrictions of the observation platforms; the ability to de-conflict platforms and activities to ensure that training and testing activities do not impact each other; and the ability to avoid interaction with non-Navy sea space and airspace uses, such as established commercial air traffic routes, commercial vessel shipping lanes, and areas used for energy exploration or alternative energy development. Other safety considerations included identifying if mitigation measures would reasonably allow Lookouts to safely and effectively maintain situational awareness while observing the mitigation zones during typical activity conditions, or if the mitigation would increase the safety risk for personnel. For example, the safety risk would increase if Lookouts were required to direct their attention away from essential mission requirements.
- **Implementing the mitigation is sustainable:** One of the primary factors that the Navy incorporates into the planning and scheduling of its training and testing activities is the amount and type of available resources, such as funding, personnel, and equipment. Mitigation measures must be sustainable over the life of the Proposed Action, meaning that they will not require the use of resources in excess of what is available. When assessing whether implementing a mitigation measure would be sustainable, the Navy considered if the measure would require excessive time on station or time away from homeport for Navy personnel, require the use of additional personnel (i.e., manpower) or equipment (e.g., adding a small boat to serve as an additional observation platform), or result in additional operational costs (e.g., increased fuel consumption, equipment maintenance, or acquisition of new equipment).
- **Implementing the mitigation allows the Navy to continue meeting its mission requirements:** The Navy considered if each individual measure and the iterative and cumulative impact of all potential measures would be within the Navy's legal authority to implement. The Navy also considered if mitigation would modify training or testing activities in a way that would prevent individual activities from meeting their mission objectives and if mitigation would prevent the Navy from meeting its national security requirements or statutorily-mandated Title 10 requirements, such as by:
  - Impacting training and testing realism or preventing ready access to ranges, operating areas, facilities, or range support structures (which would reduce realism and present sea space and airspace conflicts).
  - Impacting the ability for Sailors to train and become proficient in using sensors and weapon systems as would be required in areas analogous to where the military operates or causing an erosion of capabilities or reduction in perishable skills (which would result in a significant risk to personnel or equipment safety during military missions and combat operations).
  - Impacting the ability for units to meet their individual training and certification requirements (which would impact the ability to deploy with the required level of readiness necessary to accomplish any tasking by Combatant Commanders).

- Impacting the ability to certify forces to deploy to meet national security tasking (which would limit the flexibility of Combatant Commanders and warfighters to project power, engage in multi-national operations, and conduct the full range of naval warfighting capabilities in support of national security interests).
- Impacting the ability of researchers, program managers, and weapons system acquisition programs to conduct accurate acoustic research to meet research objectives, effectively test systems and platforms (and components of these systems and platforms) before full-scale production or delivery to the fleet, or complete shipboard maintenance, repairs, or pierside testing prior to at-sea operations (which would not allow the Navy to ensure safety, functionality, and accuracy in military mission and combat conditions per required acquisition milestones or on an as-needed basis to meet operational requirements).
- Requiring the Navy to provide advance notification of specific times and locations of Navy platforms, such as platforms using active sonar (which would present national security concerns).
- Reducing the Navy's ability to be ready, maintain deployment schedules, or respond to national emergencies or emerging national security challenges (which would present national security concerns).

5.2.3.2 Factors Affecting Practicality

Two of the factors that influenced whether procedural mitigation measures met the practicality criteria were the number of times mitigation measures would likely be implemented and the duration over which the activity would likely be ceased due to mitigation implementation. The number of times mitigation would likely be implemented is largely dependent on the size of the mitigation zone. As a mitigation zone size increases, the area of observation increases by an order of magnitude. This is because mitigation zones are measured as the radius (r) from a stressor but apply to circular area (A) around that stressor ($A = \pi * r^2$, where π is a constant that is approximately equal to 3.14). For example, a 100-yard (yd.) mitigation zone is equivalent to an area of 31,416 square yd. A 200 yd. mitigation zone is equivalent to an area of 125,664 square yd. Therefore, increasing a mitigation zone from 100 yd. to 200 yd. (i.e., doubling the mitigation zone radius) would quadruple the mitigation zone area (the area over which mitigation must be implemented). Similarly, increasing a mitigation zone from 1,000 yd. to 4,000 yd. (i.e., quadrupling the mitigation zone radius) would increase the mitigation zone area by a factor of 16. Increasing the area over which mitigation must be implemented consequently increases the number of times mitigation would likely be implemented during that activity.

The duration over which mitigation is implemented can differ considerably depending on the mitigation zone size, number of animal sightings, behavioral state of animals sighted (e.g., travelling at a fast pace on course to exit the mitigation zone, milling slowly in the center of the mitigation zone), and which pre-activity commencement or during-activity recommencement condition is met before the activity can commence or resume after each sighting. The duration of mitigation implementation typically equates to the amount of time the training or testing activity will be extended. The impact that extending the length of an activity has on safety, sustainability, and the Navy's ability to accomplish the activity's intended objectives varies by activity. This is one reason why the Navy tailors its mitigation zone sizes and mitigation requirements by activity category or stressor and the platforms involved.

As described in Section 5.2.1 (Procedural Mitigation Development), the Navy will mitigate for each applicable sighting and will continue mitigating until one of five conditions has been met. In some instances, such as if an animal dives underwater after a sighting, it may not be possible for a Lookout to visually verify if the animal has exited the mitigation zone. The Navy cannot delay or cease activities indefinitely for the purpose of mitigation due to impacts on safety, sustainability, and the Navy's ability to continue meeting its mission requirements. To account for this, one of the pre-activity commencement and during-activity recommencement conditions is an established post-sighting wait period of 30 minutes (min.) or 10 min., based on the platforms involved. Wait periods are designed to allow animals the maximum amount of time practical to resurface (i.e., become available to be observed by a Lookout) before activities resume. When developing the length of its wait periods, the Navy factored in the assumption that mitigation may need to be implemented more than once. For example, an activity may need to be delayed or ceased for more than one 30 min. or 10 min. period.

The Navy assigns a 30 min. wait period to activities conducted from vessels and that involve aircraft that are not typically fuel constrained (e.g., maritime patrol aircraft). A 30 min. period covers the average dive times of most marine mammals and a portion of the dive times of sea turtles and deep-diving marine mammals (i.e., sperm whales, dwarf and pygmy sperm whales [Kogia whales], and beaked whales) (U.S. Department of the Navy, 2017b). The Navy determined that a 30 min. wait period is the maximum wait time that is practical to implement during activities involving vessels and aircraft that are not typically fuel constrained to allow the activities to continue meeting their intended objectives. Implementing a longer wait period (such as 45 min. or 60 min. to cover the average dive times of sea turtles and additional marine mammal species) would be impractical to implement. Activities are scheduled to occur at specific locations within specific timeframes based on range scheduling and for sea space deconfliction. Increasing the wait period, and consequently, the amount of time activities would need to be delayed or extended in order to accomplish their intended objectives, would impact activity realism or cause sea space conflicts in a way that could impact the Navy's ability to continue meeting its mission requirements. For example, delaying an explosive activity for multiple wait periods could result in personnel not being able to detonate an explosive before the participating platforms are required to depart the range due to range scheduling; therefore, the activity would not accomplish its intended objectives.

The Navy assigns a 10 min. wait period to activities involving aircraft that are typically fuel constrained (e.g., rotary-wing aircraft, fighter aircraft). A 10 min. period covers a portion, but not the average, dive times of marine mammals and sea turtles (U.S. Department of the Navy, 2017b). The Navy determined that a 10 min. wait period is the maximum wait time that is practical to implement during activities involving aircraft that are typically fuel constrained. Increasing the wait period, and consequently the amount of time the training or testing activity would need to be extended in order to accomplish its intended objective, would require aircraft to depart the activity area to refuel in order to safely complete the event. If the wait period was implemented multiple times, the aircraft would be required to depart the activity area to refuel multiple times. Refueling events would vary in duration, depending on the activity location and proximity to the nearest refueling station. Multiple refueling events would generally be expected to extend the length of the activity by two to five times or more. This would impact activity realism, could cause air space or sea space conflicts in a way that could impact the Navy's ability to continue meeting its mission requirements, would decrease the ability for Lookouts to safely and effectively maintain situational awareness of the activity area, and would increase safety risks due to increased pilot fatigue and accelerated fatigue-life of aircraft. For example, delaying an Anti-Submarine Warfare Tracking Exercise – Helicopter activity for multiple wait periods could result in personnel not being able to effectively search for, detect, classify, localize, and track a simulated threat submarine before the rotary-wing aircraft is required to depart the range due to range scheduling; therefore, the activity would not accomplish its intended objectives.

Factors that influenced whether a mitigation area measure met the practicality criteria included the historical use and projected future use of geographic locations for training and testing activities under the Proposed Action, and the relative importance of each location. The frequency that an area is used for training or testing does not necessarily equate to that area's level of importance for meeting an individual activity objective, or collectively, the Navy's mission requirements. While frequently used areas can be essential to one or more types of military readiness activities, some infrequently used areas are critical for a particular training exercise, testing mission, or research project.

5.3 Procedural Mitigation to be Implemented

The first procedural mitigation measure (Section 5.3.1, Environmental Awareness and Education) is designed to aid Lookouts and other personnel with observation, environmental compliance, and reporting responsibilities. The remaining procedural mitigation measures are organized by stressor type and training or testing activity category.

5.3.1 Environmental Awareness and Education

The Navy will continue to implement procedural mitigation to provide environmental awareness and education to the appropriate personnel to aid visual observation, environmental compliance, and reporting responsibilities, as outlined in Table 5.3-1.

Table 5.3-1: Environmental Awareness and Education

Procedural Mitigation Description
Stressor or Activity • All training and testing activities, as applicable
Resource Protection Focus • Marine mammals • Sea turtles • Birds
Mitigation Requirements • Appropriate personnel (including civilian personnel) involved in mitigation and training or testing activity reporting under the Proposed Action will complete one or more modules of the U.S. Navy Afloat Environmental Compliance Training Series, as identified in their career path training plan. Modules include: – **Introduction to the U.S. Navy Afloat Environmental Compliance Training Series.** The introductory module provides information on environmental laws (e.g., ESA, MMPA) and the corresponding responsibilities that are relevant to Navy training and testing activities. The material explains why environmental compliance is important in supporting the Navy's commitment to environmental stewardship. – **Marine Species Awareness Training.** All bridge watch personnel, Commanding Officers, Executive Officers, maritime patrol aircraft aircrews, anti-submarine warfare and mine warfare rotary-wing aircrews, Lookouts, and equivalent civilian personnel must successfully complete the Marine Species Awareness Training prior to standing watch or serving as a Lookout. The Marine Species Awareness Training provides information on sighting cues, visual observation tools and techniques, and sighting notification procedures. Navy biologists developed Marine Species Awareness Training to improve the effectiveness of visual observations for biological resources, focusing on marine mammals and sea turtles, and including floating vegetation, jellyfish aggregations, and flocks of seabirds. – **U.S. Navy Protective Measures Assessment Protocol.** This module provides the necessary instruction for accessing mitigation requirements during the event planning phase using the Protective Measures Assessment Protocol software tool. – **U.S. Navy Sonar Positional Reporting System and Marine Mammal Incident Reporting.** This module provides instruction on the procedures and activity reporting requirements for the Sonar Positional Reporting System and marine mammal incident reporting.

The Navy requires Lookouts and other personnel to complete their assigned environmental compliance responsibilities (e.g., mitigation, reporting requirements) before, during, and after training and testing activities. Marine Species Awareness Training was first developed in 2007 and has since undergone numerous updates to ensure that the content remains current, with the most recent product approved by NMFS and released by the Navy in 2014. In 2014, the Navy developed a series of educational training modules, known as the Afloat Environmental Compliance Training program, to ensure Navywide compliance with environmental requirements. The Afloat Environmental Compliance Training program, including the updated Marine Species Awareness Training, helps Navy personnel from the most junior Sailors to Commanding Officers gain a better understanding of their personal environmental compliance roles and responsibilities. Additional information on the Protective Measures Assessment Protocol is provided in Section 5.1.2.1 (Protective Measures Assessment Protocol), and additional information on training and testing activity and incident reports is provided in Section 5.1.2.2 (Monitoring, Research, and Reporting Initiatives).

From an operational perspective, the interactive web-based format of the U.S. Navy Afloat Environmental Compliance Training Series is ideal for providing engaging and educational content that is cost effective and convenient to access by personnel who oftentimes face rotating job assignments. The U.S. Navy Afloat Environmental Compliance Training Series has resulted in an improvement in the quality and accuracy of training and testing activity reports, incident reports, and Sonar Positional Reporting System reports submitted by Navy operators. Improved reporting quality indicates that the U.S. Navy Afloat Environmental Compliance Training Series is helping to facilitate Navywide environmental compliance as intended.

Lookouts and members of the operational community have demonstrated enhanced knowledge and understanding of the Navy's environmental compliance responsibilities since the development of the U.S. Navy Afloat Environmental Compliance Training Series. For example, it is likely that the implementation of the Marine Species Awareness Training starting in 2007, and the additional U.S. Navy Afloat Environmental Compliance Training Series modules starting in 2014, potentially helped contribute to a Navy-wide reduction in vessel strikes of marine mammals in areas where the Navy trains and tests. This indicates that the environmental awareness and education program is helping to improve the effectiveness of mitigation implementation. A more detailed analysis of vessel strikes is presented in Section 3.4.2.4 (Impacts from Physical Disturbance and Strike) of this Final Supplemental EIS/OEIS.

5.3.2 Acoustic Stressors

The Navy will implement procedural mitigation to avoid or reduce potential impacts on biological resources from the acoustic stressors or activities discussed in the sections below. In addition to procedural mitigation, the Navy will implement mitigation for acoustic stressors within mitigation areas, such as requirements to prohibit or limit certain activities in certain locations. Mitigation area requirements for acoustic stressors are detailed in Appendix K (Geographic Mitigation Assessment).

5.3.2.1 Active Sonar

The Navy will continue to implement procedural mitigation to avoid or reduce potential impacts on marine mammals and sea turtles from active sonar, as outlined in Table 5.3-2. In the 2015 NWTT Final EIS/OEIS, the Navy's active sonar mitigation zones were based on associated average ranges to PTS. When developing the mitigation for this Final Supplemental EIS/OEIS, the Navy analyzed the potential for increasing the sizes of these mitigation zones. The Navy determined that the current mitigation zones for active sonar are the largest areas within which it is practical to implement mitigation; therefore, it will continue implementing these same mitigation zones under the Proposed Action.

The Navy is clarifying in the table that the mitigation zone for low-frequency active sonar sources at 200 dB will be the same as the mitigation implemented for hull-mounted mid-frequency active sonar; whereas low-frequency active sonar sources below 200 dB will implement the same mitigation zone as high-frequency active sonar and mid-frequency active sonar sources that are not hull-mounted. The Navy is also clarifying that it will require observation of the mitigation zone prior to the initial start of the activity to ensure the area is clear of applicable biological resources. The Navy has always verified that the mitigation zone is visually clear prior to conducting active sonar activities and is more clearly capturing this current practice in the mitigation measures for this activity. The Navy will follow the incident reporting procedures outlined in Section 5.1.2.2.3 (Incident Reports) if an incident is detected at any time during the event.

Table 5.3-2: Procedural Mitigation for Active Sonar

Procedural Mitigation Description
Stressor or Activity • Low-frequency active sonar, mid-frequency active sonar, high-frequency active sonar – For vessel-based active sonar activities, mitigation applies only to sources that are positively controlled and deployed from manned surface vessels (e.g., sonar sources towed from manned surface platforms). – For aircraft-based active sonar activities, mitigation applies only to sources that are positively controlled and deployed from manned aircraft that do not operate at high altitudes (e.g., rotary-wing aircraft). Mitigation does not apply to active sonar sources deployed from unmanned aerial systems or aircraft operating at high altitudes (e.g., maritime patrol aircraft).
Resource Protection Focus • Marine mammals • Sea turtles (only for sources < 2 kilohertz [kHz])
Number of Lookouts and Observation Platform • Hull-mounted sources: – 1 Lookout: Platforms with space or manning restrictions while underway (at the forward part of a small boat or ship) and platforms using active sonar while moored or at anchor (including pierside) – 2 Lookouts: Platforms without space or manning restrictions while underway (at the forward part of the ship) • Sources that are not hull-mounted: – 1 Lookout on the ship or aircraft conducting the activity
Mitigation Requirements • Mitigation zones: – 1,000 yd. power down, 500 yd. power down, and 200 yd. or 100 yd. shut down for low-frequency active sonar at 200 decibels (dB) and hull-mounted mid-frequency active sonar – 200 yd. or 100 yd. shut down for low-frequency active sonar < 200 dB, mid-frequency active sonar sources that are not hull-mounted, and high-frequency active sonar • Prior to the initial start of the activity (e.g., when maneuvering on station): – Observe the mitigation zone for floating vegetation; if observed, relocate or delay the start until the mitigation zone is clear. – Observe the mitigation zone for marine mammals and sea turtles; if observed, relocate or delay the start of active sonar transmission.

Table 5.3-2: Procedural Mitigation for Active Sonar (continued)

Procedural Mitigation Description
• During the activity: – Low-frequency active sonar at 200 dB and hull-mounted mid-frequency active sonar: Observe the mitigation zone for marine mammals and sea turtles (for sources < 2 kHz); power down active sonar transmission by 6 dB if a marine mammal or sea turtle is observed within 1,000 yd. of the sonar source; power down an additional 4 dB (10 dB total) if a marine mammal or sea turtle is observed within 500 yd.; cease transmission if a cetacean or sea turtle is observed within 200 yd.; cease transmission if a pinniped in the NWTT Offshore Area or Western Behm Canal is observed within 200 yd.; cease transmission if a pinniped in NWTT Inland Waters is observed within 100 yd. (except if hauled out on, or in the water near, man-made structures and vessels). – Low-frequency active sonar < 200 dB, mid-frequency active sonar sources that are not hull-mounted, and high-frequency active sonar: Observe the mitigation zone for marine mammals and sea turtles (for sources < 2 kHz); cease transmission if a cetacean, sea turtle, or pinniped in the NWTT Offshore Area or Western Behm Canal is observed within 200 yd. of the sonar source; cease transmission if a pinniped in NWTT Inland Waters is observed within 100 yd. (except if hauled out on, or in the water near, man-made structures and vessels). • Commencement/recommencement conditions after a marine mammal or sea turtle sighting before or during the activity: – The Navy will allow a sighted marine mammal or sea turtle to leave the mitigation zone prior to the initial start of the activity (by delaying the start) or during the activity (by not recommencing or powering up active sonar transmission) until one of the following conditions has been met: (1) the animal is observed exiting the mitigation zone; (2) the animal is thought to have exited the mitigation zone based on a determination of its course, speed, and movement relative to the sonar source; (3) the mitigation zone has been clear from any additional sightings for 10 min. for aircraft-deployed sonar sources or 30 min. for vessel-deployed sonar sources; (4) for mobile activities, the active sonar source has transited a distance equal to double that of the mitigation zone size beyond the location of the last sighting; or (5) for activities using hull-mounted sonar, the Lookout concludes that dolphins are deliberately closing in on the ship to ride the ship's bow wave, and are therefore out of the main transmission axis of the sonar (and there are no other marine mammal sightings within the mitigation zone).

The mitigation zone sizes and proximity to the observation platforms will result in a high likelihood that Lookouts will be able to detect marine mammals and sea turtles throughout the mitigation zones. Naval Sea Systems Command testing ranges and the designated pierside maintenance and testing locations in NWTT Inland Waters offer a controlled static environment, which increases the likelihood that any Southern Resident killer whales, gray whales, and other marine mammal species would be observed by Navy Lookouts prior to the start of an activity using active sonar. Observing for indicators of marine mammal and sea turtle presence will further help avoid or reduce potential impacts on these resources within the mitigation zones. Pinnipeds use Navy structures (e.g., submarines, security barriers) as haul-outs at several locations within NWTT Inland Waters, despite these areas being heavily trafficked for the past several decades. Because these animals are present in NWTT Inland Waters consistently throughout the year, the Navy would be unable to avoid them entirely unless they were physically removed from the water or haul-out locations. Efforts to remove or relocate pinnipeds away from Navy activities in NWTT Inland Waters would likely result in higher animal stress levels or behavioral disturbances and would present logistical constraints due to the number of animals that are typically present in these locations at any given time. For this reason, the Navy implements a smaller active sonar shut down mitigation zone for pinnipeds observed in NWTT Inland Waters than for other marine mammals and pinnipeds observed in the NWTT Offshore Area or Western Behm Canal.

Section 3.4.2.1.2 (Impacts from Sonar and Other Transducers) of this Final Supplemental EIS/OEIS provides a full analysis of the potential impacts of sonar on marine mammals and includes the impact ranges for various source bins. For low-frequency active sonar at 200 dB and hull-mounted mid-frequency active sonar, bin MF1 has the longest predicted ranges to PTS. For the highest source level in bin MF1, the 1,000 yd. and 500 yd. power down mitigation zones extend beyond the average ranges to PTS for marine mammals. The 200 yd. shut down mitigation zone extends beyond the average ranges to PTS for low-frequency cetaceans, mid-frequency cetaceans, otariids, and phocids, and into a portion of the average range to PTS for high-frequency cetaceans. The ranges to PTS for the 200 yd. shut down mitigation zone were calculated based on full power transmissions and do not consider that the impact ranges would be reduced if the 1,000 yd. and 500 yd. power down mitigation measures are implemented in response to a marine mammal sighting in those mitigation zones. If an animal is first sighted in the 1,000 yd. or 500 yd. power down mitigation zone, the source level reduction would shorten the ranges to PTS, and the 200 yd. shut down mitigation would then extend beyond the average ranges to PTS for all marine mammal hearing groups. The 100 yd. shut down mitigation zone applicable only to pinnipeds observed in NWTT Inland Waters extends beyond the average ranges to PTS for otariids and phocids.

For low-frequency active sonar below 200 dB, mid-frequency active sonar sources that are not hull-mounted, and high-frequency active sonar, bin HF4 has the longest predicted ranges to PTS. For the highest source level in bin HF4, the 200 yd. shut down mitigation zone extends beyond the average ranges to PTS for marine mammals. The 100 yd. shut down mitigation zone applicable only to pinnipeds observed in NWTT Inland Waters extends beyond the average ranges to PTS for otariids and phocids. In summary, the mitigation zones for active sonar will help avoid or reduce the potential for exposure to PTS for marine mammals.

The active sonar mitigation zones also extend into a portion of the average ranges to TTS for marine mammals; therefore, mitigation will help avoid or reduce the potential for some exposure to higher levels of TTS. Active sonar sources that fall within lower source bins or are used at lower source levels have shorter impact ranges than those discussed above; therefore, the mitigation zones will extend further beyond or into the average ranges to PTS and TTS for these sources. The analysis in Section 3.4.2.1.2 (Impacts from Sonar and Other Transducers) of this Final Supplemental EIS/OEIS indicates that pygmy and dwarf sperm whales (*Kogia* whales) are the only deep-diving marine mammal species that could potentially experience PTS impacts from active sonar in the Study Area. The 30 min. wait period for vessel-deployed sources will cover the average dive times of marine mammal species that could experience PTS from sonar in the mitigation zone, except for *Kogia* whales. The 10 min. wait period for aircraft-deployed sources will cover a portion, but not the average, dive times of marine mammals.

Section 3.5.2.1.2 (Impacts from Sonar and Other Transducers) provides a full analysis of the potential impacts of sonar on sea turtles. Due to sea turtle hearing capabilities, the mitigation only applies to sea turtles during the use of sources below 2 kHz. The range to auditory effects for most active sonar sources in sea turtle hearing range (e.g., LF4) is zero meters. Impact ranges are longer (i.e., up to tens of meters) for active sonars with higher source levels. The mitigation zones for active sonar extend beyond the ranges to PTS and TTS for sea turtles; therefore, mitigation will help avoid or reduce the potential for exposure to these effects for sea turtles.

The Navy currently uses, and will continue to use, computer simulation to augment training and testing whenever possible. As discussed in Section 1.4.1 (Why the Navy Trains), simulators and synthetic training are critical elements that provide early skill repetition and enhance teamwork; however, they cannot replicate the complexity and stresses faced by Sailors during military missions and combat operations to which the Navy trains under the Proposed Action (e.g., anti-submarine warfare training using hull-mounted mid-frequency active sonar). As described previously, the mitigation zones developed for this Final Supplemental EIS/OEIS are based on the largest areas within which it is practical for the Navy to implement mitigation during training and testing within the Study Area. Training and testing with active sonar are essential to national security. Active sonar is the only reliable technology for detecting and tracking potential enemy diesel-electric submarines. For example, small diesel-electric submarines operate quietly and may hide in shallow coastal and littoral waters. The ability to effectively operate active sonar is a highly perishable skill that must be repeatedly practiced during realistic training. Naval forces must train in the same mode and manner in which they conduct military missions and combat operations. Anti-submarine warfare training typically involves the periodic use of active sonar to develop the "tactical picture," or an understanding of the battle space (e.g., area searched or unsearched, identifying false contacts, and understanding the water conditions). This can take from several hours or more and typically occurs over vast areas with varying physical and oceanographic conditions (e.g., bathymetry, topography, surface fronts, and variations in sea surface temperature). Sonar operators train to avoid or reduce interference and sound-reducing clutter from varying ocean floor topographies and environmental conditions, practice coordinating their efforts with other sonar operators in a strike group, develop skill proficiency in detecting and tracking submarines and other threats, and practice the focused endurance vital to effectively working as a team in shifts around the clock until the conclusion of the event.

Increasing the mitigation zone sizes would result in a larger area over which active sonar would need to be powered down or shut down in response to a sighting, and therefore would likely increase the number of times that these mitigation measures would be implemented. This would extend the length of the activity, significantly diminish event realism, and prevent activities from meeting their intended objectives. It would also create fundamental differences between how active sonar would be used in training and how active sonar should be used during military missions and combat operations. For example, additional active sonar power downs or shut downs would prevent sonar operators from developing and maintaining awareness of the tactical picture during training events. Without realistic training in conditions analogous to military missions and combat operations, sonar operators cannot become proficient in effectively operating active sonar. Sonar operators, vessel crews, and aircrews would be expected to operate active sonar during military missions and combat operations in a manner inconsistent with how they were trained.

During integrated training, multiple vessels and aircraft may participate in an exercise using different warfare components simultaneously. Degrading the value of one training element results in a degradation of the training value of the other training elements. Degrading the value of training would cause a reduction in perishable skills and diminished operational capability, which would significantly impact military readiness. Each of these factors would ultimately impact the ability for units to meet their individual training and certification requirements and the Navy's ability to certify forces to safely deploy to meet national security tasking. Diminishing proficiency or eroding active sonar capabilities would present a significant risk to personnel safety during military missions and combat operations and would impact the ability to deploy with the required level of readiness necessary to accomplish any tasking by Combatant Commanders.

Increasing the number of times that the Navy must power down or shut down active sonar transmissions during testing activities would result in similar consequences to activity realism. For example, at-sea sonar testing activities are required in order to calibrate or document the functionality of sonar and torpedo systems while a ship or submarine is in an open ocean environment. Additional powering down or shutting down active sonar transmissions would prevent this activity from meeting its intended objective, such as verifying if the ship meets design acoustic specifications. These types of impacts would impede the ability of researchers, program managers, and weapons system acquisition programs to meet research objectives and testing requirements per required acquisition milestones or on an as-needed basis to meet operational requirements, and would impede shipboard maintenance, repairs, or pierside testing prior to at-sea operations.

For activities that involve aircraft (e.g., activities involving rotary-wing aircraft that use dipping sonar or sonobuoys to locate submarines or submarine targets), extending the length of the activity would require aircraft to depart the area to refuel. If multiple refueling events were required, the length of the activity would be extended by two to five times or more, which would decrease the ability for Lookouts to safely and effectively maintain situational awareness of the activity area and increase safety risks due to increased pilot fatigue and accelerated fatigue-life of aircraft. Extending the length of the activity would also result in additional operational costs due to increased fuel consumption. Increasing the mitigation zone sizes would not result in a substantial reduction of injurious impacts because, as described above, the mitigation zones extend beyond the average ranges to PTS for sea turtles and marine mammals.

In summary, the operational community determined that implementing procedural mitigation for active sonar beyond what is detailed in Table 5.3-2 would be incompatible with the practicality assessment criteria for safety, sustainability, and mission requirements.

5.3.2.2 Weapons Firing Noise

The Navy will continue to implement procedural mitigation to avoid or reduce potential impacts on marine mammals, sea turtles, and seabirds from weapons firing noise, as outlined in Table 5.3-3. In the 2015 NWTT Final EIS/OEIS, the weapons firing noise mitigation zone was based on the associated average ranges to PTS. When developing the mitigation for this Final Supplemental EIS/OEIS, the Navy analyzed the potential for increasing the size of the mitigation zone. The Navy determined that the current mitigation zone is the largest area within which it is practical to implement mitigation for this activity; therefore, it will continue implementing the same mitigation zone size under the Proposed Action. The Navy is clarifying in the table that it will require observation of the mitigation zone prior to the initial start of the activity to ensure the area is clear of applicable biological resources. The Navy has always verified that the mitigation zone is visually clear prior to conducting weapons firing activities and is more clearly capturing this current practice in the mitigation measures for this activity. The Navy will follow the incident reporting procedures outlined in Section 5.1.2.2.3 (Incident Reports) if an incident is detected at any time during the event.

The small mitigation zone size and proximity to the observation platform will result in a high likelihood that Lookouts will be able to detect marine mammals, sea turtles, and seabirds throughout the mitigation zone. Section 3.6.2.1.5 (Impacts from Weapons Noise) provides a full analysis of the potential impacts of weapon noise on birds. Due to the difficulty of differentiating bird species, the Navy will implement mitigation for all seabird species for weapon noise during large-caliber weapons firing. Although there is a low likelihood that marbled murrelets and short-tailed albatross will occur in locations where the Navy conducts large-caliber gunnery activities, the mitigation will help the Navy further avoid or reduce potential impacts (e.g., startle response) on these ESA-listed bird species and other seabird species that occur offshore.

Table 5.3-3: Procedural Mitigation for Weapons Firing Noise

Procedural Mitigation Description
Stressor or Activity • Weapons firing noise associated with large-caliber gunnery activities
Resource Protection Focus • Marine mammals • Sea turtles • Seabirds (marbled murrelet and short-tailed albatross)
Number of Lookouts and Observation Platform • 1 Lookout positioned on the ship conducting the firing – Depending on the activity, the Lookout could be the same one described in Section 5.3.3.3 (Explosive Medium-Caliber and Large-Caliber Projectiles) or Section 5.3.4.3 (Small-, Medium-, and Large-Caliber Non-Explosive Practice Munitions)
Mitigation Requirements • Mitigation zone: – 30° on either side of the firing line out to 70 yd. from the muzzle of the weapon being fired • Prior to the initial start of the activity: – Observe the mitigation zone for floating vegetation; if observed, relocate or delay the start until the mitigation zone is clear. – Observe the mitigation zone for marine mammals, sea turtles, and seabirds; if observed, relocate or delay the start of weapons firing. • During the activity: – Observe the mitigation zone for marine mammals, sea turtles, and seabirds; if observed, cease weapons firing. • Commencement/recommencement conditions after a marine mammal, sea turtle, or seabird sighting before or during the activity: – The Navy will allow a sighted marine mammal, sea turtle, or seabird to leave the mitigation zone prior to the initial start of the activity (by delaying the start) or during the activity (by not recommencing weapons firing) until one of the following conditions has been met: (1) the animal is observed exiting the mitigation zone; (2) the animal is thought to have exited the mitigation zone based on a determination of its course, speed, and movement relative to the firing ship; (3) the mitigation zone has been clear from any additional sightings for 30 min.; or (4) for mobile activities, the firing ship has transited a distance equal to double that of the mitigation zone size beyond the location of the last sighting.

Section 3.4.2.1.5 (Impacts from Weapon Noise) and Section 3.5.2.1.5 (Impacts from Weapon Noise) of this Final Supplemental EIS/OEIS provide an analysis of the potential impacts of weapon noise on marine mammals and sea turtles, respectively. As described in Section 3.0.5.3.1.3 (Weapons Firing, Launch, and Impact Noise) of the 2015 NWTT Final EIS/OEIS, underwater sounds from large-caliber weapons firing activities 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. The mitigation zone extends beyond the distance to which marine mammals and sea turtles would likely experience PTS or TTS from weapons firing noise; therefore, mitigation will help avoid or reduce the potential for exposure to these impacts. Observing for indicators of marine mammal and sea turtle presence will further help avoid or reduce impacts on these resources within the mitigation zone.

As described previously, the mitigation zone developed for this Final Supplemental EIS/OEIS is based on the largest area within which it is practical for the Navy to implement mitigation for this activity. Increasing the mitigation zone would result in a larger area over which weapons firing would need to be ceased in response to a sighting, and therefore would likely increase the number of times weapons firing would be ceased. However, increasing the mitigation zone size would not result in a substantial reduction of injurious impacts because the mitigation zone extends beyond the average ranges to PTS for sea turtles and marine mammals.

Large-caliber gunnery training activities may involve a single ship firing or may be conducted as part of a larger exercise involving multiple ships. Surface ship crews learn to track targets (e.g., with radar), engage targets, practice defensive marksmanship, and coordinate their efforts within the context of larger activities. Increasing the number of times that the Navy must cease weapons firing during training would decrease realism and impact the ability for Navy Sailors to train and become proficient in using large-caliber guns as required during military missions and combat operations. For example, additional ceasing of the activity would reduce the crew's ability to react to changes in the tactical situation or respond to an incoming threat, which could result in a delay to the ship's training schedule. When training is undertaken in the context of a coordinated exercise involving multiple ships, degrading the value of one of the training elements results in a degradation of the training value of the other training elements. These factors would ultimately impact the ability for units to meet their individual training and certification requirements, and the Navy's ability to certify forces to deploy to meet national security tasking.

In summary, the operational community determined that implementing procedural mitigation for weapons firing noise beyond what is detailed in Table 5.3-3 would be incompatible with the practicality assessment criteria for safety and mission requirements.

5.3.3 Explosive Stressors

The Navy will implement procedural mitigation to avoid or reduce potential impacts on biological resources from the explosives discussed in the sections below. Section 3.4.2.2 (Explosive Stressors), Section 3.5.2.2 (Explosive Stressors), and Section 3.6.2.2 (Explosive Stressors) provide a full analysis of the potential impacts of explosives on marine mammals, sea turtles, and birds, respectively, including predicted impact ranges. In addition to procedural mitigation, the Navy will implement mitigation for explosives within mitigation areas, such as requirements to prohibit or limit certain activities in certain locations (e.g., within a specified distance from shore). Mitigation area requirements for explosives are detailed in Appendix K (Geographic Mitigation Assessment).

5.3.3.1 Explosive Sonobuoys

The Navy will continue to implement procedural mitigation to avoid or reduce potential impacts on marine mammals and sea turtles from explosive sonobuoys, as outlined in Table 5.3-4. In the 2015 NWTT Final EIS/OEIS, explosive sonobuoys had two mitigation zone sizes based on net explosive weight and the associated average ranges to PTS. When developing mitigation for this Final Supplemental EIS/OEIS, the Navy analyzed the potential for increasing the size of these mitigation zones. The Navy identified an opportunity to increase the mitigation zone size by 250 yd. for sonobuoys using up to 2.5 lb. net explosive weight so that explosive sonobuoys will implement a 600 yd. mitigation zone, regardless of net explosive weight, to enhance protections to the maximum extent practicable. This increase is reflected in Table 5.3-4. The mitigation zone for explosive sonobuoys is now based on the largest area within which it is practical to implement mitigation.

Table 5.3-4: Procedural Mitigation for Explosive Sonobuoys

Procedural Mitigation Description
Stressor or Activity • Explosive sonobuoys
Resource Protection Focus • Marine mammals • Sea turtles
Number of Lookouts and Observation Platform • 1 Lookout positioned in an aircraft or on a small boat • If additional platforms are participating in the activity, personnel positioned in those assets (e.g., safety observers, evaluators) will support observing the mitigation zone for applicable biological resources while performing their regular duties.
Mitigation Requirements • Mitigation zone: – 600 yd. around an explosive sonobuoy • Prior to the initial start of the activity (e.g., during deployment of a sonobuoy field, which typically lasts 20–30 min.): – Observe the mitigation zone for floating vegetation; if observed, relocate or delay the start until the mitigation zone is clear. – Conduct passive acoustic monitoring for marine mammals; use information from detections to assist visual observations. – Visually observe the mitigation zone for marine mammals and sea turtles; if observed, relocate or delay the start of sonobuoy or source/receiver pair detonations. • During the activity: – Observe the mitigation zone for marine mammals and sea turtles; if observed, cease sonobuoy or source/receiver pair detonations. • Commencement/recommencement conditions after a marine mammal or sea turtle sighting before or during the activity: – The Navy will allow a sighted marine mammal or sea turtle to leave the mitigation zone prior to the initial start of the activity (by delaying the start) or during the activity (by not recommencing detonations) until one of the following conditions has been met: (1) the animal is observed exiting the mitigation zone; (2) the animal is thought to have exited the mitigation zone based on a determination of its course, speed, and movement relative to the sonobuoy; or (3) the mitigation zone has been clear from any additional sightings for 10 min. when the activity involves aircraft that have fuel constraints, or 30 min. when the activity involves aircraft that are not typically fuel constrained. • After completion of the activity (e.g., prior to maneuvering off station): – When practical (e.g., when platforms are not constrained by fuel restrictions or mission-essential follow-on commitments), observe the vicinity of where detonations occurred; if any injured or dead marine mammals or ESA-listed species are observed, follow established incident reporting procedures. – If additional platforms are supporting this activity (e.g., providing range clearance), these assets will assist in the visual observation of the area where detonations occurred.

The Navy is clarifying in the table that it will require observation of the mitigation zone prior to the initial start of the activity to ensure the area is clear of applicable biological resources. The Navy has always verified that the mitigation zone is visually clear prior to conducting explosive activities and is more clearly capturing this current practice in the mitigation measures for this activity. The Navy developed a new mitigation measure requiring the Lookout to observe the mitigation zone after completion of the activity. In accordance with the 2015 NWTT Final EIS/OEIS consultation requirements, the Navy currently conducts post-activity observations for some, but not all explosive activities. When developing mitigation for this Final Supplemental EIS/OEIS, the Navy determined that it could expand this requirement to other explosive activities for enhanced consistency and to help determine if any resources were injured during explosive events, when practical. The Navy is adding a requirement that additional platforms already participating in the activity will support observing the mitigation zone before, during, and after the activity while performing their regular duties. There are typically multiple platforms in the vicinity of activities that use explosive sonobuoys (e.g., safety aircraft). When available, having additional personnel support observations of the mitigation zone will help increase the likelihood of detecting biological resources. The Navy will follow the incident reporting procedures outlined in Section 5.1.2.2.3 (Incident Reports) if an incident is detected at any time during the event, including during the post-activity observations.

Some activities that use explosive sonobuoys involve detonations of a single sonobuoy or sonobuoy pair, while other activities involve deployment of a field of sonobuoys that may be dispersed over a large distance. Lookouts will have a better likelihood of detecting marine mammals and sea turtles when observing the mitigation zone around a single sonobuoy, sonobuoy pair, or a smaller sonobuoy field than when observing a sonobuoy field dispersed over a large distance. When observing large sonobuoy fields, Lookouts will be more likely to detect large visual cues (e.g., whale blows or large pods of dolphins) than individual marine mammals, cryptic marine mammal species, and sea turtles. Observing for indicators of marine mammal and sea turtle presence will further help avoid or reduce potential impacts on these resources within the mitigation zones.

Bin E3 has the longest predicted impact ranges for explosive sonobuoys used in the Study Area (e.g., MK-61 SUS sonobuoys). For the largest explosive in bin E3, the mitigation zone extends beyond the ranges to 50 percent non-auditory injury and 50 percent mortality for sea turtles and marine mammals. The mitigation zone extends beyond the average ranges to PTS for sea turtles, mid-frequency cetaceans, and otariids, into a portion of the average ranges to PTS for high-frequency cetaceans, low-frequency cetaceans, and phocids. The mitigation zone also extends beyond or into a portion of the average ranges to TTS for sea turtles and marine mammals. Therefore, depending on the species, mitigation will help avoid or reduce all or a portion of the potential for exposure to mortality, non-auditory injury, PTS, and higher levels of TTS for the largest explosives in bin E3. Smaller explosives in bin E3 and explosives in smaller source bins (E1) have shorter predicted impact ranges; therefore, the mitigation zone will extend further beyond or cover a greater portion of the impact ranges for these explosives.

As described previously, the mitigation zone developed for this Final Supplemental EIS/OEIS is based on the largest area within which it is practical for the Navy to implement mitigation. It is not practical to increase the mitigation zone because observations within the margin of increase would be ineffective unless the Navy allocated additional platforms to observe for biological resources. This is particularly true when observations occur from a small boat or during observations of a large field of sonobuoys. The use of additional personnel and equipment (aircraft or small boats) would be unsustainable due to increased operational costs and an exceedance of the available manpower and resources for this activity. Adding aircraft to observe the mitigation zone could result in airspace conflicts with the event participants. This would either require the aircraft conducting the activity to modify their flight plans (which would reduce activity realism) or force the observing aircraft to position itself a safe distance away from the activity area (which would decrease observation effectiveness). Adding vessels to observe the mitigation zone would increase safety risks due to the presence of observation vessels within the vicinity of explosive sonobuoys or an explosive sonobuoy field.

Increasing the mitigation zone size would result in a larger area over which detonations would need to be ceased in response to a sighting, and therefore would likely increase the number of times detonations would be ceased and would extend the length of the activity. These impacts would significantly diminish event realism in a way that would prevent the activity from meeting its intended objectives. For example, during Anti-Submarine Warfare Tracking Test—Maritime Patrol Aircraft (SUS) events, additional ceasing of the activity would not allow the Navy to effectively test sensors and systems that are used to detect and track submarines and ensure that systems perform to specifications and meet operational requirements. Such testing is required to ensure functionality and accuracy in military mission and combat conditions. Extending the length of the activity would require aircraft to depart the area to refuel. If multiple refueling events were required, the activity length would extend by two to five times or more, which would decrease the ability for Lookouts to safely and effectively maintain situational awareness of the activity area and increase safety risks due to increased pilot fatigue and accelerated fatigue-life of aircraft. Extending the length of the activity would also result in additional operational costs due to increased fuel consumption.

In summary, the operational community determined that implementing procedural mitigation for explosive sonobuoys beyond what is detailed in Table 5.3-4 would be incompatible with the practicality assessment criteria for safety, sustainability, and mission requirements.

5.3.3.2 Explosive Torpedoes

The Navy will continue to implement procedural mitigation to avoid or reduce potential impacts on marine mammals and sea turtles from explosive torpedoes, as outlined in Table 5.3-5. In the 2015 NWTT Final EIS/OEIS, the explosive torpedo mitigation zone was based on net explosive weight and the associated average ranges to PTS. When developing the mitigation for this Final Supplemental EIS/OEIS, the Navy analyzed the potential for increasing the size of this mitigation zone. The Navy determined that the current mitigation zone is the largest area within which it is practical to implement mitigation for this activity; therefore, it will continue implementing this same mitigation zone under the Proposed Action.

The post-activity observations for explosive torpedoes are a continuation from the 2015 NWTT Final EIS/OEIS and will help the Navy determine if any resources were injured during the activity. The Navy will follow the incident reporting procedures outlined in Section 5.1.2.2.3 (Incident Reports) if an incident is detected at any time during the event, including during the post-activity observations. The Navy is clarifying in the table that it will require observation of the mitigation zone prior to the initial start of the activity to ensure the area is clear of applicable biological resources. The Navy has always verified that the mitigation zone is visually clear prior to conducting explosive activities and is more clearly capturing this current practice in the mitigation measures for this activity. The Navy is adding a requirement that additional platforms already participating in the activity will support observing the mitigation zone before, during, and after the activity while performing their regular duties. Typically, when aircraft are firing explosive torpedoes, there are additional observation aircraft, support vessels (e.g., range craft for torpedo retrieval), or other safety aircraft in the vicinity. When available, having additional personnel support observations of the mitigation zone will help increase the likelihood of detecting biological resources.

Table 5.3-5: Procedural Mitigation for Explosive Torpedoes

Procedural Mitigation Description
<u>Stressor or Activity</u> • Explosive torpedoes
<u>Resource Protection Focus</u> • Marine mammals • Sea turtles
<u>Number of Lookouts and Observation Platform</u> • 1 Lookout positioned in an aircraft • If additional platforms are participating in the activity, personnel positioned in those assets (e.g., safety observers, evaluators) will support observing the mitigation zone for applicable biological resources while performing their regular duties.
<u>Mitigation Requirements</u> • Mitigation zone: – 2,100 yd. around the intended impact location • Prior to the initial start of the activity (e.g., during deployment of the target): – Observe the mitigation zone for floating vegetation; if observed, relocate or delay the start until the mitigation zone is clear. – Conduct passive acoustic monitoring for marine mammals; use information from detections to assist visual observations. – Visually observe the mitigation zone for marine mammals, sea turtles, and jellyfish aggregations; if observed, relocate or delay the start of firing. • During the activity: – Observe the mitigation zone for marine mammals, sea turtles, and jellyfish aggregations; if observed, cease firing. • Commencement/recommencement conditions after a marine mammal or sea turtle sighting before or during the activity: – The Navy will allow a sighted marine mammal or sea turtle to leave the mitigation zone prior to the initial start of the activity (by delaying the start) or during the activity (by not recommencing firing) until one of the following conditions has been met: (1) the animal is observed exiting the mitigation zone; (2) the animal is thought to have exited the mitigation zone based on a determination of its course, speed, and movement relative to the intended impact location; or (3) the mitigation zone has been clear from any additional sightings for 10 min. when the activity involves aircraft that have fuel constraints, or 30 min. when the activity involves aircraft that are not typically fuel constrained. • After completion of the activity (e.g., prior to maneuvering off station): – When practical (e.g., when platforms are not constrained by fuel restrictions or mission-essential follow-on commitments), observe the vicinity of where detonations occurred; if any injured or dead marine mammals or ESA-listed species are observed, follow established incident reporting procedures. – If additional platforms are supporting this activity (e.g., providing range clearance), these assets will assist in the visual observation of the area where detonations occurred.

Explosive torpedo activities involve detonations at a target located down range of the firing platform. Due to the distance between the mitigation zone and the observation platform, Lookouts will have a better likelihood of detecting large visual cues (e.g., whale blows or large pods of dolphins) than individual marine mammals, cryptic marine mammal species, and sea turtles. Some species of sea turtles forage on jellyfish, and some of the locations where explosive torpedo activities could occur support high densities of jellyfish throughout parts of the year. Observing for indicators of marine mammal and sea turtle presence (including jellyfish aggregations) will further help avoid or reduce potential impacts on these resources within the mitigation zone. The post-activity observations for marine mammals and sea turtles will help the Navy determine if any resources were injured during the activity.

Bin E11 has the longest predicted impact ranges for explosive torpedoes used in the Study Area. For the largest explosive in bin E11, the mitigation zone extends beyond the ranges to 50 percent non-auditory injury and 50 percent mortality for sea turtles and marine mammals. The mitigation zone extends beyond the average ranges to PTS for sea turtles, mid-frequency cetaceans, and otariids, and into a portion of the average ranges to PTS for low-frequency cetaceans, high-frequency cetaceans, and phocids. The mitigation zone also extends into a portion of the average ranges to TTS for sea turtles and marine mammals. Therefore, depending on the species, mitigation will help avoid or reduce all or a portion of the potential for exposure to mortality, non-auditory injury, PTS, and higher levels of TTS for the largest explosives in bin E11. Explosive torpedoes in smaller source bins (e.g., E8) have shorter predicted impact ranges; therefore, the mitigation zone will extend further beyond or cover a greater portion of the impact ranges for these explosives.

As described previously, the mitigation zone developed for this Final Supplemental EIS/OEIS is based on the largest area within which it is practical for the Navy to implement mitigation. It is not practical to increase this mitigation zone because observations within the margin of increase would be ineffective unless the Navy allocated additional platforms to observe for biological resources. The use of additional personnel and observation platforms would be unsustainable due to increased operational costs and an exceedance of the available manpower and resources for this activity. Adding aircraft to observe the mitigation zone could result in airspace conflicts with the event participants. This would either require the aircraft participating in the activity to modify their flight plans (which would reduce activity realism) or force the observing aircraft to position itself a safe distance away from the activity area (which would decrease observation effectiveness). Adding vessels to observe the mitigation zone would increase safety risks due to the presence of observation vessels within the vicinity of explosive torpedoes.

Increasing the mitigation zone size would result in a larger area over which detonations would need to be ceased in response to a sighting, and therefore would likely increase the number of times detonations would be ceased and would extend the length of the activity. These impacts would significantly diminish event realism in a way that would prevent the activity from meeting its intended objectives. For example, the Navy conducts Torpedo (Explosive) Testing events to test the functionality of torpedoes and torpedo launch systems. These events often involve aircrews locating, approaching, and firing a torpedo on an artificial target. They require focused situational awareness of the activity area and continuous coordination between the participating platforms as required during military missions and combat operations. Extending the length of the activity would require aircraft to depart the area to refuel. If the firing aircraft departed the activity location to refuel, the aircrew would lose the ability to maintain situational awareness and effectively coordinate with other participating platforms. If multiple refueling events were required, the activity length would extend by two to five times or more, which would increase safety risks due to increased pilot fatigue and accelerated fatigue-life of aircraft. Therefore, an increase in mitigation would impede the Navy's ability to meet testing requirements per required acquisition milestones or on an as-needed basis to meet operational requirements. Extending the length of the activity would also result in additional operational costs due to increased fuel consumption.

In summary, the operational community determined that implementing procedural mitigation for explosive torpedoes beyond what is detailed in Table 5.3-5 would be incompatible with the practicality assessment criteria for safety, sustainability, and mission requirements.

5.3.3.3 Explosive Medium-Caliber and Large-Caliber Projectiles

The Navy will continue to implement procedural mitigation to avoid or reduce potential impacts on marine mammals, sea turtles, and seabirds from explosive gunnery activities, as outlined in Table 5.3-6.

Table 5.3-6: Procedural Mitigation for Explosive Medium-Caliber and Large-Caliber Projectiles

Procedural Mitigation Description
Stressor or Activity • Gunnery activities using explosive medium-caliber and large-caliber projectiles – Mitigation applies to activities using a surface target
Resource Protection Focus • Marine mammals • Sea turtles • Seabirds (marbled murrelet and short-tailed albatross)
Number of Lookouts and Observation Platform • 1 Lookout on the vessel conducting the activity – For activities using explosive large-caliber projectiles, depending on the activity, the Lookout could be the same as the one described in Section 5.3.2.2 (Weapons Firing Noise) • If additional platforms are participating in the activity, personnel positioned in those assets (e.g., safety observers, evaluators) will support observing the mitigation zone for applicable biological resources while performing their regular duties.
Mitigation Requirements • Mitigation zones: – 200 yd. (for seabirds) or 600 yd. (for marine mammals and sea turtles) around the intended impact location for explosive medium-caliber projectiles – 1,000 yd. (for marine mammals and sea turtles) around the intended impact location for explosive large-caliber projectiles • Prior to the initial start of the activity (e.g., when maneuvering on station): – Observe the mitigation zone for floating vegetation; if observed, relocate or delay the start until the mitigation zone is clear. – Observe the mitigation zone for marine mammals, sea turtles, and seabirds; if observed, relocate or delay the start of firing. • During the activity: – Observe the mitigation zone for marine mammals, sea turtles, and seabirds; if observed, cease firing. • Commencement/recommencement conditions after a marine mammal, sea turtle, or seabird sighting before or during the activity: – The Navy will allow a sighted marine mammal, sea turtle, or seabird to leave the mitigation zone prior to the initial start of the activity (by delaying the start) or during the activity (by not recommencing firing) until one of the following conditions has been met: (1) the animal is observed exiting the mitigation zone; (2) the animal is thought to have exited the mitigation zone based on a determination of its course, speed, and movement relative to the intended impact location; (3) the mitigation zone has been clear from any additional sightings for 30 min. for vessel-based firing; or (4) for activities using mobile targets, the intended impact location has transited a distance equal to double that of the mitigation zone size beyond the location of the last sighting. • After completion of the activity (e.g., prior to maneuvering off station): – When practical (e.g., when platforms are not constrained by fuel restrictions or mission-essential follow-on commitments), observe the vicinity of where detonations occurred; if any injured or dead marine mammals or ESA-listed species are observed, follow established incident reporting procedures. – If additional platforms are supporting this activity (e.g., providing range clearance), these assets will assist in the visual observation of the area where detonations occurred.

In the 2015 NWTT Final EIS/OEIS, explosive gunnery activity mitigation zones were based on guidance from the USFWS for seabirds and net explosive weight and the associate average ranges to PTS for marine mammals and sea turtles. When developing mitigation for this Final Supplemental EIS/OEIS, the Navy analyzed the potential for increasing the size of these mitigation zones. The Navy identified an opportunity to increase the marine mammal and sea turtle mitigation zone sizes by 400 yd. to enhance protections to the maximum extent practicable. These increases are reflected in Table 5.3-6. The marine mammal and sea turtle mitigation zones for explosive medium-caliber and large-caliber projectiles are now based on the largest areas within which it is practical to implement mitigation. The seabird mitigation zone remains consistent with USFWS guidance. The Navy is clarifying in the table that it will require observation of the mitigation zone prior to the initial start of the activity to ensure the area is clear of applicable biological resources. The Navy has always verified that the mitigation zone is visually clear prior to conducting explosive activities and is more clearly capturing this current practice in the mitigation measures for this activity.

The Navy developed a new mitigation measure requiring the Lookout to observe the mitigation zone after completion of the activity. In accordance with the 2015 NWTT Final EIS/OEIS consultation requirements, the Navy currently conducts post-activity observations for some, but not all explosive activities. When developing the mitigation for this Final Supplemental EIS/OEIS, the Navy determined that it could expand this requirement to other explosive activities for enhanced consistency and to help determine if any resources were injured during explosive events, when practical. The Navy is adding a requirement that additional platforms already participating in the activity will support observing the mitigation zone before, during, and after the activity while performing their regular duties. When available, having additional personnel support observations of the mitigation zone will help increase the likelihood of detecting biological resources. The Navy will follow the incident reporting procedures outlined in Section 5.1.2.2.3 (Incident Reports) if an incident is detected at any time during the event, including during the post-activity observations.

Large-caliber gunnery activities involve vessels firing projectiles at targets located up to 6 nautical miles (NM) down range. Medium-caliber gunnery activities in the Study Area involve vessels firing projectiles at targets located up to 4,000 yd. down range, although typically much closer. Lookouts will be more likely to detect large visual cues (e.g., whale blows, breaching whales) than individual marine mammals, cryptic marine mammal species and sea turtles when observing mitigation zones located at the furthest firing distances. The Navy will implement larger mitigation zones for large-caliber gunnery activities than for medium-caliber gunnery activities for marine mammals and sea turtles due to the nature of how the activities are conducted. During large-caliber gunnery activities, Lookouts typically have access to high-powered binoculars mounted on the ship deck. This will enable observation of the distant mitigation zone in combination with hand-held binoculars and naked-eye scanning. Observing for indicators of marine mammal and sea turtle presence will further help avoid or reduce potential impacts on these resources within the mitigation zones.

Due to the difficulty of differentiating bird species, the Navy will implement mitigation for all seabird species during explosive medium-caliber weapons firing. Although there is a low likelihood that marbled murrelets and short-tailed albatross will occur in locations where the Navy conducts medium-caliber gunnery activities, the mitigation will help the Navy further avoid or reduce potential impacts on these ESA-listed bird species, as well as other seabird species that could occur offshore. The Navy will not implement mitigation for seabirds during explosive large-caliber gunnery events because Lookouts would not be effective at detecting seabirds from the distant firing location, even with the use of high-powered binoculars.

The mitigation applies only to activities using surface targets. Most airborne targets are recoverable aerial drones that are not intended to be hit by ordnance. Given the speed of the projectiles and mobile target, and the long ranges that projectiles typically travel, it is not possible to definitively predict or to effectively observe where the projectile fragments will fall. For gunnery activities using explosive medium-caliber and large-caliber projectiles, the potential military expended material fall zone can only be predicted within thousands of yards, which can be up to 6 NM from the firing location. These areas are too large to be effectively observed for marine mammals and sea turtles with the number of personnel and platforms available for this activity. The potential risk to marine mammals and sea turtles during events using airborne targets is limited to the animal being directly struck by falling military expended materials. There is no potential for direct impact from the explosives because the detonations occur in air. Based on the extremely low potential for projectile fragments to co-occur in space and time with a marine mammal or sea turtle at or near the surface of the water, the potential for a direct strike is negligible; therefore, mitigation for gunnery activities using airborne targets would not be effective at avoiding or reducing potential impacts.

Bin E5 (e.g., 5-in. projectiles) has the longest predicted impact ranges for explosive projectiles that apply to the 1,000 yd. mitigation zone. Bin E2 (e.g., 40-millimeter [mm] projectiles) has the longest predicted impact ranges for explosive projectiles that apply to the 600 yd. mitigation zone. The 1,000 yd. and 600 yd. mitigation zones extend beyond the respective ranges to 50 percent non-auditory injury and 50 percent mortality for sea turtles and marine mammals. The 1,000 yd. and 600 yd. mitigation zones extend beyond the respective average ranges to PTS for sea turtles, low-frequency cetaceans, mid-frequency cetaceans, otariids, and phocids, and into a portion of the average ranges to PTS for high-frequency cetaceans. The mitigation zones also extend beyond or into a portion of the average ranges to TTS for sea turtles and marine mammals. Therefore, depending on the species, mitigation will help avoid or reduce all or a portion of the potential for exposure to mortality, non-auditory injury, PTS, and higher levels of TTS for the largest explosives in bin E5 and bin E2. Explosives in smaller source bins (e.g., E1) have shorter predicted impact ranges; therefore, the mitigation zones will extend further beyond or cover a greater portion of the impact ranges for these explosives.

As described previously, the mitigation zones for marine mammals and sea turtles developed for this Final Supplemental EIS/OEIS are based on the largest areas within which it is practical for the Navy to implement mitigation. It is not practical to increase these mitigation zones because observations within the margin of increase would be unsafe and ineffective. One of the mission-essential safety protocols for explosive gunnery activities is a requirement for event participants (including the Lookout) to maintain focus on the activity area to ensure safety of Navy personnel and equipment, and the public. The typical activity areas for medium-caliber and large-caliber gunnery activities coincide with the applicable mitigation zones; therefore, the Lookout can safely and effectively observe the mitigation zones for biological resources while simultaneously maintaining focus on the activity area. However, if the mitigation zone sizes increased, the Lookout would need to redirect attention to observe beyond the activity area. This would not meet the safety criteria since personnel would be required to direct attention away from mission requirements. Alternatively, the Navy would need to add personnel to serve as additional Lookouts on the existing observation platforms or allocate additional platforms to the activity to observe for biological resources. These actions would not be safe or sustainable due to an exceedance of manpower, resource, and space restrictions for these activities. Similarly, positioning platforms closer to the intended impact location would increase safety risks related to proximity to the detonation location and path of the explosive projectile.

Increasing the mitigation zone sizes would result in larger areas over which detonations would need to be ceased in response to a sighting, and therefore would likely increase the number of times firing would be ceased and would extend the length of the activity. These impacts would significantly diminish event realism in a way that would prevent activities from meeting their intended objectives. For example, the Navy must train its gun crews to coordinate with other participating platforms (e.g., small boats launching a target, other firing platforms), locate and engage surface targets (e.g., remote controlled high-speed targets), and practice precise defensive marksmanship to disable threats.

Depending on the type of target being used, additional stopping of the activity could result in the target needing to be recovered and relaunched, which would cause a significant loss of training time. These types of impacts would reduce the number of opportunities that gun crews have to fire on the target and cause significant delays to the training schedule. Therefore, an increase in mitigation would impede the ability for gun crews to train and become proficient in using their weapons as required during military missions and combat operations and would prevent units from meeting their individual training and certification requirements (which would prevent them from deploying with the required level of readiness necessary to accomplish their missions). Extending the length of the activity would also result in additional operational costs due to increased fuel consumption.

In summary, the operational community determined that implementing procedural mitigation for explosive medium-caliber and large-caliber projectiles beyond what is detailed in Table 5.3-6 would be incompatible with the practicality assessment criteria for safety, sustainability, and mission requirements.

5.3.3.4 Explosive Missiles

The Navy will continue to implement procedural mitigation to avoid or reduce potential impacts on marine mammals and sea turtles from explosive missiles, as outlined in Table 5.3-7. In the 2015 NWTT Final EIS/OEIS, the explosive missile mitigation zone was based on charge size and associated average ranges to PTS. When developing the mitigation for this Final Supplemental EIS/OEIS, the Navy analyzed the potential for increasing the size of this mitigation zone. The Navy determined that the current mitigation zone for explosive missiles is the largest area within which it is practical to implement mitigation for this activity; therefore, it will continue implementing this same mitigation zone under the Proposed Action. The Navy is clarifying in the table that it will require observation of the mitigation zone prior to the initial start of the activity to ensure the area is clear of applicable biological resources. The Navy has always verified that the mitigation zone is visually clear prior to conducting explosive activities and is more clearly capturing this current practice in the mitigation measures for this activity. The Navy developed a new mitigation measure requiring the Lookout to observe the mitigation zone after completion of the activity. In accordance with the 2015 NWTT Final EIS/OEIS consultation requirements, the Navy currently conducts post-activity observations for some, but not all explosive activities. When developing the mitigation for this Final Supplemental EIS/OEIS, the Navy determined that it could expand this requirement to other explosive activities for enhanced consistency and to help determine if any resources were injured during explosive events, when practical. The Navy is adding a requirement that additional platforms already participating in the activity will support observing the mitigation zone before, during, and after the activity while performing their regular duties. Typically, when aircraft are firing explosive munitions there are additional observation aircraft, multiple aircraft firing munitions, or other safety aircraft in the vicinity. For example, during typical explosive missile exercises, two aircraft circle the activity location. One aircraft clears the intended impact location while the other fires, and vice versa. A third aircraft is typically present for safety or proficiency inspections. When available, having additional personnel support observations of the mitigation zone will help increase the likelihood of detecting biological resources. The Navy will follow the incident reporting procedures outlined in Section 5.1.2.2.3 (Incident Reports) if an incident is detected at any time during the event, including during the post-activity observations.

Table 5.3-7: Procedural Mitigation for Explosive Missiles

Procedural Mitigation Description
<u>Stressor or Activity</u> • Aircraft-deployed explosive missiles – Mitigation applies to activities using a surface target
<u>Resource Protection Focus</u> • Marine mammals • Sea turtles
<u>Number of Lookouts and Observation Platform</u> • 1 Lookout positioned in an aircraft • If additional platforms are participating in the activity, personnel positioned in those assets (e.g., safety observers, evaluators) will support observing the mitigation zone for applicable biological resources while performing their regular duties.
<u>Mitigation Requirements</u> • Mitigation zone: – 2,000 yd. around the intended impact location • Prior to the initial start of the activity (e.g., during a fly-over of the mitigation zone): – Observe the mitigation zone for floating vegetation; if observed, relocate or delay the start until the mitigation zone is clear. – Observe the mitigation zone for marine mammals and sea turtles; if observed, relocate or delay the start of firing. • During the activity: – Observe the mitigation zone for marine mammals and sea turtles; if observed, cease firing. • Commencement/recommencement conditions after a marine mammal or sea turtle sighting before or during the activity: – The Navy will allow a sighted marine mammal or sea turtle to leave the mitigation zone prior to the initial start of the activity (by delaying the start) or during the activity (by not recommencing firing) until one of the following conditions has been met: (1) the animal is observed exiting the mitigation zone; (2) the animal is thought to have exited the mitigation zone based on a determination of its course, speed, and movement relative to the intended impact location; or (3) the mitigation zone has been clear from any additional sightings for 10 min. when the activity involves aircraft that have fuel constraints, or 30 min. when the activity involves aircraft that are not typically fuel constrained. • After completion of the activity (e.g., prior to maneuvering off station): – When practical (e.g., when platforms are not constrained by fuel restrictions or mission-essential follow-on commitments), observe the vicinity of where detonations occurred; if any injured or dead marine mammals or ESA-listed species are observed, follow established incident reporting procedures. – If additional platforms are supporting this activity (e.g., providing range clearance), these assets will assist in the visual observation of the area where detonations occurred.

Missile exercises conducted under the Proposed Action involve firing munitions at a target typically located up to 15 NM down range, and infrequently up to 75 NM down range. Due to the distance between the mitigation zone and the observation platform, the Lookout will have a better likelihood of detecting marine mammals and sea turtles during close-range observations and are less likely to detect these resources once positioned at the firing location, particularly individual marine mammals, cryptic marine mammal species, and sea turtles. There is a chance that animals could enter the mitigation zone after the aircraft conducts its close-range mitigation zone observations and before firing begins (once the aircraft has transited to its firing position). Observing for indicators of marine mammal and sea turtle presence will further help avoid or reduce potential impacts on these resources within the mitigation zones.

The mitigation applies to aircraft-deployed missiles because aircraft can fly over the intended impact area prior to commencing firing. Mitigation would be ineffective for vessel-deployed missiles because of the inability for a Lookout to detect marine mammals or sea turtles from a vessel from the distant firing position. It would not be effective or practical to have a vessel conduct close-range observations of the mitigation zone prior to firing due to the length of time it would take to complete observations and transit back to the firing position, and the costs associated with increased fuel consumption.

The mitigation applies to activities using surface targets. Most airborne targets are recoverable aerial drones that are not intended to be hit by ordnance. For example, telemetry-configured anti-air missiles used in training are designed to detonate or simulate a detonation near a target, but not as a result of a direct strike on a target. Given the speed of missiles and mobile targets, the high altitudes involved, and the long ranges that missiles typically travel, it is not possible to definitively predict or to effectively observe where the missile fragments will fall. The potential expended material fall zone can only be predicted within tens of miles for long range events, which can be 75 NM from the firing location; and thousands of yards for short range events, which can occur 15 NM from the firing location. These areas are too large to be effectively observed for marine mammals and sea turtles with the number of personnel and platforms available for this activity. The potential risk to marine mammals and sea turtles during events using airborne targets is limited to the animal being directly struck by falling military expended materials. There is no potential for direct impact from explosives because the detonations occur in air. Based on the extremely low potential for military expended materials to co-occur in space and time with a marine mammal or sea turtle at or near the surface of the water, the potential for a direct strike is negligible; therefore, mitigation would not be effective at avoiding or reducing potential impacts.

Bin E10 (e.g., Harpoon missiles) has the longest predicted impact ranges for explosive missiles used in the Study Area. The 2,000 yd. mitigation zone extends beyond the ranges to 50 percent non-auditory injury and 50 percent mortality for sea turtles and marine mammals. The mitigation zone extends beyond the average ranges to PTS for sea turtles, low-frequency cetaceans, mid-frequency cetaceans, otariids, and phocids, and into a portion of the average range to PTS for high-frequency cetaceans. The mitigation zone also extends beyond or into a portion of the average ranges to TTS for sea turtles and marine mammals. Therefore, depending on the species, mitigation will help avoid or reduce all or a portion of the potential for exposure to mortality, non-auditory injury, PTS, and higher levels of TTS for the largest explosives in bin E10.

As described previously, the mitigation zone developed for this Final Supplemental EIS/OEIS is based on the largest area within which it is practical for the Navy to implement mitigation. It is not practical to increase the mitigation zone because observations within the margin of increase would be unsafe and ineffective unless the Navy allocated additional platforms to the activity to observe for biological resources. The use of additional personnel and equipment (e.g., aircraft) would be unsustainable due to increased operational costs and an exceedance of the available manpower and resources for this activity. Adding aircraft to observe the mitigation zone could result in airspace conflicts with the event participants. This would either require the aircraft conducting the activity to modify their flight plans (which would reduce activity realism) or force the observing aircraft to position itself a safe distance away from the activity area (which would decrease observation effectiveness). Similarly, positioning platforms closer to the intended impact location (as would be required if mitigation applied to vessel-deployed missiles) would increase safety risks related to proximity to the detonation location and path of the explosive missile.

Increasing the mitigation zone size would result in larger areas over which firing would need to be ceased in response to a sighting, and therefore would likely increase the number of times detonations would be ceased and would extend the length of the activity. These impacts would significantly diminish event realism in a way that would prevent the activity from meeting its intended objectives. Explosive missile events require focused situational awareness of the activity area and continuous coordination between the participating platforms as required during military missions and combat operations. For activities using missiles in the larger net explosive weight category, the flyover distance between the mitigation zone and the firing location can extend upwards of 75 NM; therefore, even aircraft with larger fuel capacities would need to depart the activity area to refuel if the length of the activity was extended. If the firing aircraft departed the activity location to refuel, the aircrew would lose the ability to maintain situational awareness of the activity area and effectively coordinate with other participating platforms. If multiple refueling events were required, the activity length would extend by two to five times or more, which would increase safety risks due to increased pilot fatigue and accelerated fatigue-life of aircraft. These types of impacts would cause a significant loss of training or testing time, reduce the number of opportunities that aircrews have to fire on the target, and cause a significant delay to the training or testing schedule. Therefore, an increase in mitigation would impede the ability for aircrews to train and become proficient in using their weapons as required during military missions and combat operations, would prevent units from meeting their individual training and certification requirements (which would prevent them from deploying with the required level of readiness necessary to accomplish their missions), and would impede the ability of program managers and weapons system acquisition programs to meet testing requirements per required acquisition milestones or on an as-needed basis to meet operational requirements. Extending the length of the activity would also result in additional operational costs due to increased fuel consumption.

In summary, the operational community determined that implementing procedural mitigation for explosive missiles beyond what is detailed in Table 5.3-7 would be incompatible with the practicality assessment criteria for safety, sustainability, and mission requirements.

5.3.3.5 Explosive Bombs

The Navy will continue to implement procedural mitigation to avoid or reduce potential impacts on marine mammals and sea turtles from explosive bombs, as outlined in Table 5.3-8.

Table 5.3-8: Procedural Mitigation for Explosive Bombs

Procedural Mitigation Description
Stressor or Activity • Explosive bombs
Resource Protection Focus • Marine mammals • Sea turtles
Number of Lookouts and Observation Platform • 1 Lookout positioned in the aircraft conducting the activity • If additional platforms are participating in the activity, personnel positioned in those assets (e.g., safety observers, evaluators) will support observing the mitigation zone for applicable biological resources while performing their regular duties.
Mitigation Requirements • Mitigation zone: – 2,500 yd. around the intended target • Prior to the initial start of the activity (e.g., when arriving on station): – Observe the mitigation zone for floating vegetation; if observed, relocate or delay the start until the mitigation zone is clear. – Observe the mitigation zone for marine mammals and sea turtles; if observed, relocate or delay the start of bomb deployment. • During the activity (e.g., during target approach): – Observe the mitigation zone for marine mammals and sea turtles; if observed, cease bomb deployment. • Commencement/recommencement conditions after a marine mammal or sea turtle sighting before or during the activity: – The Navy will allow a sighted marine mammal or sea turtle to leave the mitigation zone prior to the initial start of the activity (by delaying the start) or during the activity (by not recommencing bomb deployment) until one of the following conditions has been met: (1) the animal is observed exiting the mitigation zone; (2) the animal is thought to have exited the mitigation zone based on a determination of its course, speed, and movement relative to the intended target; (3) the mitigation zone has been clear from any additional sightings for 10 min.; or (4) for activities using mobile targets, the intended target has transited a distance equal to double that of the mitigation zone size beyond the location of the last sighting. • After completion of the activity (e.g., prior to maneuvering off station): – When practical (e.g., when platforms are not constrained by fuel restrictions or mission-essential follow-on commitments), observe the vicinity of where detonations occurred; if any injured or dead marine mammals or ESA-listed species are observed, follow established incident reporting procedures. – If additional platforms are supporting this activity (e.g., providing range clearance), these assets will assist in the visual observation of the area where detonations occurred.

In the 2015 NWTT Final EIS/OEIS, the explosive bombing mitigation zone was based on net explosive weight and the associated average ranges to PTS. When developing the mitigation for this Final Supplemental EIS/OEIS, the Navy analyzed the potential for increasing the size of this mitigation zone. The Navy determined that the current mitigation zone for explosive bombs is the largest area within which it is practical to implement mitigation for this activity; therefore, it will continue implementing this same mitigation zone under the Proposed Action. The Navy is clarifying in the table that it will require observation of the mitigation zone prior to the initial start of the activity to ensure the area is clear of applicable biological resources. The Navy has always verified that the mitigation zone is visually clear prior to conducting explosive activities and is more clearly capturing this current practice in the mitigation measures for this activity. The Navy developed a new mitigation measure requiring the Lookout to observe the mitigation zone after completion of this activity. In accordance with the

2015 NWTT Final EIS/OEIS consultation requirements, the Navy currently conducts post-activity observations for some, but not all explosive activities. When developing mitigation for this Final Supplemental EIS/OEIS, the Navy determined that it could expand this requirement to other explosive activities for enhanced consistency and to help determine if any resources were injured during explosive events, when practical. The Navy is adding a requirement that additional platforms already participating in the activity will support observing the mitigation zone before, during, and after the activity while performing their regular duties. Typically, when aircraft are firing explosive munitions there are additional observation aircraft, multiple aircraft firing munitions, or other safety aircraft in the vicinity. When available, having additional personnel support observations of the mitigation zone will help increase the likelihood of detecting biological resources. The Navy will follow the incident reporting procedures outlined in Section 5.1.2.2.3 (Incident Reports) if an incident is detected at any time during the event, including during the post-activity observations.

Bombing exercises involve an aircraft deploying munitions at a surface target located beneath the firing platform. During target approach, aircraft maintain a relatively steady altitude of approximately 1,500 ft. Lookouts, by necessity for safety and mission success, primarily focus their attention on the water surface surrounding the intended detonation location (i.e., the mitigation zone). Being positioned in an aircraft gives the Lookout a good vantage point for observing marine mammals and sea turtles throughout the mitigation zone. Observing for indicators of marine mammal and sea turtle presence will further help avoid or reduce potential impacts on these resources within the mitigation zone.

Bin E10 (e.g., 500 lb. bomb) has the longest predicted impact ranges for explosive bombs used in the Study Area. The 2,500 yd. mitigation zone extends beyond the ranges to 50 percent non-auditory injury and 50 percent mortality for sea turtles and marine mammals. The mitigation zone extends beyond the average ranges to PTS for sea turtles, low-frequency cetaceans, mid-frequency cetaceans, otariids, and phocids, and into a portion of the average range to PTS for high-frequency cetaceans. The mitigation zone also extends beyond or into a portion of the average ranges to TTS for sea turtles and marine mammals. Therefore, depending on the species, mitigation will help avoid or reduce all or a portion of the potential for exposure to mortality, non-auditory injury, PTS, and higher levels of TTS for the largest bombs in bin E10. Smaller bombs in bin E10 (e.g., 250 lb. bomb) have shorter predicted impact ranges; therefore, the mitigation zone will extend further beyond or cover a greater portion of the impact ranges for these explosives.

As described previously, the mitigation zone developed for this Final Supplemental EIS/OEIS is based on the largest area within which it is practical for the Navy to implement mitigation. It is not practical to increase this mitigation zone because observations within the margin of increase would be unsafe and ineffective unless the Navy allocated additional platforms to the activity to observe for biological resources. The use of additional personnel and aircraft would be unsustainable due to increased operational costs and an exceedance of the available manpower and resources for this activity. Adding aircraft to observe the mitigation zone could result in airspace conflicts with the event participants. This would either require the aircraft participating in the activity to modify their flight plans (which would reduce activity realism) or force the observing aircraft to position itself a safe distance away from the activity area (which would decrease observation effectiveness). Adding vessels to observe the mitigation zone would increase safety risks due to the presence of observation vessels within the vicinity of the intended explosive bomb detonation location.

Increasing the mitigation zone would result in a larger area over which explosive bomb deployment would need to be ceased in response to a sighting, and therefore would likely increase the number of times explosive bombing activities would be ceased and would extend the length of the activity. These impacts would significantly diminish event realism in a way that would prevent the activity from meeting its intended objectives. For example, critical components of a Bombing Exercise Air-to-Surface training activity are the assembly, loading, delivery, and assessment of an explosive bomb. The activity requires focused situational awareness of the activity area and continuous coordination between multiple training components. The training exercise starts with ground personnel, who must practice the building and loading of explosive munitions. Training includes the safe handling of explosive material, configuring munitions to precise specifications, and loading munitions onto aircraft. Aircrew must then identify a target and safely deliver fused munitions, discern if the bomb was assembled correctly, and determine bomb damage assessments based on how and where the explosive detonated. Extending the length of the activity would require aircraft to depart the area to refuel. If the firing aircraft departed the activity area to refuel, aircrew would lose the ability to maintain situational awareness of the activity area, effectively coordinate with other participating platforms, and complete all training components as required during military missions and combat operations. If multiple refueling events were required, the activity length would be extended by two to five times or more, which would cause a significant loss of training time and would increase safety risks due to increased pilot fatigue and accelerated fatigue-life of aircraft. This would reduce the number of opportunities that aircrews have to approach targets and deploy bombs, which would cause a significant delay to the training schedule. Therefore, an increase in mitigation would impede the ability for aircrews to train and become proficient in using their weapons. This would prevent units from meeting their individual training and certification requirements and deploying with the required level of readiness necessary to accomplish their missions. Extending the length of the activity would also result in additional operational costs due to increased fuel consumption.

In summary, the operational community determined that implementing procedural mitigation for explosive bombs beyond what is detailed in Table 5.3-8 would be incompatible with the practicality assessment criteria for safety, sustainability, and mission requirements.

5.3.3.6 Explosive Mine Countermeasure and Neutralization Activities

The Navy developed new procedural mitigation to avoid or reduce potential impacts on marine mammals, sea turtles, seabirds, and fish from explosive mine countermeasure and neutralization activities, as outlined in Table 5.3-9. The mitigation applies to all explosive mine countermeasure and neutralization activities except those that involve the use of Navy divers, which are discussed in Section 5.3.3.7 (Explosive Mine Neutralization Activities Involving Navy Divers).

The types of charges used in these activities are positively controlled, which means the detonation is controlled by the personnel conducting the activity and is not authorized until the mitigation zone is clear at the time of detonation. Explosive Mine Countermeasure and Neutralization Testing activities will be scheduled to be conducted in daylight hours and detonations will not occur past sunset. Conducting explosive activities in the daytime in Beaufort sea state number 3 conditions or less (i.e., good visibility conditions) ensures safety of event participants while increasing the likelihood that marine mammals and sea turtles will be detected prior to and during the activity. By using the smallest practicable charge for each activity (e.g., using a smaller net explosive weight if the testing program objective can still be met), the Navy will be able to reduce potential impacts on marine mammals, sea turtles, ESA-listed fish, and marbled murrelets, while maintaining the ability to accomplish the required testing objectives.

Table 5.3-9: Procedural Mitigation for Explosive Mine Countermeasure and Neutralization Activities

Procedural Mitigation Description
Stressor or Activity • Explosive mine countermeasure and neutralization activities
Resource Protection Focus • Marine mammals • Sea turtles • Seabirds (marbled murrelet) • Fish
Number of Lookouts and Observation Platform • 1 Lookout positioned on a vessel or in an aircraft when implementing the smaller mitigation zone • 2 Lookouts (one positioned in an aircraft and one on a small boat) when implementing the larger mitigation zone • If additional platforms are participating in the activity, personnel positioned in those assets (e.g., safety observers, evaluators) will support observing the mitigation zone for applicable biological resources while performing their regular duties.
Mitigation Requirements • Mitigation zones: – 600 yd. around the detonation site for activities using ≤ 5 lb. net explosive weight – 2,100 yd. around the detonation site for activities using > 5–60 lb. net explosive weight • Prior to the initial start of the activity (e.g., when maneuvering on station; typically, 10 min. when the activity involves aircraft that have fuel constraints, or 30 min. when the activity involves aircraft that are not typically fuel constrained): – Observe the mitigation zone for floating vegetation; if observed, relocate or delay the start until the mitigation zone is clear. – Observe the mitigation zone for marine mammals and sea turtles; if observed, relocate or delay the start of detonations. • During the activity: – Observe the mitigation zone for marine mammals and sea turtles; if observed, cease detonations. – The Navy will use the smallest practicable charge size for each activity. – The Navy will conduct activities in daylight hours only in Beaufort Sea state number 3 conditions or less. • Commencement/recommencement conditions after a marine mammal or sea turtle sighting before or during the activity: – The Navy will allow a sighted marine mammal or sea turtle to leave the mitigation zone prior to the initial start of the activity (by delaying the start) or during the activity (by not recommencing detonations) until one of the following conditions has been met: (1) the animal is observed exiting the mitigation zone; (2) the animal is thought to have exited the mitigation zone based on a determination of its course, speed, and movement relative to detonation site; or (3) the mitigation zone has been clear from any additional sightings for 10 min. when the activity involves aircraft that have fuel constraints, or 30 min. when the activity involves aircraft that are not typically fuel constrained. • After completion of the activity (typically 10 min. when the activity involves aircraft that have fuel constraints, or 30 min. when the activity involves aircraft that are not typically fuel constrained): – Observe the vicinity of where detonations occurred; if any injured or dead marine mammals or ESA-listed species are observed, follow established incident reporting procedures. – If additional platforms are supporting this activity (e.g., providing range clearance), these assets will assist in the visual observation of the area where detonations occurred.

When developing the new mitigation for this Final Supplemental EIS/OEIS, the Navy analyzed a range of potential mitigation zone sizes for the type of explosives used during explosive mine countermeasure and neutralization activities under the Proposed Action. The Navy will adopt mitigation zones that are consistent with the ones used during comparable activities in other at-sea training and testing Study Areas. The mitigation zones for explosive mine countermeasure and neutralization activities are based on the largest areas within which it is practical for the Navy to implement mitigation during the types of activities conducted under the Proposed Action. When available, having additional personnel support observations of the mitigation zone will help increase the likelihood of detecting biological resources. The post-activity observations will help the Navy determine if any resources were injured during the activity. The Navy will follow the incident reporting procedures outlined in Section 5.1.2.2.3 (Incident Reports) if an incident is detected at any time during the event, including during the post-activity observations.

For the 600 yd. mitigation zone, the small observation area and proximity to the observation platform will result in a high likelihood that the Lookout will be able to detect marine mammals and sea turtles throughout the mitigation zone (regardless of the type of observation platform used). For the 2,100 yd. mitigation zone, the Lookout on a small boat will be more likely to detect large visual cues (e.g., whale blows or large pods of dolphins) or splashes of individual marine mammals than cryptic marine mammal species and sea turtles near the mitigation zone perimeter, while the Lookout positioned in an aircraft will help increase the chance that marine mammals and sea turtles will be detected throughout the mitigation zone. Observing for indicators of marine mammal and sea turtle presence will further help avoid or reduce potential impacts on these resources within the mitigation zones.

Bin E7 (e.g., 60 lb. mine) has the longest predicted impact ranges for explosives that apply to the 2,100 yd. mitigation zone. Bin E4 (e.g., 5 lb. net explosive weight charge) has the longest predicted impact ranges for explosives that apply to the 600 yd. mitigation zone. The 2,100 yd. and 600 yd. mitigation zones extend beyond the respective ranges to 50 percent non-auditory injury and 50 percent mortality for sea turtles and marine mammals. The 2,100 yd. mitigation zone extends beyond the respective average ranges to PTS for sea turtles, low-frequency cetaceans, mid-frequency cetaceans, otariids, and phocids, and into a portion of the average ranges to PTS for high-frequency cetaceans. The 600 yd. mitigation zone extends beyond the respective average ranges to PTS for sea turtles, mid-frequency cetaceans, and otariids, and into a portion of the average ranges to PTS for low-frequency cetaceans, high-frequency cetaceans, and phocids. The mitigation zones also extend into a portion of the average ranges to TTS for sea turtles and marine mammals. Therefore, depending on the species, mitigation will help avoid or reduce all or a portion of the potential for exposure to mortality, non-auditory injury, PTS, and higher levels of TTS for the largest explosives in bin E7 and bin E4. Smaller explosives within bin E7 and bin E4 have shorter predicted impact ranges; therefore, the mitigation zones will cover a greater portion of the impact ranges for these explosives.

As described previously, the mitigation zones developed for this Final Supplemental EIS/OEIS are based on the largest areas within which it is practical for the Navy to implement mitigation. It is not practical to increase these mitigation zones because observations within the margin of increase would be unsafe and ineffective unless the Navy allocated additional platforms to the activity to observe for biological resources. The use of additional personnel and equipment (e.g., small boats, aircraft) would be unsustainable due to increased operational costs and an exceedance of available manpower and resources for this activity. Adding aircraft to observe the mitigation zone could result in airspace conflicts with the event participants. This would either require the aircraft conducting the activity to modify their flight plans (which would reduce activity realism) or force the observing aircraft to position itself a safe distance away from the activity area (which would decrease observation effectiveness). Adding vessels to observe the mitigation zone would increase safety risks due to the presence observation vessels within the vicinity of detonations.

Increasing the mitigation zone sizes would result in larger areas over which firing would need to be ceased in response to a sighting, and therefore would likely increase the number of times detonations would be ceased and would extend the length of the activity. These impacts would significantly diminish realism in a way that would prevent the activity from meeting its intended objectives. For example, Mine Countermeasure and Neutralization Testing events require focused situational awareness of the activity area and coordination of tactics between amphibious warfare ships, mine warfare ships, surface combatants, and rotary-wing aircraft crews to ensure systems can effectively neutralize threat mines and mine-like objects. During these events, personnel evaluate the system's ability to detect and destroy mines from an airborne mine countermeasures-capable rotary-wing aircraft in advance of delivery to the fleet for operational use. Extending the length of these activities would require aircraft to depart the activity area to refuel. If multiple refueling events were required, the length of the activity would be extended by two to five times or more. This would decrease the ability for Lookouts to safely and effectively maintain situational awareness of the activity area and would increase safety risks due to increased pilot fatigue and accelerated fatigue-life of aircraft.

These types of impacts would result in a significant loss of testing time (which would reduce the Navy's ability to validate whether mine neutralization systems perform as expected) and cause a significant delay to the testing schedule. Therefore, an increase in mitigation would impede the ability of program managers and weapons system acquisition programs to meet testing requirements per required acquisition milestones or on an as-needed basis to meet operational requirements. Extending the length of the activities would also result in additional operational costs due to increased fuel consumption.

In summary, the operational community determined that implementing procedural mitigation for explosive mine countermeasure and neutralization activities beyond what is detailed in Table 5.3-9 would be incompatible with the practicality assessment criteria for safety, sustainability, and mission requirements.

5.3.3.7 Explosive Mine Neutralization Activities Involving Navy Divers

The Navy will continue to implement procedural mitigation to avoid or reduce potential impacts on marine mammals, seabirds, and fish from explosive mine neutralization activities involving Navy divers as outlined in Table 5.3-10. Navy divers participating in these activities may be explosive ordnance disposal personnel. Information specific to seasonal charge size requirements at the Hood Canal and Crescent Harbor Explosive Ordnance Detonation ranges developed to avoid or reduce potential impacts on fish, including migrating Chinook salmon, chum salmon, and bull trout, is presented in Section K.3.3 (Mitigation Areas for Marine Species in NWTT Inland Waters). In the 2015 NWTT Final EIS/OEIS, the marine mammal mitigation zone for explosive mine neutralization activities involving Navy divers was based on net explosive weight and the associated average ranges to PTS. The seabird mitigation zones were based on guidance from the USFWS. Mitigation does not apply to sea turtles or short-tailed albatross because they are not likely to occur at the locations where the Navy conducts explosive mine neutralization activities involving Navy divers in the Study Area.

When developing the mitigation for this Final Supplemental EIS/OEIS, the Navy analyzed the potential for increasing the size of the marine mammal mitigation zone. The Navy identified an opportunity to increase the marine mammal mitigation zone by 100 yd. to enhance protections to the maximum extent practicable. This increase is reflected in Table 5.3-10. The marine mammal mitigation zone for explosive mine neutralization activities involving the use of Navy divers is now based on the largest area within which it is practical to implement mitigation for the charge sizes used under the Proposed Action. The seabird mitigation zones remain consistent with USFWS guidance. The post-activity observations are a continuation from the 2015 NWTT Final EIS/OEIS and will help the Navy determine if any resources were injured during the activity. The Navy will follow the incident reporting procedures outlined in Section 5.1.2.2.3 (Incident Reports) if an incident is detected at any time during the event, including during the post-activity observations. The Navy is clarifying in the table that it will require observation of the mitigation zone prior to the initial start of the activity to ensure the area is clear of applicable biological resources. The Navy has always verified that the mitigation zone is visually clear prior to conducting explosive activities and is more clearly capturing this current practice in the mitigation measures for this activity.

Table 5.3-10: Procedural Mitigation for Explosive Mine Neutralization Activities Involving Navy Divers

Procedural Mitigation Description
Stressor or Activity • Explosive mine neutralization activities involving Navy divers
Resource Protection Focus • Marine mammals • Seabirds (marbled murrelet) • Fish
Number of Lookouts and Observation Platform • 2 Lookouts on one small boat for activities using < 0.1 lb. net explosive weight, one of which will be a Navy biologist • 2 Lookouts on two small boats with one Lookout each, one of which will be a Navy biologist, for activities using > 0.5–2.5 lb. net explosive weight • All divers placing the charges on mines will support the Lookouts while performing their regular duties and will report applicable sightings to the lead Lookout, the supporting small boat, or the Range Safety Officer. • If additional platforms are participating in the activity, personnel positioned in those assets (e.g., safety observers, evaluators) will support observing the mitigation zone for applicable biological resources while performing their regular duties.
Mitigation Requirements • Mitigation zones: – 100 yd. (for seabirds) around the detonation site during activities using < 0.1 lb. net explosive weight – 400 yd. (seabirds) or 500 yd. (marine mammals) around the detonation site during activities using > 0.5–2.5 lb. net explosive weight • Prior to the initial start of the activity (starting 30 min. before the first planned detonation): – Observe the mitigation zone for floating vegetation; if observed, relocate or delay the start until the mitigation zone is clear. – Observe the mitigation zone for marine mammals and seabirds; if observed, relocate or delay the start of detonations. – Pre-event observations of the mitigation zones for seabirds will include naked eye scanning along transect lines no more than 50 meters (m) wide using vessel speeds between 5 and 10 knots. – The Navy will ensure the area is clear of marine mammals for 30 min. prior to commencing a detonation. – A Navy biologist will serve as the lead Lookout and will make the final determination that the mitigation zone is clear of any biological resource sightings prior to the commencement of a detonation. The Navy biologist will maintain radio communication with the unit conducting the event and the other Lookout.

Table 5.3-10: Procedural Mitigation for Explosive Mine Neutralization Activities Involving Navy Divers (continued)

Procedural Mitigation Description
• During the activity: – Observe the mitigation zone for marine mammals and seabirds; if observed, cease detonations. – To the maximum extent practicable depending on mission requirements, safety, and environmental conditions, boats will position themselves near the mid-point of the mitigation zone radius (but outside of the detonation plume and human safety zone), will position themselves on opposite sides of the detonation location (when two boats are used), and will travel in a circular pattern around the detonation location with one Lookout observing inward toward the detonation site and the other observing outward toward the perimeter of the mitigation zone. – The Navy will use only positively controlled charges (i.e., no time-delay fuses). – The Navy will use the smallest practicable charge size for each activity. – Activities will be conducted in Beaufort Sea state number 2 conditions or less and will not be conducted in low visibility conditions. • Commencement/recommencement conditions after a marine mammal or seabird sighting before or during the activity: – The Navy will allow a sighted marine mammal or seabird to leave the mitigation zone prior to the initial start of the activity (by delaying the start) or during the activity (by not recommencing detonations) until one of the following conditions has been met: (1) the animal is observed exiting the mitigation zone; (2) the animal is thought to have exited the mitigation zone based on a determination of its course, speed, and movement relative to the detonation site; or (3) the mitigation zone has been clear from any additional sightings for 30 min. • After each detonation and the completion of an activity (for 30 min): – Observe the vicinity of where detonations occurred and immediately downstream of the detonation location; if any injured or dead marine mammals or ESA-listed species are observed, follow established incident reporting procedures. – If additional platforms are supporting this activity (e.g., providing range clearance), these assets will assist in the visual observation of the area where detonations occurred. – If any injured or dead seabirds or fish are observed, notify the appropriate Navy Region Environmental Director, Navy Pacific Fleet Environmental Office, and local base wildlife biologist and include information on the number of adults or juveniles and species, if possible. – The Navy will submit a mitigation summary report to the USFWS after the completion of each activity.

The charges used during explosive mine neutralization activities involving Navy divers in the Study Area are all positively controlled, which means that the detonation is controlled by the personnel conducting the activity and is not authorized until the area is clear at the time of detonation. This will allow Lookouts time to continuously observe the mitigation zone for biological resources right up to the point of detonation. By using the smallest practicable positive control charge for each activity (e.g., using 1.5 lb. net explosive weight in place of 2.5 lb. net explosive weight if the training objective can still be met), the Navy will be able to minimize potential impacts while maintaining the ability to accomplish the required training objectives. The pre-activity observations will typically entail a line transect survey (with each transect being no more than approximately 50 m wide) at speeds ranging between approximately 5–10 knots. The primary Lookouts for this activity will not include the boat drivers; however, the boat drivers will support the Lookouts while performing their regular duties. The small observation area and proximity to observation platforms will result in a high likelihood that Lookouts will be able to detect marine mammals throughout the mitigation zone. Observing for indicators of marine mammal presence will further help avoid or reduce impacts on these resources within the mitigation zone.

Due to the difficulty of differentiating bird species, the Navy will implement mitigation for all seabird species during this activity. Conducting activities in Beaufort sea state number 2 conditions or less (i.e., good visibility conditions) and having the Navy divers, boat drivers, and other personnel (typically four to five people per unit) support the Lookouts while performing their regular duties will increase the likelihood that marine mammals and seabirds will be detected prior to and during the activity.

Bin E3 has the longest predicted impact ranges for explosives used for these activities in the Study Area. The 500 yd. mitigation zone extends beyond the respective ranges to 50 percent non-auditory injury and 50 percent mortality for marine mammals. The mitigation zone extends beyond the average ranges to PTS for low-frequency cetaceans, mid-frequency cetaceans, and otariids, and into a portion of the average ranges to PTS for high-frequency cetaceans and phocids. The mitigation zone also extends beyond or into a portion of the average ranges to TTS for marine mammals. Therefore, depending on the species, mitigation will help avoid or reduce all or a portion of the potential for exposure to mortality, non-auditory injury, PTS, and higher levels of TTS for the largest explosives in bin E3. Smaller explosives within bin E3 have shorter predicted impact ranges; therefore, the mitigation zones will cover a greater portion of the impact ranges for these explosives.

As described previously, the marine mammal mitigation zone developed for this Final Supplemental EIS/OEIS is based on the largest area within which it is practical for the Navy to implement mitigation. It is not practical to increase the mitigation zone because observations within the margin of increase would be unsafe and ineffective unless the Navy allocated additional platforms to the activity to observe for biological resources. Because mine neutralization activities involve training Navy divers in the safe handling of explosive charges, one of the mission-essential safety protocols required of all event participants, including Lookouts, is to maintain focus on the activity area to ensure safety of personnel and equipment. The typical mine neutralization activity area coincides with the marine mammal mitigation zone size developed for this Final Supplemental EIS/OEIS; therefore, Lookouts can safely and effectively observe the mitigation zones for biological resources while simultaneously maintaining focus on the activity area. However, if the marine mammal mitigation zone size increased, Lookouts would need to redirect their attention beyond the activity area. This would not meet the safety criteria since personnel would be required to direct their attention away from mission requirements. Alternatively, the Navy would need to add personnel to serve as additional Lookouts on the existing observation platforms or allocate additional platforms to the activity to observe for biological resources. These actions would not be safe or sustainable due to an exceedance of manpower, resource, and space restrictions for these activities.

Increasing the mitigation zone sizes would result in larger areas over which detonations would need to be ceased in response to a sighting, and therefore would likely increase the number of times detonations would be ceased. This would extend the length of the activities and cause significant safety risks for Navy divers and loss of training time. Ceasing an activity (e.g., fuse initiation) with divers in the water would have safety implications for diver air consumption and bottom time. It would also impede the ability for Navy divers to complete the training exercise with the focused endurance as required during military missions and combat operations. These impacts would significantly diminish event realism in a way that would prevent activities from meeting their intended objectives. For example, the number of opportunities that divers would have to locate and neutralize mines would be reduced. Divers would then not be able to gain skill proficiency in precise identification and evaluation of a threat mine, safe handling of explosive material during charge placement, and effective charge detonation or fuse initiation. Mine neutralization activities involving the use of Navy divers only take place during daylight hours for safety reasons; therefore, extending the length of the activity could delay the activity into the next day or next several days, which would significantly impact training schedules for all participating platforms. Therefore, an increase in mitigation would impede the ability for Navy divers to train and become proficient in mine neutralization and would prevent units from meeting their individual training and certification requirements (which would prevent them from deploying with the required level of readiness necessary to accomplish their missions).

In summary, the operational community determined that implementing procedural mitigation for explosive mine neutralization activities involving Navy divers beyond what is detailed in Table 5.3-10 would be incompatible with the practicality assessment criteria for safety, sustainability, and mission requirements.

5.3.4 Physical Disturbance and Strike Stressors

The Navy will implement procedural mitigation to avoid or reduce potential impacts on biological resources from the physical disturbance and strike stressors or activities discussed in the sections below. Section 3.4.2.4 (Impacts from Physical Disturbance and Strike), Section 3.5.2.4 (Physical Disturbance and Strike Stressors), and Section 3.6.2.4 (Physical Disturbance and Strike Stressors) provide a full analysis of the potential impacts of physical disturbance and strikes on marine mammals, sea turtles, and birds, respectively. In addition to procedural mitigation, the Navy will implement mitigation for physical disturbance and strike within mitigation areas, such as requirements to prohibit or limit certain activities in certain locations (e.g., within a specified distance from shore). Mitigation area requirements for physical disturbance and strike stressors are detailed in Appendix K (Geographic Mitigation Assessment).

5.3.4.1 Vessel Movement

The Navy will continue to implement procedural mitigation to avoid or reduce the potential for vessel strikes of marine mammals and sea turtles, as outlined in Table 5.3-11. The procedural mitigation measures for vessel movement are a continuation from the 2015 NWTT Final EIS/OEIS based on the largest area within which it is practical for the Navy to implement mitigation and guidance from NMFS for vessel strike avoidance. The Navy is clarifying in the table that the mitigation zones for training activities will be the same as the mitigation zones for testing activities under the Proposed Action. Although the Navy is unable to position Lookouts on unmanned vessels, as a standard operating procedure, some vessels that operate autonomously have embedded sensors that aid in avoidance of large objects. The embedded sensors may help those unmanned vessels avoid vessel strikes of marine mammals.

As discussed in Section 5.3.1 (Environmental Awareness and Education), it is likely that the implementation of the Marine Species Awareness Training starting in 2007, and the additional U.S. Navy Afloat Environmental Compliance Training Series modules starting in 2014, potentially helped contribute to a Navy-wide reduction of vessel strikes of marine mammals across areas where the Navy trains and tests. The Navy is able to detect if a whale is struck due to the diligence of standard watch personnel and Lookouts stationed specifically to observe for marine mammals while a vessel is underway. In the unlikely event that a vessel strike of a marine mammal occurs, the Navy will notify the appropriate regulatory agency immediately or as soon as operational security considerations allow per the established incident reporting procedures described in Section 5.1.2.2.3 (Incident Reports). The Navy's incident reports include relevant information pertaining to the incident, including but not limited to vessel speed.

Table 5.3-11: Procedural Mitigation for Vessel Movement

Procedural Mitigation Description
Stressor or Activity • Vessel movement – The mitigation will not be applied if (1) the vessel's safety is threatened, (2) the vessel is restricted in its ability to maneuver (e.g., during launching and recovery of aircraft or landing craft, during towing activities, when mooring, during Transit Protection Program exercises or other events involving escort vessels), (3) the vessel is submerged or operated autonomously, or (4) when impractical based on mission requirements (e.g., during test body retrieval by range craft).
Resource Protection Focus • Marine mammals • Sea turtles
Number of Lookouts and Observation Platform • 1 Lookout on the vessel that is underway **Mitigation Requirements** • Mitigation zones: – 500 yd. around whales – 200 yd. (for surface ships) around other marine mammals (except bow-riding dolphins and pinnipeds hauled out man-made navigational structures, port structures, and vessels) – 100 yd. (for small boats, such as range craft) around other marine mammals (except bow-riding dolphins and pinnipeds hauled out man-made navigational structures, port structures, and vessels) – Within the vicinity of sea turtles • During the activity: – When underway, observe the mitigation zone for marine mammals and sea turtles; if observed, maneuver to maintain distance. • Additional requirements: – If a marine mammal or sea turtle vessel strike occurs, the Navy will follow the established incident reporting procedures.

The mitigation zones are smaller for marine mammal species such as pinnipeds to account for variations in mission requirements and activity locations (e.g., range craft operating in narrow channels where pinnipeds are consistently present in high densities). Similarly, a mitigation zone size is not specified for sea turtles to allow flexibility based on vessel type and mission requirements. The small mitigation zone sizes and proximity to the observation platform will result in a high likelihood that Lookouts will be able to detect marine mammals throughout the mitigation zones while vessels are underway. As discussed in Section K.3.3 (Mitigation Areas for Marine Species in NWTT Inland Waters), geographic mitigation for Small Boat Attack exercises, which involve high-speed Navy security force vessels, includes Navy biologists working with NMFS and Navy event planners to consider the likelihood of marine mammal presence as specific details of the event are planned (e.g., timing, location, duration), which will help the Navy further avoid or reduce potential impacts from vessel movements on marine mammals in NWTT Inland Waters.

As described in Section 5.1.2 (Vessel Safety) of the 2015 NWTT Final EIS/OEIS, Navy vessels are required to operate in accordance with applicable navigation rules. Applicable rules include the Inland Navigation Rules (33 Code of Federal Regulations 83) and International Regulations for Preventing Collisions at Sea (72 COLREGS), which were formalized in the Convention on the International Regulations for Preventing Collisions at Sea, 1972. These rules require that vessels proceed at a safe speed so proper and effective action can be taken to avoid collision and so vessels can be stopped within a distance appropriate to the prevailing circumstances and conditions. In addition to complying with navigation requirements, Navy ships transit at speeds that are optimal for fuel conservation, to maintain ship schedules, and to meet mission requirements. Vessel captains use the totality of the circumstances to ensure the vessel is traveling at appropriate speeds in accordance with navigation rules. Depending on the circumstances, this may involve adjusting speeds during periods of reduced visibility or in certain locations.

Navy vessel operators need to train to proficiently operate vessels as they would during military missions and combat operations, including being able to react to changing tactical situations and evaluate system capabilities. For example, during training activities involving flight operations from an aircraft carrier, the vessel must maintain a certain wind speed over the deck to launch or recover aircraft. Depending on wind conditions, the aircraft carrier itself must travel at a certain speed to generate the wind required to launch or recover aircraft. Implementing vessel speed restrictions would increase safety risks for Navy personnel and equipment and the public during the training event and would reduce skill proficiency in a way that would increase safety risks during military missions and combat operations. Furthermore, vessel speed restrictions would not allow the Navy to continue meeting its training requirements due to diminished realism of training exercises.

The Navy needs to test the full range of its vessel and system capabilities to ensure safety and functionality in conditions analogous to military missions and combat operations. For example, during non-explosive torpedo testing activities, the Navy must operate its vessels using speeds typical of military missions and combat operations to accurately test the functionality of its acoustic countermeasures and torpedo systems during firing. Vessel speed restrictions would not allow the Navy to continue meeting its testing program requirements due to diminished realism of testing events. Researchers, program managers, and weapons system acquisition programs would be unable to conduct accurate acoustic research to meet research objectives and effectively test vessels and vessel-deployed systems and platforms before full-scale production or delivery to the fleet. Such testing is required to ensure functionality and accuracy in military mission and combat conditions per required acquisition milestones or on an as-needed basis to meet operational requirements.

In summary, the operational community determined that implementing procedural mitigation for vessel movements beyond what is detailed in Table 5.3-11 would be incompatible with the practicality assessment criteria for safety, sustainability, and mission requirements.

5.3.4.2 Towed In-Water Devices

The Navy will continue to implement procedural mitigation to avoid or reduce the potential for strike of marine mammals and sea turtles from towed in-water devices, as outlined in Table 5.3-12. Vessels involved in towing in-water devices will implement the mitigation described in Section 5.3.4.1 (Vessel Movement), in addition to the mitigation outlined in Table 5.3-12.

The mitigation zones for towed in-water devices are a continuation from the 2015 NWTT Final EIS/OEIS based on the largest area within which it is practical for the Navy to implement mitigation. The Navy is clarifying in the table that the mitigation zones for training and testing activities will be the same under the Proposed Action. The small mitigation zone sizes and proximity to the observation platform will result in a high likelihood that Lookouts will be able to detect marine mammals throughout the mitigation zones. The mitigation zone for marine mammals is smaller for in-water devices that are towed by small boats to account for variations in mission requirements and activity locations (e.g., range craft operating in narrow channels). Similarly, a mitigation zone size is not specified for sea turtles to allow flexibility based on towing platform type and mission requirements.

Table 5.3-12: Procedural Mitigation for Towed In-Water Devices

Procedural Mitigation Description
Stressor or Activity • Towed in-water devices – Mitigation applies to devices towed from a manned surface platform or manned aircraft, or when a manned support craft is already participating in an activity involving in-water devices being towed by unmanned platforms – The mitigation will not be applied if the safety of the towing platform or in-water device is threatened
Resource Protection Focus • Marine mammals • Sea turtles
Number of Lookouts and Observation Platform • 1 Lookout positioned on the towing platform or support craft
Mitigation Requirements • Mitigation zones: – 250 yd. (for in-water devices towed by aircraft or surface ships) around marine mammals (except bow-riding dolphins and pinnipeds hauled out on man-made navigational structures, port structures, and vessels) – 100 yd. (for in-water devices towed by small boats, such as range craft) around marine mammals (except bow-riding dolphins and pinnipeds hauled out on man-made navigational structures, port structures, and vessels). – Within the vicinity of sea turtles • During the activity (i.e., when towing an in-water device) – Observe the mitigation zone for marine mammals and sea turtles; if observed, maneuver to maintain distance.

Mission and safety requirements determine the operational parameters (e.g., course, speed) for in-water device towing platforms. Towed-in water devices must be towed at certain speeds and water depths for stability, which are controlled in part by the towing platform's speed and directional movements. Because these devices are towed and not self-propelled, they generally have limited maneuverability and are not able to make immediate course corrections. For example, a high degree of pilot skill is required when rotary-wing aircraft are deploying in-water devices, safely towing them at relatively low speeds and altitudes, and recovering them. The aircraft can safely alter course to shift the route of the towed device in response to a sighted marine mammal or sea turtle up to a certain extent (i.e., up to the size of the mitigation zone) while still maintaining the parameters needed for stable towing. However, the aircraft would be unable to further alter its course to more drastically course-correct the towed device without decreasing towing stability, which would have implications for safety of personnel and equipment.

In summary, the operational community determined that implementing procedural mitigation for towed in-water devices beyond what is detailed in Table 5.3-12 would be incompatible with the practicality assessment criteria for safety.

5.3.4.3 Small-, Medium-, and Large-Caliber Non-Explosive Practice Munitions

The Navy will continue to implement procedural mitigation to avoid or reduce the potential for strike of marine mammals, sea turtles, and seabirds from small-, medium-, and large-caliber non-explosive practice munitions, as outlined in Table 5.3-13.

Table 5.3-13: Procedural Mitigation for Small-, Medium-, and Large-Caliber Non-Explosive Practice Munitions

Procedural Mitigation Description
Stressor or Activity • Gunnery activities using small-, medium-, and large-caliber non-explosive practice munitions – Mitigation applies to activities using a surface target
Resource Protection Focus • Marine mammals • Sea turtles • Seabirds (marbled murrelet and short-tailed albatross)
Number of Lookouts and Observation Platform • 1 Lookout positioned on the platform conducting the activity – Depending on the activity, the Lookout could be the same as the one described in Section 5.3.2.2 (Weapons Firing Noise)
Mitigation Requirements • Mitigation zone: – 200 yd. around the intended impact location • Prior to the initial start of the activity (e.g., when maneuvering on station): – Observe the mitigation zone for floating vegetation; if observed, relocate or delay the start until the mitigation zone is clear. – Observe the mitigation zone for marine mammals and sea turtles (small-, medium-, and large-caliber activities) and seabirds (small- and medium-caliber activities); if observed, relocate or delay the start of firing. • During the activity: – Observe the mitigation zone for marine mammals and sea turtles (small-, medium-, and large-caliber activities) and seabirds (small- and medium-caliber activities); if observed, cease firing. • Commencement/recommencement conditions after a marine mammal, sea turtle, or seabird sighting before or during the activity: – The Navy will allow a sighted marine mammal, sea turtle, or seabird to leave the mitigation zone prior to the initial start of the activity (by delaying the start) or during the activity (by not recommencing firing) until one of the following conditions has been met: (1) the animal is observed exiting the mitigation zone; (2) the animal is thought to have exited the mitigation zone based on a determination of its course, speed, and movement relative to the intended impact location; (3) the mitigation zone has been clear from any additional sightings for 10 min. for aircraft-based firing or 30 min. for vessel-based firing; or (4) for activities using a mobile target, the intended impact location has transited a distance equal to double that of the mitigation zone size beyond the location of the last sighting.

The mitigation zone is conservatively designed to be several times larger than the impact footprint for large-caliber non-explosive practice munitions, which are the largest projectiles used for these activities. Small-caliber and medium-caliber non-explosive practice munitions have smaller impact footprints than large-caliber non-explosive practice munitions; therefore, the mitigation zone will extend even further beyond the impact footprints for these smaller projectiles.

Large-caliber gunnery activities involve vessels firing projectiles at a target located up to 6 NM down range. Small- and medium-caliber gunnery activities involve vessels or aircraft firing projectiles at targets located up to 4,000 yd. down range, although typically much closer. Lookouts will have a better likelihood of detecting marine mammals and sea turtles when observing mitigation zones around targets located close to the firing platform. When observing activities that use a target located far from the firing platform, Lookouts will be more likely to detect large visual cues (e.g., whale blows or large pods of dolphins) than individual marine mammals, cryptic marine mammal species, and sea turtles.

Observing for indicators of marine mammal and sea turtle presence will further help avoid or reduce impacts on these resources within the mitigation zone. Positioning additional observers closer to the targets would increase safety risks because these platforms would be located in the vicinity of an intended impact location or in the path of a projectile.

Due to the difficulty of differentiating bird species, the Navy will implement mitigation for all seabird species during non-explosive small- and medium-caliber weapons firing. The mitigation will help the Navy further avoid or reduce potential impacts on ESA-listed marbled murrelets and short-tailed albatross and other seabird species that occur offshore. The Navy will not implement mitigation for seabirds during non-explosive large-caliber gunnery events because Lookouts would not be effective at detecting seabirds from the distant firing location, even with the use of high-powered binoculars.

5.3.4.4 Non-Explosive Missiles

The Navy will continue to implement procedural mitigation to avoid or reduce the potential for strike of marine mammals and sea turtles from non-explosive missiles, as outlined in Table 5.3-14. The mitigation zone for non-explosive missiles is conservatively designed to be several times larger than the impact footprint for the largest non-explosive missile used for these activities. Smaller non-explosive missiles have smaller impact footprints than the largest non-explosive missile used for these activities; therefore, the mitigation zone will extend even further beyond the impact footprints for these smaller projectiles. Mitigation applies to activities using non-explosive missiles fired from aircraft at targets that are typically located up to 15 NM down range, and infrequently up to 75 NM down range. There is a chance that animals could enter the mitigation zone after the aircraft conducts its close-range mitigation zone observations and before firing begins (once the aircraft has transited to its firing position). Due to the distance between the mitigation zone and the observation platform, Lookouts will have a better likelihood of detecting marine mammals and sea turtles during the close-range observations and are less likely to detect these resources once positioned at the firing location, particularly individual marine mammals, cryptic marine mammal species, and sea turtles. Observing for indicators of marine mammal and sea turtle presence will further help avoid or reduce potential impacts on these resources within the mitigation zone during the close-range observations. The mitigation only applies to aircraft-deployed missiles for the reasons discussed in Section 5.3.3.4 (Explosive Missiles). Positioning additional observers closer to the targets would increase safety risks because these platforms would be located in the vicinity of an intended impact location or in the path of a projectile.

Table 5.3-14: Procedural Mitigation for Non-Explosive Missiles

Procedural Mitigation Description
Stressor or Activity • Aircraft-deployed non-explosive missiles – Mitigation applies to activities using a surface target
Resource Protection Focus • Marine mammals • Sea turtles
Number of Lookouts and Observation Platform • 1 Lookout positioned in an aircraft
Mitigation Requirements • Mitigation zone: – 900 yd. around the intended impact location • Prior to the initial start of the activity (e.g., during a fly-over of the mitigation zone): – Observe the mitigation zone for floating vegetation; if observed, relocate or delay the start until the mitigation zone is clear. – Observe the mitigation zone for marine mammals and sea turtles; if observed, relocate or delay the start of firing. • During the activity: – Observe the mitigation zone for marine mammals and sea turtles; if observed, cease firing. • Commencement/recommencement conditions after a marine mammal or sea turtle sighting prior to or during the activity: – The Navy will allow a sighted marine mammal or sea turtle to leave the mitigation zone prior to the initial start of the activity (by delaying the start) or during the activity (by not recommencing firing) until one of the following conditions has been met: (1) the animal is observed exiting the mitigation zone; (2) the animal is thought to have exited the mitigation zone based on a determination of its course, speed, and movement relative to the intended impact location; or (3) the mitigation zone has been clear from any additional sightings for 10 min. when the activity involves aircraft that have fuel constraints, or 30 min. when the activity involves aircraft that are not typically fuel constrained.

5.3.4.5 Non-Explosive Bombs and Mine Shapes

The Navy will continue to implement procedural mitigation to avoid or reduce the potential for strike of marine mammals and sea turtles from non-explosive bombs and mine shapes, as outlined in Table 5.3-15. The mitigation zone for non-explosive bombs and mine shapes is conservatively designed to be several times larger than the impact footprint for the largest non-explosive bomb used for these activities. Smaller non-explosive bombs and mine shapes have smaller impact footprints than the largest non-explosive bomb used for these activities; therefore, the mitigation zone will extend even further beyond the impact footprints for these smaller military expended materials. Activities involving non-explosive bombing and mine laying involve aircraft deploying munitions or mine shapes from a relatively steady altitude of approximately 1,500 ft. at a surface target or in an intended minefield located beneath the aircraft. Due to the mitigation zone size, proximity to the observation platform, and the good vantage point from an aircraft, Lookouts will be able to observe the entire mitigation zone during approach of the target or intended minefield location. Observing for indicators of marine mammal and sea turtle presence will further help avoid or reduce impacts on these resources within the mitigation zone.

Table 5.3-15: Procedural Mitigation for Non-Explosive Bombs and Mine Shapes

Procedural Mitigation Description
Stressor or Activity • Non-explosive bombs • Non-explosive mine shapes during mine laying activities
Resource Protection Focus • Marine mammals • Sea turtles
Number of Lookouts and Observation Platform • 1 Lookout positioned in an aircraft
Mitigation Requirements • Mitigation zone: – 1,000 yd. around the intended target • Prior to the initial start of the activity (e.g., when arriving on station): – Observe the mitigation zone for floating vegetation; if observed, relocate or delay the start until the mitigation zone is clear. – Observe the mitigation zone for marine mammals and sea turtles; if observed, relocate or delay the start of bomb deployment or mine laying. • During the activity (e.g., during approach of the target or intended minefield location): – Observe the mitigation zone for marine mammals and sea turtles; if observed, cease bomb deployment or mine laying. • Commencement/recommencement conditions after a marine mammal or sea turtle sighting prior to or during the activity: – The Navy will allow a sighted marine mammal or sea turtle to leave the mitigation zone prior to the initial start of the activity (by delaying the start) or during the activity (by not recommencing bomb deployment or mine laying) until one of the following conditions has been met: (1) the animal is observed exiting the mitigation zone; (2) the animal is thought to have exited the mitigation zone based on a determination of its course, speed, and movement relative to the intended target or minefield location; (3) the mitigation zone has been clear from any additional sightings for 10 min.; or (4) for activities using mobile targets, the intended target has transited a distance equal to double that of the mitigation zone size beyond the location of the last sighting.

5.4 Mitigation Areas to be Implemented

As a result of the Navy's biological effectiveness and operational assessments, the Navy developed mitigation areas in the NWTT Offshore Area and NWTT Inland Waters, as summarized in the sections below. Additional details, including the complete biological effectiveness and operational assessments for each area, are provided in Appendix K (Geographic Mitigation Assessment).

5.4.1 Mitigation Areas for Seafloor Resources

The seafloor resource mitigation is a continuation from the 2015 NWTT Final EIS/OEIS. As outlined in Table 5.4-1, the Navy will implement mitigation to avoid or reduce potential impacts from explosives and physical disturbance and strike stressors on submerged cultural resources (i.e., shipwrecks), sensitive seafloor resources, and any biological resources that inhabit, shelter, rest, feed, or occur in the mitigation areas. Figure 5.4-1 shows the relevant seafloor resources and the Navy training or testing locations that overlap them. The Navy developed mitigation areas as either the anchor swing circle diameter or a 350 yd. radius around a seafloor resource, as indicated by the best available georeferenced data. Without this mitigation, explosives and physical disturbance and strike stressors could potentially impact these resources during certain training and testing activities in the Study Area.

The mitigation areas are particularly important to one or more resources for a biologically important ecological function (i.e., live hard bottom habitat and artificial reefs that provide critical ecosystem functions). Seafloor resources fulfill important ecosystem functions. Live hard bottom habitats and artificial structures (e.g., artificial reefs, shipwrecks) provide attachment substrate for aquatic vegetation and invertebrates, such as corals, seaweed, seagrass, macroalgae, and sponges. These habitats in turn support a community of organisms, such as fish, shrimp, crabs, barnacles, worms, and sea cucumbers. Dive sites occur throughout nearshore areas of the Study Area where there are shipwrecks and artificial reefs, making these resources highly valuable from a socioeconomic standpoint. Similarly, submerged aquatic vegetation attached to live hardbottom or artificial reefs provides important habitat for commercially and recreationally important fish species. Historic shipwrecks are classified as archaeological resources and are an important part of maritime history.

Table 5.4-1: Seafloor Resource Mitigation Areas in the NWTT Study Area

Mitigation Area Description
Stressor or Activity • Explosives • Physical disturbance and strikes
Resource Protection Focus • Live hard bottom • Artificial reefs • Shipwrecks
Mitigation Requirements • Seafloor Resource Mitigation Areas (year-round) – Within the anchor swing circle of live hard bottom, artificial reefs, and shipwrecks, the Navy will not conduct precision anchoring (except in designated areas). – Within a 350 yd. radius of live hard bottom, artificial reefs, and shipwrecks, the Navy will not conduct explosive mine countermeasure and neutralization activities or explosive mine neutralization activities involving Navy divers (except in designated locations), and the Navy will not place mine shapes, anchors, or mooring devices on the seafloor (except in designated areas).

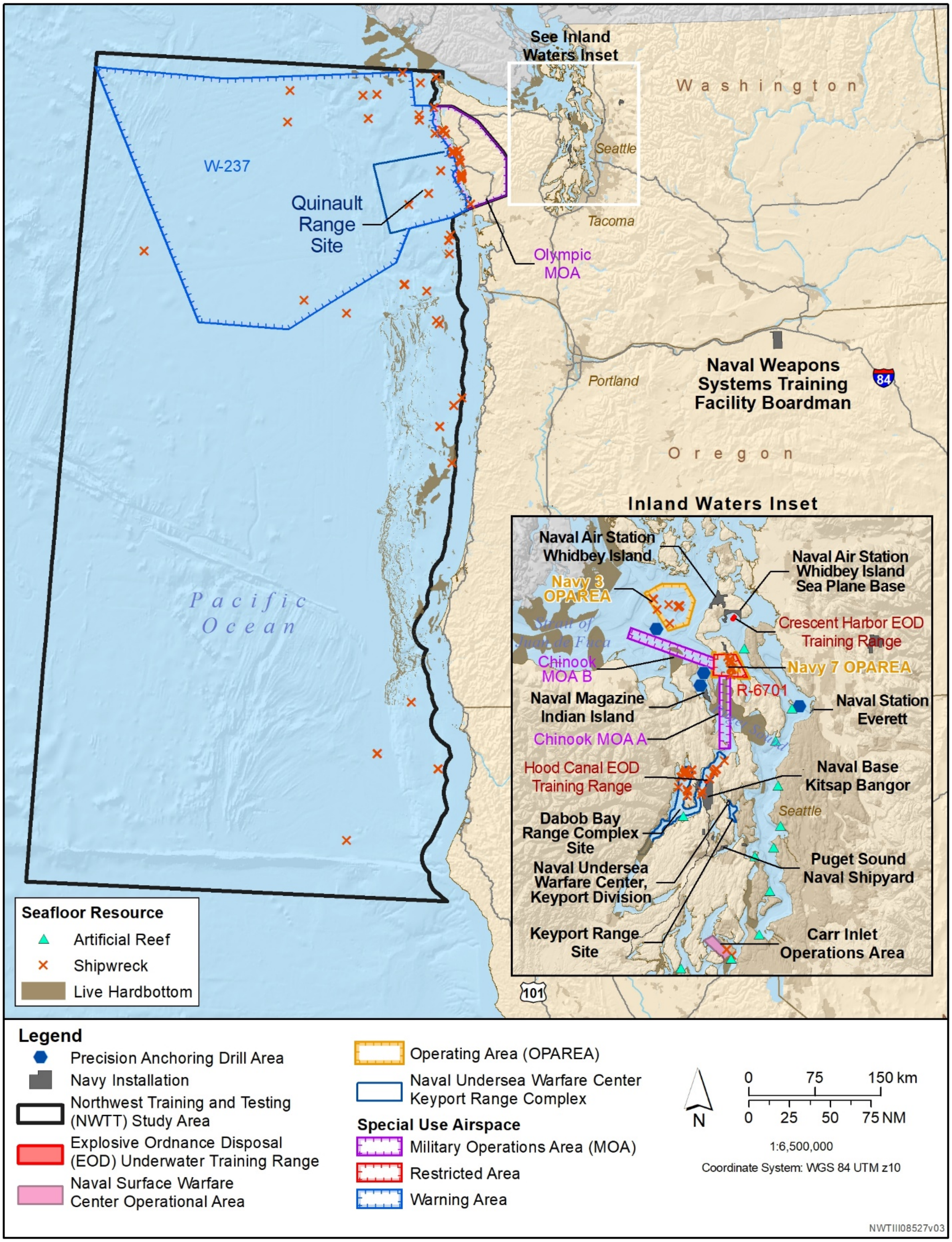

Figure 5.4-1: Seafloor Resource Mitigation Areas in the NWTT Study Area

5.4.2 Mitigation Areas for Marine Species in the Northwest Training and Testing Offshore Area

As described in Table 5.4-2 and shown in Figure 5.4-2, the Navy developed mitigation areas in the NWTT Offshore Area to avoid or reduce potential impacts on marine mammals, sea turtles, ESA-listed fish, and marbled murrelets. The Navy developed these mitigation areas to help avoid or reduce potential impacts from active sonar, explosives, and physical disturbance and strike in areas that the best available science suggests are particularly important to one or more of the following species for a biologically important life process (e.g., foraging, migration, reproduction):

- Humpback whale
- Gray whale
- Southern Resident killer whale
- Leatherback sea turtle
- Bull trout
- Steelhead
- Chinook salmon
- Coho salmon
- Chum salmon
- Sockeye salmon
- Green sturgeon
- Marbled murrelet

Implementing additional geographic mitigation in the NWTT Offshore Area beyond what is described in Table 5.4-2 would be impractical due to implications for safety, sustainability, and the Navy's ability to continue meeting its mission requirements for the reasons described in Appendix K (Geographic Mitigation Assessment).

Table 5.4-2: Marine Species Mitigation Areas in the NWTT Offshore Area

Mitigation Area Description
Stressor or Activity • Sonar (mitigation does not apply to active sonar sources used for safety of navigation) • Explosives • Physical disturbance and strikes
Resource Protection Focus • Marine mammals (humpback whale, gray whale, Southern Resident killer whale, harbor porpoise) • Sea turtles (leatherback sea turtle) • Seabirds (marbled murrelet) • Fish (bull trout, steelhead, Chinook salmon, coho salmon, chum salmon, sockeye salmon, green sturgeon)
Mitigation Requirements[1] • **Marine Species Coastal Mitigation Area (year-round or seasonal if specified)** – Within 50 NM from shore in the Marine Species Coastal Mitigation Area: ▪ The Navy will not conduct explosive training activities. ▪ The Navy will not conduct explosive testing activities (except explosive Mine Countermeasure and Neutralization Testing). ▪ The Navy will not conduct non-explosive missile training activities. ▪ The Navy will issue annual seasonal awareness notification messages to alert ships and aircraft to the possible presence of increased concentrations of Southern Resident killer whales from December 1 to June 30, humpback whales from May 1 through December 31, and gray whales from May 1 to November 30. For safe navigation and to avoid interactions with large whales, the Navy will instruct vessels to remain vigilant to the presence of Southern Resident killer whales, humpback whales, and gray whales that may be vulnerable to vessel strikes or potential impacts from training and testing activities. Platforms will use the information from the awareness notification messages to assist their visual observation of applicable mitigation zones during training and testing activities and to aid in the implementation of procedural mitigation. – Within 20 NM from shore in the Marine Species Coastal Mitigation Area: ▪ The Navy will conduct a maximum combined total of 33 hours of surface ship hull-mounted MF1 mid-frequency active sonar during testing annually within 20 NM from shore in the Marine Species Coastal Mitigation Area, the Juan de Fuca Eddy Marine Species Mitigation Area, and the Olympic Coast National Marine Sanctuary Mitigation Area. ▪ To the maximum extent practical, the Navy will conduct explosive Mine Countermeasure and Neutralization Testing from July 1 through September 30 when operating within 20 NM from shore. ▪ From October 1 through June 30, the Navy will conduct a maximum of one explosive Mine Countermeasure and Neutralization Testing event, not to exceed the use of 20 explosives from bin E4 and 3 explosives from bin E7 annually, and not to exceed the use of 60 explosives from bin E4 and 9 explosives from bin E7 over 7 years. ▪ The Navy will not conduct non-explosive large-caliber gunnery training activities. ▪ The Navy will not conduct non-explosive bombing training activities. – Within 12 NM from shore in the Marine Species Coastal Mitigation Area: ▪ The Navy will not conduct Anti-Submarine Warfare Tracking Exercise – Helicopter, – Maritime Patrol Aircraft, – Ship, or – Submarine training activities (which involve the use of mid-frequency or high-frequency active sonar). ▪ The Navy will not conduct non-explosive Anti-Submarine Warfare Torpedo Exercise – Submarine training activities (which involve the use of mid-frequency or high-frequency active sonar). ▪ The Navy will conduct a maximum of one Unmanned Underwater Vehicle Training event within 12 NM from shore at the Quinault Range Site. Unmanned Underwater Vehicle Training events within 12 NM from shore at the Quinault Range Site will be cancelled or moved to another training location if Southern Resident killer whales are detected at the planned training location during the event planning process, or immediately prior to the event, as applicable. ▪ During explosive Mine Countermeasure and Neutralization Testing, the Navy will not use explosives in bin E7 closer than 6 NM from shore in the Quinault Range Site. ▪ The Navy will not conduct non-explosive small- and medium-caliber gunnery training activities.

Table 5.4-2: Marine Species Mitigation Areas in the NWTT Offshore Area (continued)

Mitigation Area Description
• **Olympic Coast National Marine Sanctuary Mitigation Area (year-round)** – Within the Olympic Coast National Marine Sanctuary Mitigation Area: ▪ The Navy will conduct a maximum of 32 hours of surface ship hull-mounted MF1 mid-frequency active sonar during training annually. ▪ The Navy will conduct a maximum combined total of 33 hours of surface ship hull-mounted MF1 mid-frequency active sonar during testing annually within 20 NM from shore in the Marine Species Coastal Mitigation Area, the Juan de Fuca Eddy Marine Species Mitigation Area, and the Olympic Coast National Marine Sanctuary Mitigation Area. ▪ The Navy will not conduct explosive Mine Countermeasure and Neutralization Testing activities. ▪ The Navy will not conduct non-explosive bombing training activities. • **Juan de Fuca Eddy Marine Species Mitigation Area (year-round)** – Within the Juan de Fuca Eddy Marine Species Mitigation Area: ▪ The Navy will conduct a maximum combined total of 33 hours of surface ship hull-mounted MF1 mid-frequency active sonar during testing annually within 20 NM from shore in the Marine Species Coastal Mitigation Area, the Juan de Fuca Eddy Marine Species Mitigation Area, and the Olympic Coast National Marine Sanctuary Mitigation Area. ▪ The Navy will not conduct explosive Mine Countermeasure and Neutralization Testing activities. • **Stonewall and Heceta Bank Humpback Whale Mitigation Area (May 1–November 30)** – Within the Stonewall and Heceta Bank Humpback Whale Mitigation Area from May 1 to November 30: ▪ The Navy will not use surface ship hull-mounted MF1 mid-frequency active sonar during training or testing. ▪ The Navy will not conduct explosive Mine Countermeasure and Neutralization Testing. • **Point St. George Humpback Whale Mitigation Area (July 1–November 30)** – Within the Point St. George Humpback Whale Mitigation Area from July 1 to November 30: ▪ The Navy will not use surface ship hull-mounted MF1 mid-frequency active sonar during training or testing. ▪ The Navy will not conduct explosive Mine Countermeasure and Neutralization Testing.

[1] Should national security present a requirement to conduct training or testing prohibited by the mitigation requirements specified in this table, naval units will obtain permission from the appropriate designated Command authority prior to commencement of the activity. The Navy will provide NMFS with advance notification and include relevant information about the event (e.g., sonar hours, explosives use, non-explosive practice munitions use) in its annual activity reports to NMFS.

5.4.3 Mitigation Areas for Marine Species in NWTT Inland Waters

As described in Table 5.4-3 and shown in Figure 5.4-2, the Navy developed mitigation areas in NWTT Inland Waters to avoid or reduce potential impacts on marine mammals, ESA-listed fish, and marbled murrelets. The Navy developed these mitigation areas to help avoid or reduce potential impacts from active sonar, explosives, and physical disturbance and strike in areas that the best available science suggests are particularly important to one or more of the following species for a biologically important life process (e.g., foraging, migration, reproduction):

- Gray whale
- Southern Resident killer whale
- Bull trout
- Puget Sound Chinook salmon
- Hood Canal summer-run chum salmon
- Green sturgeon
- Rockfish
- Marbled murrelet

Implementing additional geographic mitigation in NWTT Inland Waters beyond what is described in Table 5.4-3 would be impractical due to implications for safety, sustainability, and the Navy's ability to continue meeting its mission requirements for the reasons described in Appendix K (Geographic Mitigation Assessment).

Table 5.4-3: Marine Species Mitigation Areas in NWTT Inland Waters

Mitigation Area Description
Stressor or Activity • Sonar (mitigation does not apply to active sonar sources used for safety of navigation) • Explosives • Physical disturbance and strikes
Resource Protection Focus • Marine mammals (gray whale, Southern Resident killer whale) • Seabirds (marbled murrelet) • Fish (bull trout, Puget Sound Chinook salmon, Hood Canal summer-run chum salmon, green sturgeon, rockfish)
Mitigation Requirements[1] • **Northern Puget Sound Gray Whale Mitigation Area (March 1–May 31)** – Within the Northern Puget Sound Gray Whale Mitigation Area from March 1 to May 31: ▪ The Navy will not conduct Civilian Port Defense – Homeland Security Anti-Terrorism/Force Protection Exercises. • **Puget Sound and Strait of Juan de Fuca Mitigation Area (year-round or seasonal if specified)** – Within the Puget Sound and Strait of Juan de Fuca Mitigation Area: ▪ The Navy will not use low-frequency, mid-frequency, or high-frequency active sonar during training or testing within the Puget Sound and Strait of Juan de Fuca Mitigation Area, unless a required element necessitates that the activity be conducted in NWTT Inland Waters during (1) Unmanned Underwater Vehicle Training, (2) Civilian Port Defense – Homeland Security Anti-Terrorism/Force Protection Exercises, (3) activities conducted by Naval Sea Systems Command at designated locations, and (4) pierside sonar maintenance or testing at designated locations. ▪ The Navy will use the lowest active sonar source levels practical to successfully accomplish each event. ▪ Naval units will obtain permission from the appropriate designated Command authority prior to commencing pierside maintenance or testing with hull-mounted mid-frequency active sonar. ▪ The Navy will conduct a maximum of one Unmanned Underwater Vehicle Training activity annually at the NAVY 3 OPAREA, NAVY 7 OPAREA, and Manchester Fuel Depot (i.e., a maximum of one event at each location). ▪ The Navy will not use explosives during testing. ▪ The Navy will not use explosives during training except at the Hood Canal EOD Range and Crescent Harbor EOD Range during explosive mine neutralization activities involving the use of Navy divers. ▪ The Navy will not use explosives in bin E4 (>2.5–5 lb. net explosive weight) or above, and will instead use explosives in bin E0 (< 0.1 lb. net explosive weight) or bin E3 (> 0.5–2.5 lb. net explosive weight). ▪ During February, March, and April at the Hood Canal EOD Range, the Navy will not use explosives in bin E3 (> 0.5–2.5 lb. net explosive weight) and will instead use explosives in bin E0 (< 0.1 lb. net explosive weight). ▪ During August, September, and October at the Hood Canal EOD Range, the Navy will avoid using explosives in bin E3 (> 0.5–2.5 lb. net explosive weight) and will instead use explosives in bin E0 (< 0.1 lb. net explosive weight) to the maximum extent practical unless necessitated by mission requirements. ▪ At the Crescent Harbor EOD Range, the Navy will conduct explosive activities at least 1,000 m from the closest point of land. ▪ The Navy will not conduct non-explosive live fire events in the mitigation area (except firing blank weapons), including gunnery exercises, missile exercises, torpedo exercises, bombing exercises, and Kinetic Energy Weapon Testing.

Table 5.4-3: Marine Species Mitigation Areas in NWTT Inland Water (continued)

Mitigation Area Description
▪ Navy event planners will coordinate with Navy biologists during the event planning process prior to conducting (1) Unmanned Underwater Vehicle Training at the NAVY 3 OPAREA, Manchester Fuel Depot, Crescent Harbor Explosive Ordnance Disposal Range, and NAVY 7 OPAREA (for Southern Resident killer whales); (2) Civilian Port Defense – Homeland Security Anti-Terrorism/Force Protection Exercises (for Southern Resident killer whales and gray whales); (3) explosive mine neutralization activities involving the use of Navy divers (for Southern Resident killer whales); and (4) Small Boat Attack Exercises, which involve firing blank small-caliber weapons (for Southern Resident killer whales and gray whales). Navy biologists will work with NMFS and will initiate communication with the appropriate marine mammal detection networks to determine the likelihood of applicable marine mammal species presence in the planned training location. Navy biologists will notify event planners of the likelihood of species presence. To the maximum extent practical, Navy planners will use this information when planning specific details of the event (e.g., timing, location, duration) to avoid planning activities in locations or seasons where species presence is expected. The Navy will ensure environmental awareness of event participants. Environmental awareness will help alert participating crews to the possible presence of applicable species in the training location. Lookouts will use the information to assist visual observation of applicable mitigation zones and to aid in the implementation of procedural mitigation. Unmanned Underwater Vehicle Training events at the NAVY 3 OPAREA, Manchester Fuel Depot, Crescent Harbor Explosive Ordnance Disposal Range, and NAVY 7 OPAREA will be cancelled or moved to another training location if the presence of Southern Resident killer whales is reported through available monitoring networks during the event planning process, or immediately prior to the event, as applicable. ▪ The Navy will issue annual seasonal awareness notification messages to alert ships and aircraft operating within the Puget Sound and Strait of Juan de Fuca Mitigation Area to the possible presence of concentrations of Southern Resident killer whales from July 1 to November 30 in the Puget Sound and Strait of Juan de Fuca, and concentrations of gray whales from March 1 to May 31 in the Strait of Juan de Fuca and northern Puget Sound. For safe navigation and to avoid interactions with large whales, the Navy will instruct vessels to remain vigilant to the presence of Southern Resident killer whales and gray whales that may be vulnerable to vessel strikes or potential impacts from training and testing activities. Platforms will use the information from the awareness notification messages to assist their visual observation of applicable mitigation zones during training and testing activities and to aid in the implementation of procedural mitigation.

[1] Should national security present a requirement to conduct training or testing prohibited by the mitigation requirements specified in this table, naval units will obtain permission from the appropriate designated Command authority prior to commencement of the activity. The Navy will provide NMFS with advance notification and include relevant information about the event (e.g., sonar hours, explosives use, non-explosive practice munitions use) in its annual activity reports to NMFS.

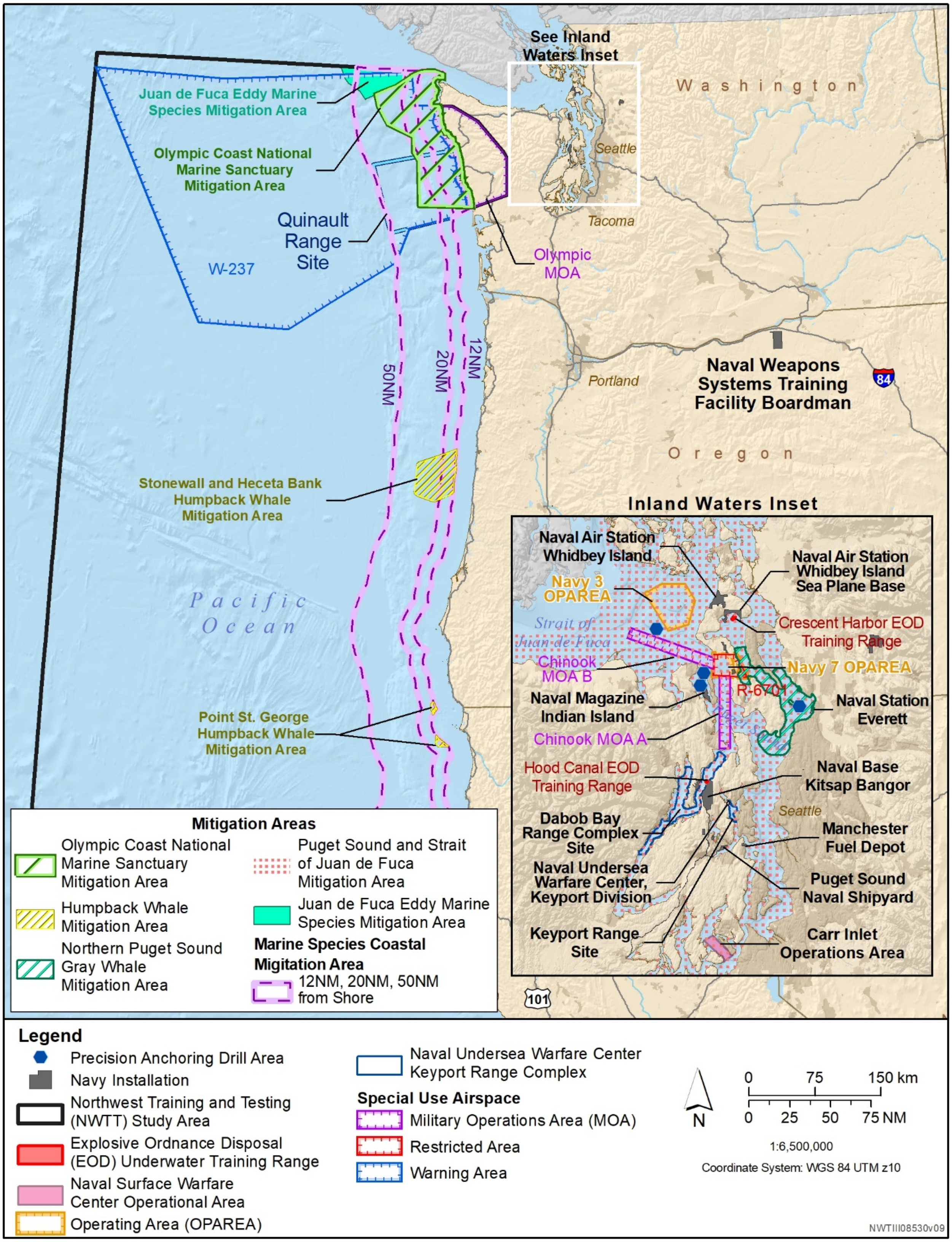

Figure 5.4-2: Marine Species Mitigation Areas in the NWTT Study Area

5.5 Measures Considered but Eliminated

As described in Section 5.2 (Mitigation Development Process), the Navy conducted a detailed review and assessment of each potential mitigation measure individually and then all potential mitigation measures collectively to determine if, as a whole, the mitigation will be effective at avoiding or reducing potential impacts and practical to implement. The assessment included consideration of mitigation recommendations received through scoping and public comments received on the 2019 NWTT Draft Supplemental EIS/OIS for this Proposed Action, during the ESA and MMPA consultation processes, and through public comments and consultations on past environmental compliance documents applicable to the Study Area. The operational community determined that implementing procedural mitigation beyond what is detailed in Section 5.3 (Procedural Mitigation to be Implemented) and Section 5.4 (Mitigation Areas to be Implemented) would be incompatible with the practicality assessment criteria for safety, sustainability, and mission requirements. Information about why implementing additional mitigation measures for active sonar, explosives, active and passive acoustic monitoring devices, thermal detection systems, third-party observers, foreign navy mitigation, and reporting requirements would be impractical is provided in the sections below and in Appendix K (Geographic Mitigation Assessment).

When analyzing all potential mitigation measures collectively, the operational community determined that adopting certain mitigation measures, such as limiting active sonar to only be conducted beyond certain distances from shore, would result in the unacceptable limitation of the Navy's utilization of sea space and airspace required to effectively support training and testing of naval forces in the Study Area. Certain measures would restrict or prohibit Navy training and testing throughout most of the Study Area except in very narrow circumstances. For example, blanket limitations or restrictions on the level, number, or timing (seasonal or time of day) of training and testing activities within discrete or broad-scale areas of water (e.g., within NWTT Inland Waters or within a certain distance from shore in the NWTT Offshore Area), or other areas vital to mission requirements would prevent the Navy from accessing its ranges, operating areas, facilities, or range support structures necessary to meet the purpose and need of the Proposed Action. As described in Section 5.2.3 (Practicality of Implementation), the Navy requires extensive sea space so that individual training and testing activities can occur at sufficient distances such that these activities do not interfere with one another, and so that Navy units can train to communicate and operate in a coordinated fashion over tens or hundreds of square miles, as required during military missions and combat operations. The Navy also needs to maintain access to sea space with the unique, challenging, and diverse environmental and oceanographic features (e.g., bathymetry, topography, surface fronts, and variations in sea surface temperature) analogous to military mission and combat conditions to achieve the highest skill proficiency and most accurate testing results possible.

Threats to national security are constantly evolving. The Navy requires the ability to adapt training and testing to meet these emerging threats. Restricting access to broad-scale areas of water would impact the ability for Navy training and testing to evolve as threats evolve. Eliminating opportunities for the Navy to train and test in a myriad of at-sea conditions would put U.S. forces at a tactical disadvantage during military missions and combat operations. This would also present a risk to national security if potential adversaries were to be alerted to the environmental conditions within which the U.S. Navy is prohibited from training and testing. Restricting large areas of ocean or other smaller areas that are critical to Navy training and testing would make training and concealment much more difficult and would adversely impact the Navy's ability to perform its statutory mission.

5.5.1 Active Sonar

When assessing and developing mitigation, the Navy considered reducing active sonar training and testing hours, modifying active sonar sound sources, implementing time-of-day restrictions and restrictions during surface ducting conditions, replacing active sonar training and testing with synthetic activities (e.g., computer simulated training), and implementing active sonar ramp-up procedures. The Navy determined that it would be practical to implement certain restrictions on the use of active sonar in the Study Area, as detailed in Section 5.3.2.1 (Active Sonar) and Appendix K (Geographic Mitigation Assessment). As discussed in Chapter 2 (Description of Proposed Action and Alternatives), Section 5.2.3 (Practicality of Implementation), Appendix A (Navy Activities Descriptions), and Appendix K (Geographic Mitigation Assessment), training and testing activities are planned and scheduled based on numerous factors and data inputs, such as compliance with the Optimized Fleet Response Plan. Information on why training and testing with active sonar is essential to national security is presented in Section 5.3.2.1 (Active Sonar). The Navy uses active sonar during military readiness activities only when it is essential to training missions or testing program requirements since active sonar has the potential to alert opposing forces to the operating platform's presence. Passive sonar and other available sensors are used in concert with active sonar to the maximum extent practicable.

The Navy currently uses, and will continue to use, computer simulation to augment training and testing whenever possible. As discussed in Section 1.4.1 (Why the Navy Trains), simulators and synthetic training are critical elements that provide early skill repetition and enhance teamwork; however, they cannot replicate the complexity and stresses faced by Sailors during military missions and combat operations to which the Navy trains under the Proposed Action (e.g., anti-submarine warfare training using hull-mounted mid-frequency active sonar). Just as a pilot would not be ready to fly solo after simulator training, operational Commanders cannot allow military personnel to engage in military missions and combat operations based merely on simulator training. Similarly, in testing a system that is being developed, simulation can be used during the initial stages of development, but ultimately the system must be tested under conditions analogous to those faced during military missions and combat operations. Systems that have undergone maintenance need to be tested, and not simulated, to ensure that the system is operating correctly.

Sonar operators must train to effectively handle bottom bounce and sound passing through changing currents, eddies, and across changes in ocean temperature, pressure, salinity, depth, and in surface ducting conditions. Sonar systems must be tested in conditions analogous to where the Navy trains and operates to ensure functionality and accuracy in military mission and combat conditions. Although the majority of sonar use occurs during the day, the Navy has a nighttime training and testing requirement for some active sonar systems, and a requirement to test in a variety of locations and environmental conditions depending on the testing program objectives. Training and testing in both good visibility (e.g., daylight, favorable weather conditions) and low visibility (e.g., nighttime, inclement weather conditions) is vital because environmental differences between day and night and varying weather conditions affect sound propagation and the detection capabilities of sonar. Temperature layers that move up and down in the water column and ambient noise levels can vary significantly between night and day. This affects sound propagation and could affect how sonar systems function and are operated.

Submarines may hide in the higher ambient noise levels of shallow coastal waters and surface ducts. Surface ducting occurs when water conditions, such as temperature layers and lack of wave action, result in little sound energy penetrating beyond a narrow layer near the surface of the water. Avoiding surface ducting conditions would be impractical because ocean conditions contributing to surface ducting change frequently, and surface ducts can be of varying duration. Surface ducting can also lack uniformity and may or may not extend over a large geographic area, making it difficult to determine where to reduce power and for what periods. Submarines have long been known to take advantage of the phenomena associated with surface ducting to avoid being detected by sonar. When surface ducting occurs, active sonar becomes more useful near the surface but less useful at greater depths. As noted by the U.S. Supreme Court in *Winter v. Natural Resources Defense Council Inc.*, 555 U.S. 7 (2008), because surface ducting conditions occur relatively rarely and are unpredictable, it is especially important for the Navy to be able to train under these conditions when they occur. Training with active sonar in these conditions is a critical component of military readiness because sonar operators need to learn how sonar transmissions are altered due to surface ducting, how submarines may take advantage of them, and how to operate sonar effectively under these conditions. Reducing power, shutting down active sonar based on environmental conditions, or implementing other sonar modification techniques (e.g., sound shielding) as a mitigation would affect a Commander's ability to develop the tactical picture. It would also prevent sonar operators from training in conditions analogous to those faced during military missions and combat operations, such as during periods of low visibility.

The Navy explicitly designs its active sonar signals to provide optimum performance at detecting underwater objects (e.g., submarines) in a variety of acoustic environments. The Navy assessed the potential for implementing active sonar signal modification as mitigation. At this time, the science on the differences in potential impacts of up or down sweeps of the sonar signal (e.g., different behavioral reactions) is extremely limited and requires further development. For example, Kastelein et al. (2012) researched the behavioral responses of a single captive harbor porpoise to varying sonar signals. Although this very limited data set suggests up or down sweeps of the sonar signal may result in different reactions by harbor porpoises in certain circumstances, this science requires further development (e.g., to determine potential reactions by other individual harbor porpoises and other marine mammal species). If future studies indicate that modifying active sonar signals (i.e., up or down sweeps) could be an effective mitigation approach, then the Navy will investigate if and how the mitigation would affect the sonar's performance. As described throughout this chapter, mitigation must meet the appropriate balance between being effective and practical to implement.

Active sonar equipment power levels are set consistent with mission requirements. Active sonar ramp-up procedures are used during seismic surveys and some foreign navy sonar activities. Ramping up involves slowly increasing sound levels over a certain length of time until the optimal source level is reached. The intent of ramping up a sound source is to alert marine mammals with a low sound level to deter them from the area and avoid higher levels of sound exposure. The best available science does not suggest that ramp-up would be an effective mitigation tool for U.S. Navy active sonar training and testing activities under the Proposed Action. Wensveen et al. (2017) found that active sonar ramp-up was not an effective method for reducing impacts on humpback whales because most whales did not display strong behavioral avoidance to the sonar signals. The study suggested that sonar ramp-up could potentially be more effective for other more behaviorally responsive species but would likely also depend on the context of exposure. For example, ramp-up would be less effective if animals have a strong motivation not to move away from their current location, such as when foraging. Dunlop et al. (2016) and von Benda-Beckmann et al. (2014) found that implementing ramp-up as a mitigation may be effective for some activities in some situations. Additionally, von Benda-Beckmann et al. (2014) found that the main factors limiting ramp-up effectiveness for a typical anti-submarine warfare activity are a high source level, a moving sonar source, and long silences between consecutive sonar transmissions.

Based on the source levels, vessel speeds, and sonar transmission intervals that will be used during typical active sonar activities under the Proposed Action, the Navy has determined that ramp-up would be an ineffective mitigation measure for the active sonar activities analyzed in this Final Supplemental EIS/OEIS.

Implementing active sonar ramp-up procedures during training or testing under the Proposed Action would not be representative of military mission and combat conditions and would significantly impact training and testing realism. For example, during an anti-submarine warfare exercise using active sonar, ramp-ups have the potential to alert opponents (e.g., target submarines) to the transmitting vessel's presence. This would defeat the purpose of the training by allowing the target submarine to detect the searching unit and take evasive measures, thereby denying the sonar operator the opportunity to learn how to locate the submarine. Similarly, testing program requirements determine test parameters to accurately determine whether a system is meeting its operational and performance requirements; therefore, implementing ramp-up during testing activities would impede the Navy's ability to collect essential data for evaluation of a system's capabilities.

Reducing realism in training impedes the ability for Navy Sailors to train and become proficient in using active sonar, erodes capabilities, and reduces perishable skills. These impacts would result in a significant risk to personnel safety during military missions and combat operations and would prevent units from meeting their individual training and certification requirements. Therefore, implementing additional mitigation that would reduce training realism would ultimately prevent units from deploying with the required level of readiness necessary to accomplish their missions and impede the Navy's ability to certify forces to deploy to meet national security tasking. Reducing realism in testing would impact the ability of researchers, program managers, and weapons system acquisition programs to conduct accurate acoustic research and effectively test systems and platforms (and components of these systems and platforms) before full-scale production or delivery to the fleet. These tests are required to ensure functionality and accuracy in military mission and combat conditions per required acquisition milestones or on an as-needed basis to meet operational requirements.

5.5.2 Explosives

When assessing and developing mitigation, the Navy considered reducing the number and size of explosives and limiting the locations and time of day of explosive training and testing in the Study Area. The Navy determined that it would be practical to implement certain restrictions on the use of explosives in the Study Area, as detailed in Section 5.3.3 (Explosive Stressors) and Appendix K (Geographic Mitigation Assessment). As discussed in Chapter 2 (Description of Proposed Action and Alternatives), Section 5.2.3 (Practicality of Implementation), Appendix A (Navy Activities Descriptions), and Appendix K (Geographic Mitigation Assessment), the locations and timing of the training and testing activities that use explosives vary throughout the Study Area based on range scheduling, mission requirements, testing program requirements, and standard operating procedures for safety and mission success.

Activities that involve explosive ordnance are inherently different from those that involve non-explosive practice munitions. For example, critical components of an explosive Bombing Exercise Air-to-Surface include the assembly, loading, delivery, and assessment of the explosive bomb. The explosive bombing training exercise starts with ground personnel, who must practice the building and loading of explosive munitions. Training includes the safe handling of explosive material, configuring munitions to precise specifications, and the loading of munitions onto aircraft. Aircrew must then identify a target and safely deliver fused munitions, discern if the bomb was assembled correctly, and determine bomb damage assessments based on how and where the explosive detonated. An air-to-surface bombing exercise using non-explosive practice munitions can train aircrews on valuable skills to locate and accurately deliver munitions on a target; however, it cannot effectively replicate the critical components of an explosive activity in terms of assembly, loading, delivery, and assessment of an explosive bomb. Reducing the number and size of explosives or diminishing activity realism by implementing time of day or geographic restrictions for additional explosive training activities would impede the ability for Navy Sailors to train and become proficient in using explosive weapons systems (which would result in a significant risk to personnel safety during military missions and combat operations), and would ultimately prevent units from meeting their individual training and certification requirements (which would prevent them from deploying with the required level of readiness necessary to accomplish their missions) and impede the Navy's ability to certify forces to deploy to meet national security tasking.

Similar to training, the Navy is required to test its explosives to quantify the compatibility of weapons with the platform from which they will be launched or released in military missions and combat operations. Such testing requires the use of the actual explosive ordnance that will be used during training exercises, military missions, and combat operations. Reducing the number and size of explosives or diminishing activity realism by implementing time of day or geographic restrictions for additional explosive testing events would impact the ability of researchers, program managers, and weapons system acquisition programs to effectively test systems and platforms (and components of these systems and platforms). Such testing must be conducted before full-scale production or delivery to the fleet to ensure functionality and accuracy in military mission and combat conditions per required acquisition milestones or on an as-needed basis to meet operational requirements. It would not be possible to illuminate mitigation zones during activities (such as during Kinetic Energy Weapon Testing) when conducted at night, due to either the size of the mitigation zone or the distance between the firing platform and the target or location.

5.5.3 Active and Passive Acoustic Monitoring Devices

When assessing and developing mitigation, the Navy considered using active and passive acoustic monitoring devices as procedural mitigation. During Surveillance Towed Array Sensor System low-frequency active sonar (which is not part of the Proposed Action), the Navy uses a specially-designed adjunct high-frequency marine mammal monitoring active sonar known as "HF/M3" to mitigate potential impacts. HF/M3 can only be towed at slow speeds and operates like a fish finder used by commercial and recreational fishermen. Installing the HF/M3 adjunct system on the tactical sonar ships used under the Proposed Action would have implications for safety and mission requirements due to impacts on speed and maneuverability. Furthermore, installing the system would significantly increase costs associated with designing, building, installing, maintaining, and manning the equipment. The Navy will not install the HF/M3 system or other adjunct marine mammal monitoring devices as mitigation under the Proposed Action. However, Navy assets with passive acoustic monitoring capabilities that are already participating in an activity will continue to monitor for marine mammals, as described in Section 5.2.1 (Procedural Mitigation Development) and Section 5.3 (Procedural Mitigation to be Implemented). Significant manpower and logistical constraints make constructing and maintaining additional passive acoustic monitoring systems for each training and testing activity under the Proposed Action impractical. For example, the Navy does not have available manpower or resources to allocate additional aircraft for the purpose of deploying, monitoring, and retrieving passive acoustic monitoring equipment during a bombing exercise. All platforms participating in explosive bombing exercises (e.g., firing aircraft, safety aircraft) must focus on situational awareness of the activity area and continuous coordination between multiple training components for safety and mission success. Therefore, it is impractical for participating platforms to divert their attention to non-mission essential tasks, such as deploying sonobuoys and monitoring for acoustic detections during the event (e.g., setting up a computer station). Diverting platforms with passive acoustic monitoring capabilities to monitor training and testing events would impact their ability to meet their mission requirements and would reduce the service life of those systems.

The Navy is continuing to improve its capabilities to use range instrumentation to aid in the passive acoustic detection of marine mammals. For example, at the Southern California Offshore Range, the Pacific Missile Range Facility off Kauai, Hawaii, and the Atlantic Undersea Test and Evaluation Center in the Bahamas, the Navy can monitor instrumented ranges in real-time or through data recorded by hydrophones. The Navy has sponsored numerous studies that have produced meaningful results on marine mammal occurrence, distribution, and behavior on these ranges through the U.S. Navy's Marine Species Monitoring Program. For information on the U.S. Navy's Marine Species Monitoring Program, see Section 5.1.2.2.1 (Marine Species Research and Monitoring Programs).

Although the Navy's instrumented ranges are helping to facilitate a better understanding of the species that are present in those areas, instrumented ranges were not developed for the purpose of mitigation, and therefore do not have the capabilities to be used effectively for mitigation. To develop an estimated position for an individual marine mammal, the animal's vocalizations must be detected on at least three hydrophones. The vocalizations must be loud enough to provide the required signal to noise ratio on those hydrophones. The hydrophones must have the required bandwidth and dynamic range to capture that signal. Detection capabilities are generally degraded under noisy conditions (such as high sea state) that affect signal to noise ratio. The ability to detect and develop an estimated position for marine mammals on the Navy's instrumented ranges depends of numerous factors, such as behavioral state (e.g., only vocalizing animals can be detected), species (e.g., species vocalize at varying rates, call types, and source levels), animal location relative to the passive acoustic receivers (hydrophones), and location on the range. The Navy's hydrophones cannot track the real-time locations of individual animals with dispersed and directional vocalizations with the level of precision needed for effective mitigation. Even marine mammals that have been vocalizing for extended periods of time have been known to stop vocalizing for hours at a time, which would prevent the Navy from obtaining or maintaining an accurate estimate of that animal's location. In addition, the Navy does not currently have the capability to perform data processing for large baleen whales in real-time. Determining if an animal is located within a mitigation zone within the timeframes required for mitigation would be prohibited by the amount of time it takes to process the data.

If a vocalizing animal is detected on only one or two hydrophones, estimating its location is not possible, and the location of the animal would be assigned generally within the detection radius around each hydrophone. The detection radius of a hydrophone is typically much larger than the mitigation zone for the activities conducted on instrumented ranges. The Navy does not have a way to verify if that vocalizing animal is located within the mitigation zone or at a location down range. Mitigating for passive acoustic detections based on unknown animal locations would essentially increase the mitigation zone sizes for each activity to that of the hydrophone detection radius. Increasing the mitigation zone sizes beyond what is described for each activity is impractical for the reasons described throughout Section 5.3 (Procedural Mitigation to be Implemented).

In summary, although the Navy is continuing to improve its capabilities to use range instrumentation to aid in the passive acoustic detection of marine mammals, at this time it would not be effective or practical for the Navy to monitor instrumented ranges for real-time mitigation or to construct additional instrumented ranges as a tool to aid in the implementation of mitigation.

5.5.4 Thermal Detection Systems and Unmanned Aerial Vehicles

When assessing and developing mitigation, the Navy considered using thermal detection systems and other technologies (e.g., autonomous platforms such as unmanned aerial vehicles, X-band radar) as procedural mitigation. The use of X-band radar instruments for marine mammal monitoring is a new field of study. A preliminary pilot experiment in the Mediterranean Sea indicated that X-band radar instruments, which allow for continuous observation of the sea surface within a certain range from the radar antenna, were able to detect bottlenose dolphins during optimal weather and sea state conditions (Mingozzi et al., 2020). Detections by radar were generally limited by conditions such as waves, which did not allow for the correct identification of small targets, and rain, which masked the radar signal reflection and reduced the ability to detect targets. The pilot experiment used a manual approach to observe for and validate radar detections; however, future technological developments could potentially allow for automated marine mammal observation using X-band radar (Mingozzi et al., 2020).

Thermal detection technology is designed to allow observers to detect the difference in temperature between a surfaced marine mammal (i.e., the body or blow of a whale) and the environment (i.e., the water and air). Thermal detection systems can be effective at detecting some types of marine mammals in a limited range of marine environmental conditions. Technologies are advancing but continue to be limited by their (1) reduced performance in certain environmental conditions, (2) ability to detect certain animal characteristics and behaviors, (3) low sensor resolution and narrow fields of view, and (4) high cost and low lifecycle (Boebel, 2017; Zitterbart et al., 2013). Current thermal detection systems have proven more effective at perceiving thermal anomalies as distance to the observer decreases (Zitterbart et al., 2020), and at detecting large whale blows than the bodies of small animals, particularly at a distance (Zitterbart et al., 2013). Zitterbart et al. (2020) found that certain cues, such as those caused by the displacement of relatively large amounts of water (e.g., whale breaches) were less affected by distance than other cues (e.g., whale blows) that showed a linear decay related to the effects of wind on thermal perceptibility. The study also found that the maximum thermal perceptibility distance ranged from < 1 to 10 kilometers, depending on factors such as cue type, species, and observation location.

The effectiveness of current technologies has not been demonstrated for small marine mammals. Thermal detection systems exhibit varying degrees of false positive detections (i.e., incorrect notifications) due in part to their low sensor resolution and reduced performance in certain environmental conditions. False positive detections may incorrectly identify other features (e.g., birds, waves, boats) as marine mammals. Zitterbart et al. (2013) reported a false positive rate approaching one incorrect notification per four minutes of observation. Zitterbart et al. (2020) reported maximum false positive rates of greater than 30 or 50 per hour, depending on observation location.

Thermal detection systems are generally thought to be most effective in detecting large, short-diving marine mammals in cold environments where there is a large temperature differential between an animal's temperature and the environment (Verfuss et al., 2018). Two studies that examined the effectiveness of thermal detection systems for marine mammal observations are Zitterbart et al. (2013), which tested a thermal detection system and automatic algorithm in polar waters between 34 and 50 degrees Fahrenheit, and a Navy-funded study in subtropical and tropical waters. Zitterbart et al. (2013) found that current technologies have limitations regarding temperature and survey conditions (e.g., rain, fog, sea state, glare, ambient brightness), for which further effectiveness studies are required. The Office of Naval Research Marine Mammals and Biology program funded a project (2013–2018) to test the thermal limits of infrared-based automatic whale detection technology. That project focused on capturing whale spouts at two different locations featuring subtropical and tropical water temperatures, optimizing detector/classifier performance on the collected data, and testing system performance by comparing system detections with concurrent visual observations. Results indicated that thermal detection systems in subtropical and tropical waters can be a valuable addition to marine mammal surveys within a certain distance from the observation platform (e.g., during seismic surveys, vessel movements), but they have challenges associated with false positive detections of waves and birds (Boebel, 2017).

The Navy has also been investigating the use of thermal detection systems with automated marine mammal detection algorithms for future mitigation during training and testing, including on autonomous platforms. For example, the Defense Advanced Research Projects Agency funded six initial studies to test and evaluate infrared-based thermal detection technologies and algorithms to automatically detect marine mammals on an unmanned surface vehicle. Based on the outcome of these initial studies, the Navy is pursuing additional follow-on research efforts.

Thermal detection systems are currently used by some specialized U.S. Air Force aircraft for marine mammal mitigation. These systems are specifically designed for and integrated into Air Force aircraft and cannot be added to Navy aircraft. Only certain Navy aircraft have specialized infrared capabilities, and these capabilities are only for fine-scale targeting within a narrow field of view. The only thermal imagery sensors aboard Navy surface ships are associated with specific weapons systems, and these sensors are not available on all vessels. These sensors are typically used only in select training events, have a limited lifespan before requiring expensive replacement, and are not optimized for marine mammal observations within the Navy's mitigation zones. For example, as described in Section 5.3.3.3 (Explosive Medium-Caliber and Large-Caliber Projectiles), Lookouts are required to observe a 1,000 yd. mitigation zone around the intended impact location during explosive large-caliber gunnery activities. In addition to observing for marine mammals, one of the activity's mission-essential requirements is for event participants, including Lookouts, to maintain focus on the mitigation zone to ensure the safety of Navy personnel and equipment and the public. Lookouts would not be able to observe the 1,000 yd. mitigation zone using the Navy's thermal imagery sensors due to their narrow fields of view and technological design specific to fine-scale targeting. Such observations would be ineffective for marine mammals and would prevent Lookouts from effectively maintaining focus on the activity area and implementing mission-essential safety protocols.

The effectiveness of even the most advanced commercially available thermal detection systems with technological designs specific to marine mammal observations is highly dependent on environmental conditions, animal characteristics, and animal behaviors (Zitterbart et al., 2013). Considering the range of environmental conditions and diversity of marine mammal species found throughout the Study Area, the use of thermal detection systems would be less effective than the traditional techniques currently employed by the Navy, such as naked-eye scanning, hand-held binoculars, and high-powered binoculars mounted on a ship deck. Furthermore, high false positive rates of thermal detection systems could result in the Navy implementing mitigation for features incorrectly identified as marine mammals. Increasing the instances of mitigation implementation based on incorrectly identified features would have significant impacts on the ability for training and testing activities to accomplish their intended objectives, without providing any mitigation benefit to the species. In addition, thermal detection systems are designed to detect marine mammals and do not have the capability to detect other resources for which the Navy is required to implement mitigation. Requiring Lookouts to use thermal detection systems would prevent them from detecting and mitigating for sea turtles and other biological resources (e.g., jellyfish aggregations).

Verfuss et al. (2018) determined that based on the science of current thermal detection system technologies, the combined performance of two or more observation methods would improve detection probability for real-time monitoring of marine mammals. Similarly, during a study conducted offshore Atlantic Canada, Smith et al. (2020) found that overall marine mammal detection rates increased when complementary methods (marine mammal observers, infrared cameras, and passive acoustic monitoring) were used. A combination of techniques balances the benefits and limitations of each method, particularly in conditions such as high sea state and low-visibility. As discussed in Section 5.3 (At-Sea Procedural Mitigation to be Implemented), the Navy's procedural mitigation measures include the maximum number of Lookouts the Navy can assign to each activity based on available manpower and resources, combined with the use of passive acoustic monitoring when those assets are already participating in an activity. It would be impractical to add personnel to serve as additional Lookouts for the sole purpose of thermal detection system use under the Proposed Action because the Navy does not have available manpower to add Lookouts to use thermal detection systems in tandem with existing Lookouts who are using traditional observation techniques.

In summary, thermal detection systems have not been sufficiently studied both in terms of their effectiveness within the environmental conditions found in the Study Area and their compatibility with Navy training and testing. The Navy plans to continue researching thermal detection systems to determine their effectiveness and compatibility with Navy applications. If the technology matures to the state where thermal detection is determined to be an effective mitigation tool during training and testing, the Navy will assess the practicality of using the technology during training and testing events and retrofitting its observation platforms with thermal detection devices. The assessment will include an evaluation of the budget and acquisition process (including costs associated with designing, building, installing, maintaining, and manning equipment that is expensive and has a relatively short lifecycle before key system components need replacing); logistical and physical considerations for device installment, repair, and replacement (e.g., conducting engineering studies to ensure there is no electronic or power interference with existing shipboard systems); manpower and resource considerations for training personnel to effectively operate the equipment; and considerations of potential security and classification issues. New system integration on Navy assets can entail up to 5–10 years of effort to account for acquisition, engineering studies, and development and execution of systems training. The Navy will provide information to NMFS about the status and findings of Navy-funded thermal detection studies and any associated practicality assessments at the annual adaptive management meetings. Information about the Navy's adaptive management program is included in Section 5.1.2.2.1.1 (Adaptive Management).

5.5.5 Third-Party Observers

When assessing and developing mitigation, the Navy considered using third-party observers during training and testing to aid in the implementation of procedural mitigation. The use of third-party observers to conduct pre- or post-activity biological resource observations would be an ineffective mitigation because marine mammals would likely move into or out of the activity area, and mitigation must be implemented at the time the activity is taking place.

There are significant manpower and logistical constraints that make using third-party observers for every training and testing activity under the Proposed Action impractical. Training and testing activities often occur simultaneously and in various regions throughout the Study Area, some of which last for days or weeks at a time. Having third-party observers embark on Navy vessels or aircraft would result in safety and security clearance issues. Training and testing event planning includes careful consideration of capacity limitations when placing personnel on participating aircraft and vessels. The Navy is unable to add third-party observers on a ship or substitute a Navy Lookout with a third-party observer without causing a berthing shortage or exceedance of other space limitations, or impacting the ability for Lookouts to complete their other mission-essential duties. The use of third-party observers also presents national security concerns due to the requirement to provide advance notification of specific times and locations of Navy platform movements and activities (e.g., vessels using active sonar).

Reliance on the availability of third-party personnel for mitigation would be impractical because training and testing activity timetables oftentimes cannot be precisely fixed and are instead based on the free-flow development of tactical situations. Waiting for third-party aircraft or vessels to complete surveys, refuel, or transit on station would extend the length of the activity in a way that would diminish realism and delay training and testing schedules. Hiring third-party civilian vessels or aircraft to observe Navy training and testing activities would also be unsustainable due to the significant associated costs. Because many training and testing activities take place offshore, the amount of time observers would spend on station would be limited due to aircraft fuel restrictions. Fuel restrictions and distance from shore would increase safety risks should mechanical problems arise. The presence of civilian aircraft or vessels in the vicinity of training and testing activities would present increased safety risks due to airspace conflicts and proximity to explosives.

5.5.6 Foreign Navy Mitigation

When assessing and developing mitigation, the Navy considered adopting the mitigation measures implemented by foreign navies. Mitigation measures are carefully developed for and assessed by each individual navy based on the potential impacts of their activities on the biological resources that live in their Study Areas, and the practicality of mitigation implementation based on their training mission and testing program requirements and the resources available for mitigation. The U.S. Navy's readiness considerations differ from those of foreign navies based on each navy's strategic reach, global mission, country-specific legal requirements, and geographic considerations. Most non-U.S. navies do not possess an integrated strike group and do not have integrated training requirements. The U.S. Navy's training is built around the integrated warfare concept and is based on the U.S. Navy's capabilities, the threats faced, the operating environment, and the overall mission. For this reason, not all measures developed for foreign navies would be effective at reducing impacts of U.S. Navy training or testing, or practical to implement by the U.S. Navy (and vice versa). For example, some navies implement active sonar ramp-up as mitigation for marine mammals; however, as described in Section 5.5.1 (Active Sonar), the U.S. Navy determined that active sonar ramp-up would be an ineffective mitigation measure for training and testing activities under the Proposed Action and would be impractical to implement because it would significantly impact training and testing realism.

The U.S. Navy will implement mitigation measures that have been determined to be effective at avoiding or reducing impacts from the Proposed Action and practical to implement by the U.S. Navy. Many of these measures are the same as, or comparable to, those implemented by foreign navies. For example, most navies implement some form of procedural mitigation to cease certain activities if a marine mammal is observed in a mitigation zone (Dolman et al., 2009). Some navies also implement geographic mitigation to restrict activities within particularly important marine mammal breeding, feeding, or migration habitats. The U.S. Navy will implement several mitigation measures and environmental compliance initiatives that are not implemented by foreign navies. For example, as discussed in Section 5.1.2.2 (Monitoring, Research, and Reporting Initiatives), the U.S. Navy will continue to sponsor scientific monitoring and research and comply with stringent reporting requirements.

5.5.7 Reporting Requirements

When assessing and developing mitigation, the Navy considered increasing its reporting requirements, such as additional reporting of vessel speeds and marine species observations. As discussed in Section 5.1.2.2 (Monitoring, Research, and Reporting Initiatives), the Navy developed its reporting requirements in conjunction with NMFS to be consistent with mission requirements and balance the usefulness of the information to be collected with the practicality of collecting it. The Navy's training and testing activity reports and incident reports are designed to verify implementation of mitigation; comply with current permits, authorizations, and consultation requirements; and improve future environmental analyses. In the unlikely event that a vessel strike of a marine mammal should occur, the Navy would provide NMFS with relevant information pertaining to the incident, including but not limited to vessel speed.

Additional reporting would be ineffective as mitigation because it would not result in modifications to training or testing activities or further avoidance or reductions of potential impacts. For example, additional reporting of vessel speed data would not result in modifications to vessel speeds (e.g., speed restrictions) or reduce the already low potential for vessel strikes of marine mammals for the reasons described in Section 5.3.4.1 (Vessel Movement). Lookouts are not trained to make species-specific identification and would not be able to provide detailed scientific data if more detailed marine species observation reports were to be required. Furthermore, the Navy does not currently maintain a record management system to collect, archive, analyze, and report every marine species observation or all vessel speed data for every training and testing activity and all vessel movements. For example, the speed of Navy vessels can fluctuate an unlimited number of times during training and testing events. Developing and implementing a record management system of this magnitude would be unduly cost prohibitive and place a significant administrative burden on vessel operators and activity participants. Burdening operational Commanders, vessel operators, and event participations with requirements to complete additional administrative reporting would distract them from preparing a ready force and focusing on mission-essential tasks. Additional reporting requirements would draw event participants' attention away from the complex tactical tasks they are primarily obligated to perform, such as driving a warship or engaging in a gunnery event, which would adversely impact personnel safety, public health and safety, and the effectiveness of training or testing.

5.6 Mitigation Summary

Table 5.6-1 provides a general summary of the mitigation measures the Navy will implement under Alternative 1 or Alternative 2 of the Proposed Action. For detailed mitigation requirements, see Section 5.3 (Procedural Mitigation to be Implemented) and Appendix K (Geographic Mitigation Assessment).

Table 5.6-1: Summary of Mitigation Requirements

Stressor, Activity, or Mitigation Category	Procedural Mitigation Requirements Wherever Activities Occur in the Study Area		Mitigation Areas (MA) with Geographic Mitigation Requirements										Species Protection Focus			
	Number of Lookouts	Mitigation Zone Size or Other Requirements[1]	Seafloor Resource MA	Marine Species Coastal MA			Olympic Coast National Marine Sanctuary MA	Juan de Fuca Eddy Marine Species MA	Stonewall and Heceta Bank Humpback Whale MA (May–Nov)	Point St. George Humpback Whale MA (July-Nov)	Puget Sound and Strait of Juan de Fuca MA	Northern Puget Sound Gray Whale MA (March-May)	Marine mammals	Sea turtles	Seabirds	Fish
				50 NM	20 NM	12 NM										
Environmental Awareness and Education	• —	• Personnel take assigned Afloat Environmental Compliance Training modules	—	Seasonal Awareness Messages for whales	—	—	—	—	—	—	Seasonal Awareness Messages for whales	—	X	X	X	—
Active Sonar	1 or 2, depending on source	• 1,000 yd. power down, 500 yd. power down, and 200 yd. or 100 yd. shut down for LF at 200 decibels (dB) and HM MF • 200 yd. or 100 yd. shut down for LF < 200 dB, MF not HM, and HF	—	—	MF1 hours limit	No non-explosive torpedo training; No ASW Tracking Exercises	MF1 hours limit	MF1 hours limit	No MF1	No MF1	Limit UUV locations for SRKW density; Coordinate with marine mammal detection networks and NMFS prior to applicable activities	No Civilian Port Defense – Homeland Security Anti-Terrorism/ Force Protection Exercises	X	X	X	X
Weapons Firing Noise	1	• 30° on either side of the firing line out to 70 yd. from the muzzle of weapon being fired	—	No explosive gunnery	No non-explosive lg-cal gunnery	—	—	—	—	—	No gunnery (except blank sm-cal)	—	X	X	X	—
Explosive Sonobuoys	1	• 600 yd. shut down	—	No explosive sonobuoys	—	—	—	—	—	—	No explosive sonobuoys	—	X	X	X	X
Explosive Torpedoes	1	• 2,100 yd. shut down	—	No explosive torpedoes	—	—	—	—	—	—	No explosive torpedoes	—	X	X	X	X
Explosive Med-Cal and Lg-Cal Projectiles	1	• Med-cal: 200 yd. (seabirds) and 600 yd. (marine mammals, sea turtles) shut down; • Lg-cal: 1,000 yd. shut down (marine mammals, sea turtles)	—	No explosive gunnery	—	—	—	—	—	—	No explosive gunnery	—	X	X	X	X
Explosive Missiles	1	• 2,000 yd. shut down	—	No explosive missiles	—	—	—	—	—	—	No explosive missiles	—	X	X	X	X
Explosive Bombs	1	• 2,500 yd. shut down	—	No explosive bombs	—	—	—	—	—	—	No explosive bombs	—	X	X	X	X
Explosive Mine Countermeasure and Neutralization Activities	1 (≤ 5 lb. NEW), 2 (> 5–60 lb. NEW)	• 600 yd. shut down (≤ 5 lb. NEW) • 2,100 yd. shut down (> 5–60 lb. NEW) • Smallest practicable charge size	No explosive MCM testing	—	Seasonal explosive MCM Testing limit	—	No explosive MCM Testing	No explosive MCM Testing	No explosive MCM Testing	No explosive MCM Testing	No explosive MCM Testing	—	X	X	X	X

Table 5.6-1: Summary of Mitigation Requirements (continued)

Stressor, Activity, or Mitigation Category	*Procedural Mitigation Requirements Wherever Activities Occur in the Study Area*		*Mitigation Areas (MA) with Geographic Mitigation Requirements*										*Species Protection Focus*			
	Number of Lookouts	*Mitigation Zone Size or Other Requirements*[1]	*Seafloor Resource MA*	*Marine Species Coastal MA*			*Olympic Coast National Marine Sanctuary MA*	*Juan de Fuca Eddy Marine Species MA*	*Stonewall and Heceta Bank Humpback Whale MA (May–Nov)*	*Point St. George Humpback Whale MA (July-Nov)*	*Puget Sound and Strait of Juan de Fuca MA*	*Northern Puget Sound Gray Whale MA (March-May)*	*Marine mammals*	*Sea turtles*	*Seabirds*	*Fish*
				50 NM	*20 NM*	*12 NM*										
Explosive Mine Neutralization Activities Involving Navy Divers	2, including 1 Navy biologist	• 100 yd. (< 0.1 lb. NEW) and 400 yd. (> 0.5–2.5 lb. NEW) shut down (seabirds), • 500 yd. (> 0.5–2.5 lb. NEW) shut down (marine mammals) • Smallest practicable charge size	No explosive mine training	—	—	—	—	—	—	—	Restricted to designated locations; Seasonal charge size or distance from shore requirements; Coordinate with marine mammal detection networks	—	X	—	X	X
Vessel Movement	1	• 500 yd. (avoid whales) • 200 yd. (surface ships avoid other marine mammals) • 100 yd. (small boats avoid other marine mammals) • Avoid sea turtle vicinity	No precision anchoring; No anchor or mooring device placement	—	—	—	—	—	—	—	Coordinate with marine mammal detection networks and NMFS prior to Small Boat Attack Exercises	—	X	X	—	—
Towed In-Water Devices	1	• 250 yd. avoidance for in-water devices towed by aircraft or surface ships (marine mammals) • 100 yd. avoidance for in-water devices towed by small boats (marine mammals) • Avoid sea turtle vicinity	—	—	—	—	—	—	—	—	—	—	X	X	—	—
Sm-, Med-, and Lg-Cal Non-Explosive Practice Munitions	1	• 200 yd. shut down during sm-, med-, lg-cal events (marine mammals, sea turtles) and sm-, med-cal events (seabirds)	—	—	No non-explosive lg-cal gunnery	No non-explosive sm- and med-cal gunnery	—	—	—	—	No non-explosive gunnery (except blank sm-cal)	—	X	X	X	X
Non-Explosive Missiles	1	• 900 yd. shut down	—	No non-explosive missiles	—	—	—	—	—	—	No non-explosive missiles	—	X	X	X	X
Non-Explosive Bombs and Mine Shapes	1	• 1,000 yd. shut down	No mine shape placement	—	No non-explosive bombing	—	No non-explosive bombing	—	—	—	No non-explosive bombing	—	X	X	X	X

[1] The mitigation zones apply to marine mammals and sea turtles unless specified otherwise

Notes: — = No mitigation or mitigation is not applicable, X = Mitigation is applicable, ASW = anti-submarine warfare, HF = high-frequency, HM = hull-mounted, LF = low-frequency, Lg-cal = large-caliber, MA = Mitigation Area, MCM = Mine Countermeasure and Neutralization Testing, Med-cal = medium-caliber, MF = mid-frequency, NEW = net explosive weight, NM = nautical miles, Sm-cal = small-caliber, S-S = surface-to-surface, yd. = yard

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6 Additional Regulatory Considerations

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6 Additional Regulatory Considerations

In accordance with the Council on Environmental Quality regulations for implementing the National Environmental Policy Act (NEPA), federal agencies shall, to the fullest extent possible, integrate the requirements of NEPA with other planning and environmental review procedures required by law or by agency practice so that all such procedures run concurrently rather than consecutively. This chapter summarizes environmental compliance for the Proposed Action; consistency with other federal, state, and local plans, policies, and regulations in addition to the ones discussed in Chapter 3 (Affected Environment and Environmental Consequences); the relationship between short-term impacts and the maintenance and enhancement of long-term productivity in the affected environment; irreversible and irretrievable commitments of resources; and energy conservation.

6.1 Consistency with Other Applicable Federal, State, and Local Plans, Policies, and Regulations

Implementation of the Proposed Action addressed in this Northwest Training and Testing (NWTT) Supplemental Environmental Impact Statement (EIS)/Overseas EIS (OEIS) (Supplemental) would comply with applicable federal, state, and local laws, regulations, and executive orders (EOs). The United States (U.S.) Department of the Navy (Navy) has consulted with and will continue to consult with regulatory agencies, as appropriate, during the NEPA process and prior to implementing the Proposed Action.

Table 6.1-1 summarizes environmental compliance requirements that were considered in preparing this Supplemental (including those that may be secondary considerations in the resource evaluations). Section 3.0.2 (Regulatory Framework) provides brief excerpts of the primary federal statutes, EOs, international standards, and guidance that form the regulatory framework for the resource evaluations. Section 1.6 (The Environmental Planning Process) provides brief excerpts of the primary federal statutes, EOs, and guidance that form the regulatory framework for the resource evaluations in Chapter 3 (Affected Environment and Environmental Consequences). Documentation of consultation and coordination with regulatory agencies is provided in Appendix I (Agency Correspondence).

Table 6.1-1: Summary of Environmental Compliance for the Proposed Action

Statutes, Regulations, Executive Orders, International Standards, and Guidance	*Status of Compliance*
Statutes and Regulations	
Abandoned Shipwreck Act (43 United States [U.S.] Code [U.S.C.] sections 2101–2106)	These legal requirements have not changed since the 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.
Act to Prevent Pollution from Ships (33 U.S.C. sections 1901–1915)	These legal requirements have not changed since the 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.
Antiquities Act (16 U.S.C. sections 431–433)	These legal requirements have not changed since the 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.

Table 6.1-1: Summary of Environmental Compliance for the Proposed Action (continued)

Statutes, Regulations, Executive Orders, International Standards, and Guidance	***Status of Compliance***
Statutes and Regulations (continued)	
Bald and Golden Eagle Protection Act (16 U.S.C. 668–668c)	These legal requirements have not changed since the 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.
Clean Air Act (42 U.S.C. sections 7401 et seq.) Clean Air Act General Conformity Rule (40 CFR section 93[B]) State Implementation Plan (SIP)	These legal requirements have not changed since the 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.
Clean Water Act (33 U.S.C. 1251 et seq.)	In November 2019, the Environmental Protection Agency and Department of Defense Uniform National Discharge Standards (UNDS) for Vessels of the Armed Forces were updated (40 CFR 1700). The Navy would continue to work with the U.S. Environmental Protection Agency Headquarters regarding UNDS. The Navy would continue to implement and comply with these requirements as outlined in 40 CFR 1700. Regarding other requirements of the Clean Water Act, the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.
Coastal Zone Management Act (16 U.S.C. sections 1451-1464)	The legal description and the definitions for this Act from the 2015 Final NWTT EIS/OEIS have not changed. A Consistency Determination was submitted to the Washington State Department of Ecology. A Negative Determination was submitted to the Oregon Department of Land Conservation and Development and the California Coastal Commission for review of federal agency activities. The Navy received conditional concurrence from Washington in a letter dated August 28, 2020, and is still in consultation with the Department of Ecology. Completion of consultations will be documented in the Record of Decision (ROD). The Navy received concurrence from Oregon on June 24, 2020, and from California on July 10, 2020. Alaska currently does not have an approved Coastal Management Program, and the Navy has no requirements to prepare and submit a Consistency Determination.

Table 6.1-1: Summary of Environmental Compliance for the Proposed Action (continued)

Statutes, Regulations, Executive Orders, International Standards, and Guidance	*Status of Compliance*
Statutes and Regulations (continued)	
Endangered Species Act (ESA) (16 U.S.C. sections 1531 et seq.)	This Supplemental analyzes potential effects to species listed under the ESA and is administered by both the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS). In accordance with Section 7 of the ESA (50 CFR section 402), during the preparation of the 2015 NWTT Final EIS/OEIS, the Navy prepared a Biological Assessment and submitted it to the USFWS. A Biological Opinion (BO) was issued by USFWS. The Navy reinitiated formal consultation in 2017 and received a revised BO in 2018 that remains valid. The Navy reinitiated formal consultation with the USFWS in 2019. A BO may be issued by the USFWS, and the Navy will adhere to any BO terms and conditions listed therein which upon implementation, causes the ESA Section 9 prohibitions to be inapplicable to covered Navy activities. The Navy prepared a Biological Assessment that was submitted to the NMFS in 2019 as part of formal consultation. A BO may be issued by NMFS, and the Navy will adhere to any BO terms and conditions listed therein which upon implementation, causes the ESA Section 9 prohibitions to be inapplicable to covered Navy activities. The Navy is still in ongoing consultation under Section 7 of the ESA with NMFS and USFWS on the potential that implementation of the Proposed Action may affect listed species. Completion of consultations will be documented in the ROD.
Historic Sites, Buildings and Antiquities Act, 1935 (54 U.S.C. 320101 et seq.) Antiquities Act (54 U.S.C. sections 320301–320303)	The citations and naming conventions for Historic Sites, Buildings and Antiquities Act have changed slightly since the 2015 NWTT Final EIS/OEIS. However, no substantive changes to the laws have occurred since 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.
Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. sections 1801–1882)	The Proposed Action has the potential to adversely affect essential fish habitat and managed species. The Navy prepared an Essential Fish Habitat Assessment and this consultation is ongoing. The results will be documented in the ROD.
Marine Mammal Protection Act (MMPA) (16 U.S.C. sections 1431 et seq.)	This Supplemental EIS/OEIS updates the analysis and is the basis for a request for a 7-year LOA, which is a change from the 2015 NWTT Final EIS/OEIS per the 2018 National Defense Authorization Act and the MMPA, as the NMFS permitting period has been changed from 5- to 7-year permits, to cover the Navy's proposed activities for the 2020–2027 timeframe.

Table 6.1-1: Summary of Environmental Compliance for the Proposed Action (continued)

Statutes, Regulations, Executive Orders, International Standards, and Guidance	***Status of Compliance***
Statutes and Regulations (continued)	
Migratory Bird Treaty Act (16 U.S.C. sections 703–712)	These legal requirements have not changed since the 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.
National Fishery Enhancement Act (33 U.S.C. section 2101 et seq.)	These legal requirements have not changed since the 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.
National Historic Preservation Act (NHPA) (54 U.S.C. section 306108)	The Proposed Action is consistent with the national policy for the preservation of historic sites, buildings, and objects of national significance. See Section 3.10 (Cultural Resources) for the assessment. Navy activities are currently covered under the completed Section 106 consultation for the 2015 NWTT Final EIS/OEIS. The Navy is engaged in consultation under NHPA Section 106 to support the Proposed Action in the Study Area under this Supplemental. Results of consultation will be documented in the ROD.
National Marine Sanctuaries Act (16 U.S.C. sections 1431–1445c-1)	The Navy and NMFS submitted a joint Sanctuary Resource Statement to Olympic Coast National Marine Sanctuary (OCNMS). This consultation is ongoing and the results will be documented in the ROD.
Resource Conservation and Recovery Act (42 U.S.C. section 6901 et seq.) Military Munitions Rule	These legal requirements have not changed since the 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.
Rivers and Harbors Act (33 U.S.C. section 401 et seq.)	These legal requirements have not changed since the 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.
The Sikes Act of 1960 (16 U.S.C. sections 670a-670o, as amended by the Sikes Act Improvement Act of 1997, Public Law No. 105-85), requires military installations with significant natural resources to prepare and implement Integrated Natural Resource Management Plans (INRMPs).	These legal requirements have not changed since the 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.
Submerged Lands Act of 1953 (43 U.S.C. sections 1301–1315)	These legal requirements have not changed since the 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.

Table 6.1-1: Summary of Environmental Compliance for the Proposed Action (continued)

Statutes, Regulations, Executive Orders, International Standards, and Guidance	***Status of Compliance***
Statutes and Regulations (continued)	
Sunken Military Craft Act (Public Law 108–375, 10 U.S.C. section 113 Note and 118 Stat. 2094–2098)	These legal requirements have not changed since the 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.
Wilderness Act (Public Law 88–577, 16 U.S.C. 1131–1136)	The Wilderness Act was not included in the 2015 NWTT Final EIS/OEIS. The Proposed Action is consistent with the management policies for the Daniel J. Evans Wilderness unit in Olympic National Park.
Executive Orders (EOs)	
EO 11990*, Protection of Wetlands*	These legal requirements have not changed since the 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.
EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*	These legal requirements have not changed since the 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.
EO 12962*, Recreational Fisheries*	These legal requirements have not changed since the 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.
EO 13045*, Protection of Children from Environmental Health Risks and Safety Risks*	These legal requirements have not changed since the 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.
EO 13089*, Coral Reef Protection*	These legal requirements have not changed since the 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.
EO 13112*, Invasive Species*	These legal requirements have not changed since the 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.
EO 13158, *Marine Protected Areas*	These legal requirements have not changed since the 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.

Table 6.1-1: Summary of Environmental Compliance for the Proposed Action (continued)

Statutes, Regulations, Executive Orders, International Standards, and Guidance	***Status of Compliance***
EOs (continued)	
EO 13175, *Consultation and Coordination With Indian Tribal Governments*	These legal requirements have not changed since the 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.
EO 13547, *Stewardship of the Ocean, Our Coasts, and the Great Lakes*	This EO was revoked and replaced by EO 13840, *Ocean Policy to Advance the Economic, Security, and Environmental Interests of the United States*, since the 2015 NWTT Final EIS/OEIS.
EO 13693, *Planning for Federal Sustainability in the Next Decade*	This EO was revoked and replaced by EO 13834, *Efficient Federal Operations* since the 2015 NWTT Final EIS/OEIS.
EO 13783, *Promoting Energy Independence and Economic Growth*	This EO revokes EO 13653, *Preparing the United States for the Impacts of Climate Change*. The Proposed Action is consistent with the policy's goals for the safe, efficient development of domestic energy resources.
EO 13792*, Review of Designations Under the Antiquities Act*	On April 26, 2017, EO 13792 was issued and directed the Secretary of the Interior to review designations of national monuments made since 1996. The Proposed Action is consistent with this EO and considers all national monuments that are still designated as such.
EO 13834, *Efficient Federal Operations*	The Proposed Action is consistent with the federal government's order to prioritize actions that reduce waste, cut costs, enhance the resilience of federal infrastructure and operations, and enable more effective accomplishment of an agency's mission. This Executive Order revokes EO 13693, *Planning for Federal Sustainability in the Next Decade*.
EO 13840, *Ocean Policy to Advance the Economic, Security, and Environmental Interests of the United States*	The Proposed Action is consistent with the comprehensive national policy for the *Ocean Policy to Advance the Economic, Security, and Environmental Interests of the United States* (which replaced EO 13547, *Stewardship of the Ocean, Our Coasts, and the Great Lakes*).
International Standards	
International Convention for the Prevention of Pollution from Ships (MARPOL)	These legal requirements have not changed since the 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.

Notes: CFR = Code of Federal Regulations, U.S. = United States, NMFS = National Marine Fisheries Service, NWTT = Northwest Training and Testing, EIS = Environmental Impact Statement, OEIS = Overseas Environmental Impact Statement, MMPA = Marine Mammal Protection Act, MBTA = Migratory Bird Treaty Act, ESA = Endangered Species Act, INRMP = Integrated Natural Resource Management Plan, OCNMS = Olympic Coast National Marine Sanctuary, BO = Biological Opinion

6.1.1 Coastal Zone Management Act Compliance

The 2015 Final NWTT EIS/OEIS describes the *Coastal Zone Management Act of 1972* (16 United States Code [U.S.C.] section 1451, et seq.). This description and the definitions from the 2015 Final NWTT

EIS/OEIS have not changed. See Sections 4.3.5.5 (Shoreline Development) and 4.4.6.3 (Coastal Development) in the 2015 Final NWTT EIS/OEIS for additional information regarding management of the coastal zone within the NWTT Study Area.

As described in the 2015 Final NWTT EIS/OEIS, a Consistency Determination (CD) or a Negative Determination were submitted for review of federal agency activities.

6.1.1.1 Washington Coastal Zone Management Program

In 1976, the State of Washington's Coastal Zone Management Program (CZMP) was the first to be accepted and approved by the National Oceanic and Atmospheric Administration, and implemented by the Washington Department of Ecology. Washington's CZMP is primarily based on their Shoreline Management Act of 1971, as well as other state land use and resource management laws. Any public federal project carried out with a federal agency, or private project licensed or permitted by a federal agency, or carried out with a federal grant, must be determined to have "Federal Consistency," which means the project is consistent with the enforceable policies of Washington's CZMP.

The coastal zone includes all lands and waters from the coastline seaward to 3 NM. The coastline along the inland marine waters is located at the seaward limit of rivers, bays, estuaries, or sound. The inland political boundaries of the counties are used as the Coastal Zone limit because they generally follow drainage divides. The Act specifically excludes from the coastal zone those lands that are subject solely by law to the discretion of or held in trust by the federal government (e.g., military reservations and other defense installations, all lands within National Parks, the Olympic Coast National Marine Sanctuary, Indian lands held in trust by the federal government, and National Forest lands and National Recreation Areas owned or leased by the federal government) (Washington State Department of Ecology, 2001).

The federal CZMA also gives special funding to assist in making improvements to the state CZMP. Washington State participates in these voluntary Improvement Grants, otherwise known as the Section 309 Program, in order to update and amend the Shoreline Master Program Guidelines under Washington's Shoreline Management Act. Washington conducted a self-assessment of their CZMP that was finalized in 2015 for improvements to the program from 2016 to 2020. The various updates to the program will be considered in the CD process between the Navy and Washington Department of Ecology (Washington Department of Ecology, 2015).

In June 2018, the State of Washington finalized and adopted a new Pacific Coast Marine Spatial Plan. The Marine Spatial Plan includes scientific information on ocean uses and resources, provides a framework for evaluating future ocean use proposals, and establishes protections for sensitive areas and fisheries. The plan was submitted to NOAA to be reviewed and approved for incorporation into Washington State's CZMP and was approved in November of 2019 as an enforceable policy via a Routine Program Change to Washington's Coastal Program. Since there is a history of military presence off the coast of Washington State, the Marine Spatial Plan includes a section about military operations (Washington State Department of Ecology, 2018). Under a Federal Consistency determination, the Navy must be compliant with the state's implementation of the Marine Spatial Plan since it was approved and is an enforceable policy of the Washington Coastal Program.

The Navy submitted a consistency determination to the Washington State Department of Ecology on May 28, 2020, and received conditional concurrence on August 28, 2020 (see Appendix I, Agency Correspondence). The Navy continues to consult with the Department of Ecology, and completion of consultations will be documented in the Record of Decision.

6.1.1.2 Oregon Coastal Management Program

The Oregon Coastal Management Program was described in the 2015 NWTT Final EIS/OEIS and has not changed. The Navy submitted a negative determination to the Oregon Department of Land Conservation and Development for the 2015 NWTT Final EIS/OEIS, and the State of Oregon concurred. The activities proposed to occur off the coast of Oregon are similar in type and level of intensity to those covered in the 2015 negative determination, for which the Department of Land Conservation and Development issued a concurrence on June 3, 2015. Therefore, the Navy submitted a negative determination for its proposed activities on May 14, 2020. The Navy received concurrence on June 24, 2020, from the Department of Land Conservation and Development (see Appendix I, Agency Correspondence) stating that the Navy can assume concurrence with the Navy's negative determination unless otherwise notified.

6.1.1.3 California Coastal Management Program

The California Coastal Act was described in the 2015 NWTT Final EIS/OEIS and has not changed. Previously, the Navy submitted a negative determination to the California Coastal Commission for the 2015 NWTT Final EIS/OEIS. The California Coastal Commission concurred with the Navy's negative determination, in which the Commission agreed that it does not appear reasonably foreseeable that the proposed activities would affect California coastal zone resources. The activities proposed to occur off the coast of California are similar in type and level of intensity to those covered in the 2015 negative determination, for which the California Coastal Commission concurred. Therefore, the Navy submitted a negative determination for its proposed activities on May 13, 2020. The Navy received concurrence with the determination on July 10, 2020 (see Appendix I, Agency Correspondence).

6.1.1.4 Alaska Coastal Management Program

The Alaska Coastal Management Program (CMP) ended at 12:01 a.m., Alaska Standard Time on July 1, 2011 per state legislative action (AS 44.66.030). The Legislature adjourned the special legislative session May 14, 2011 without passing legislation required to extend the Alaska CMP. Therefore, Alaska currently does not have an approved CMP, and the Navy has no requirements to prepare and submit a CD.

6.1.2 Marine Protected Areas

The 2015 NWTT Final EIS/OEIS discussed Marine Protected Areas (MPA) that overlapped with the Study Area (U.S. Department of the Navy, 2015). EO 13792, *Review of Designations Under the Antiquities Act*, authorized a review by the Secretary of Interior of certain designated National Monuments under the Antiquities Act. Figure 6.1-1 and Figure 6.1-2 show MPAs in the Offshore Area and Inland Waters. These areas include the Olympic Coast National Marine Sanctuary (OCNMS), National Wildlife Refuges, state or local MPAs that are included in the National System of Marine Protected Areas, and the marine component of the Olympic National Park. This Supplemental has been prepared in accordance with requirements for natural or cultural resources protected under the National System of MPAs. While several MPAs are located within the Study Area and are included in the National System of MPAs, it is important to note that through standard operating procedures, the Navy takes every precaution to train or test in these areas sparingly. Table 6.1-2 provides information on the MPAs that are new, have regulations that have changed since the 2015 NWTT Final EIS/OEIS, or have new or different Navy training and testing activities proposed to occur. Further analysis and discussion of Marine Protected Areas can be found in the 2015 NWTT Final EIS/OEIS Chapter 6 (Table 6.1-2). Additionally, the OCNMS within the Study Area receives protection under both EO 13158 and the National Marine Sanctuaries Act and is described in more detail below the table.

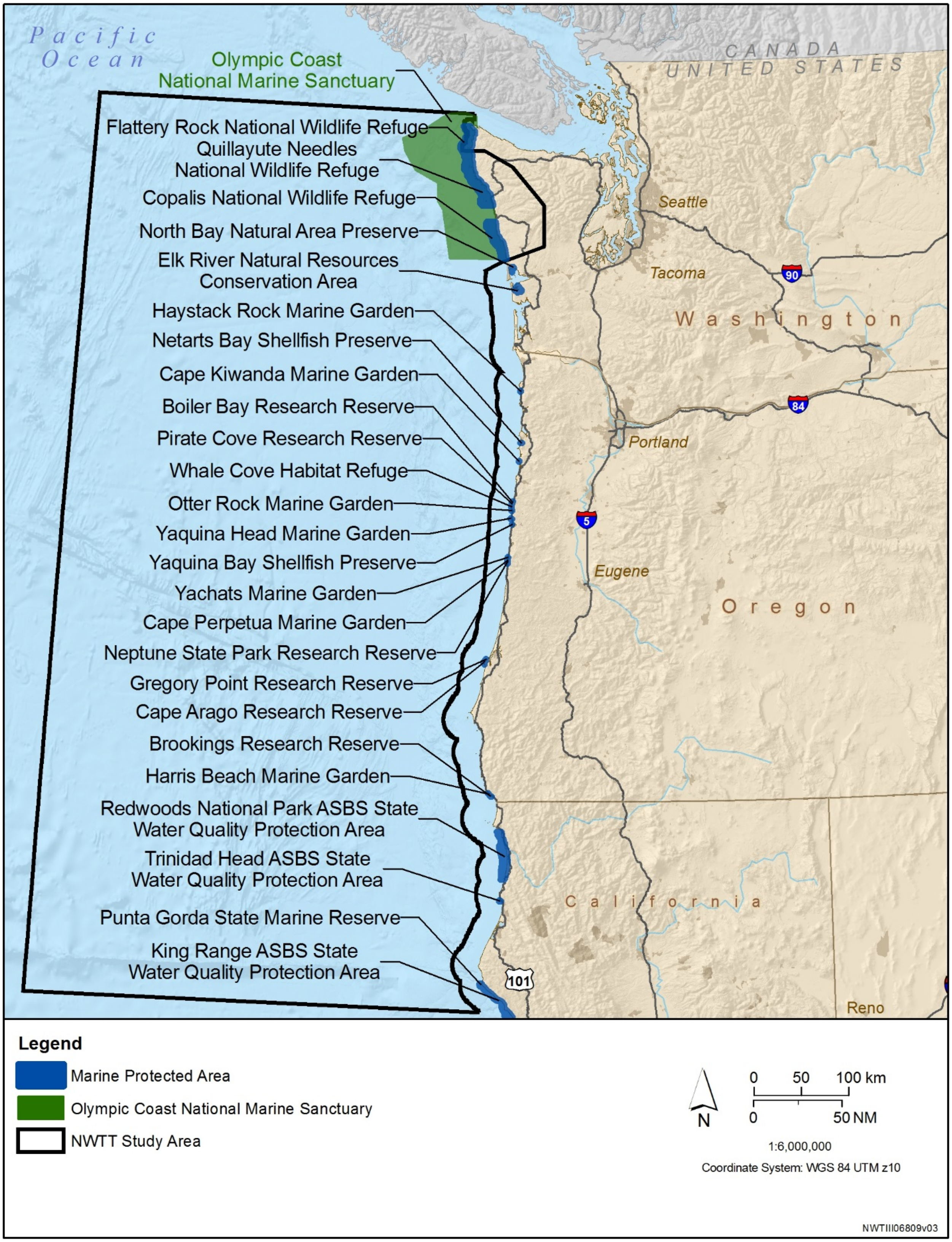

Figure 6.1-1: Marine Protected Areas in and Near the Offshore Area Portion of the Study Area

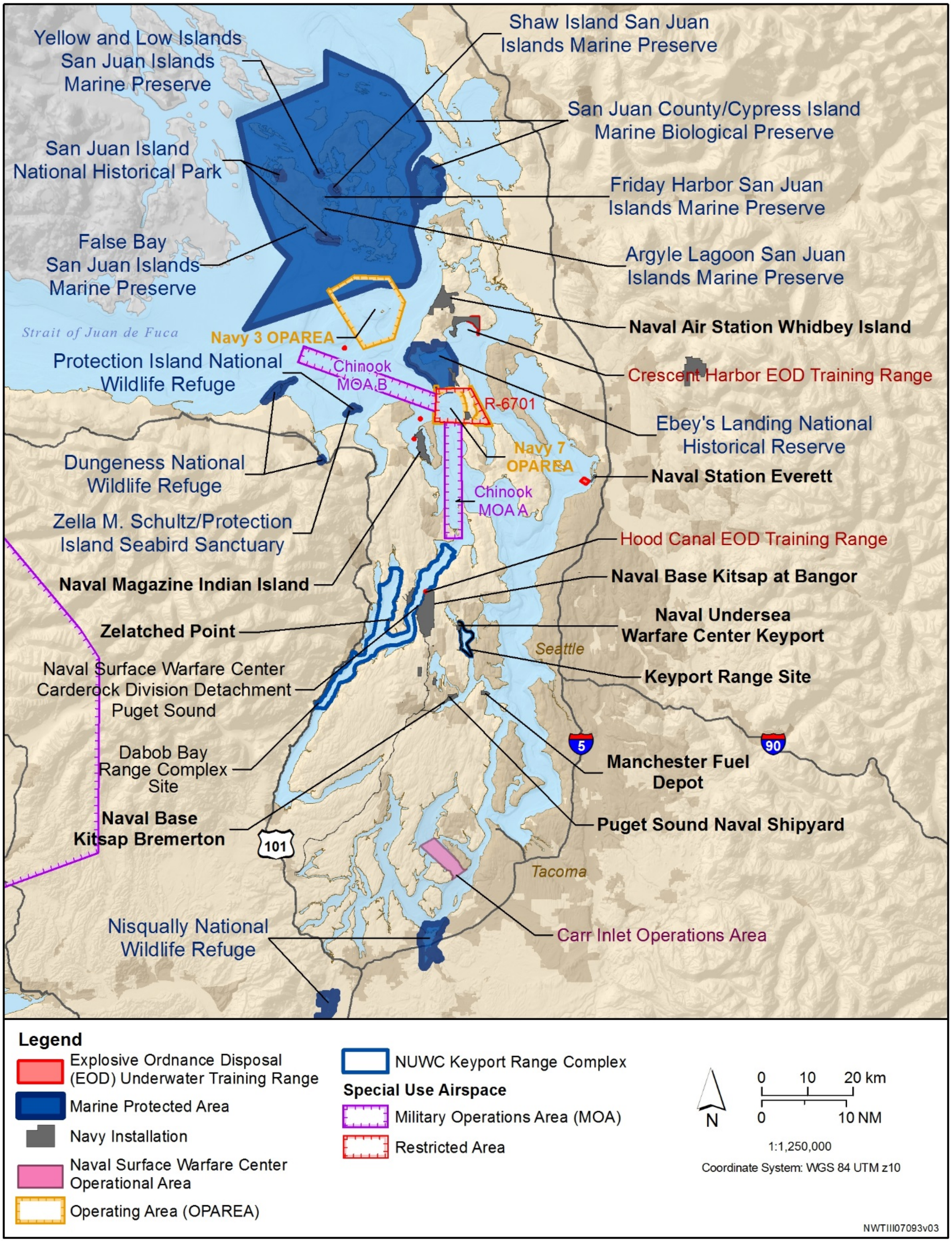

Figure 6.1-2: Marine Protected Areas in and Near the Inland Waters Area of the Study Area

Table 6.1-2: Marine Protected Areas Located Within the Northwest Training and Testing Study Area

Marine Protected Area	Location Within the Study Area	Protection Focus	Regulations Applicable to Navy Activities	Navy Proposed Training and Testing Activities and Potential Impacts
Copalis National Wildlife Refuge	Washington (Offshore Area)	Ecosystem	The Refuge is closed to visitation to protect wildlife and other natural, cultural, and other resources consistent with the conservation purpose of the Refuge.	The Navy conducts no activities in or near this area, but Navy ships may transit near or through the reserve.
Ebey's Landing National Historical Reserve	Washington (Puget Sound)	Natural Heritage	The Reserve covers the entire central Whidbey Island area, including Penn Cove.	The Navy's proposed activities in the Inland Waters would not occur within the limits of the Reserve and therefore would not violate the spatial boundaries or restrictions of the Reserve.
Flattery Rocks National Wildlife Refuge	Washington (Offshore Area)	Ecosystem	The Refuge is closed to visitors to protect wildlife and other natural, cultural, and other resources consistent with the conservation purpose of the Refuge.	The Navy conducts no activities in or near this area, but Navy ships may transit near or through the Refuge.
Olympic Coast National Marine Sanctuary	Washington (Offshore Area)	Ecosystem	The regulations state that "all Department of Defense (DoD) activities must be carried out in a manner that avoids to the maximum extent practicable any adverse impacts on sanctuary resources and qualities." If a DoD activity causes any destruction, loss, or injury to a Sanctuary resource, then the "DoD, in coordination with the Director, must promptly prevent and mitigate further damage and must restore or replace the Sanctuary resource or quality in a manner approved by the Director."	The Navy and NMFS submitted a joint Sanctuary Resource Statement to the Olympic Coast National Marine Sanctuary (OCNMS). OCNMS has 45 days to respond with conservation recommendations for the agencies to consider.

Table 6.1-2: Marine Protected Areas Located Within the Northwest Training and Testing Study Area (continued)

Marine Protected Area	Location Within the Study Area	Protection Focus	Regulations Applicable to Navy Activities	Navy Proposed Training and Testing Activities and Potential Impacts
Olympic National Park	Washington (Offshore Area)	Ecosystem	Vessels are prohibited from creating a wake or exceeding 5 miles per hour, 100 yards from shoreline in undeveloped areas. Permits are required for aircraft and air delivery; delivery/retrieval of a person/object by parachute, helicopter, or other airborne means; or removal of a downed aircraft. As a designated World Heritage Site, the Olympic National Park was analyzed in the 2015 NWTT Final EIS/OEIS in Appendix K (World Heritage Site Analysis).	The Navy does not conduct ship or submarine activities in Olympic National Park but does conduct flight activities in the Olympic Military Operations Areas in national airspace above the Park. The environmental analysis for placement of mobile emitters on U.S. Forest lands outside the Olympic National Park supporting these activities was included in the Navy's Electronic Warfare Range Environmental Assessment. The Navy received special use permits from the U.S. Forest Service for placement of these emitters. Analysis of flight activities over the Olympic National Park within the MOA airspace is included in this Proposed Action. The Navy completed a noise study in Appendix J (Airspace Noise Analysis for the Olympic Military Operations Area) to support determinations made in this Supplemental that noise impacts on the Park and its resources would not rise to the level of significance (see Appendix J, Airspace Noise Analysis for the Olympic Military Operations Area).
Quillayute Needles National Wildlife Refuge	Washington (Offshore Area)	Seabirds/ Wildlife	No discharge/depositing, no dredging or altering the seabed, no motorized aircraft below 2,000 ft. or within 1 NM seaward, and no bombing activities.	The Navy does not discharge/deposit into, dredge, or alter the seabed; fly motorized aircraft below 2,000 ft. or within 1 NM seaward of Quillayute Needles National Wildlife Refuge; or conduct bombing activities in the refuge.

Notes: DoD = Department of Defense, EIS/OEIS = Environmental Impact Statement/Overseas Environmental Impact Statement, Navy = United States Department of the Navy, NM = nautical miles, NMFS = National Marine Fisheries Service, OCNMS = Olympic Coast National Marine Sanctuary, U.S. = United States, MOA = Military Operations Area

6.1.2.1 Olympic Coast National Marine Sanctuary

Details of the OCNMS are discussed in the 2015 NWTT Final EIS/OEIS, and the dimensions, species, and descriptions of the area have not changed. The offshore portion of the Study Area encompasses the OCNMS. The mitigation developed for MMPA/ESA impacts (see Chapter 5, Mitigation) would be applied to all activities occurring near or within the Sanctuary.

Because some of the activities have changed in the Proposed Action for the 2020 NWTT Final EIS/OEIS, the Navy and NMFS have submitted a new joint Sanctuary Resource Statement to OCNMS. To ensure compliance with the National Marine Sanctuary Program regulations and the interagency consultation requirements of National Marine Sanctuaries Act section 304(d), the Navy considered all proposed modifications to training and testing activities to determine whether they have the potential to destroy, cause the loss of, or injure sanctuary resources, or result in adverse impacts on sanctuary resources or qualities. The Navy submitted a Sanctuary Resource Statement to the NOAA Office of National Marine Sanctuaries (ONMS) on April 30, 2020. After ONMS's request for additional information and clarification, the Navy submitted a revised SRS on July 9, 2020. On July 15, 2020, ONMS found the SRS sufficient. On August 28, 2020, ONMS provided an injury determination and recommended alternatives to minimize injury and to protect sanctuary resources (see Appendix I, Agency Correspondence). This consultation is ongoing and the results will be documented in the Record of Decision. The Navy has considered additional mitigation measures as indicated in Appendix K (Geographic Mitigation Assessment). Mitigation for the Olympic Coast National Marine Sanctuary Mitigation Area will consequently also help the Navy avoid or reduce potential impacts on other marine protected areas in the NWTT Offshore Area. The Flattery Rocks National Wildlife Refuge, Quillayute Needles National Wildlife Refuge, and Copalis National Wildlife Refuge are located within the boundaries of the Olympic Coast National Marine Sanctuary in the nearshore portion of the Study Area that abuts the Washington shoreline (well within 12 NM from shore). Therefore, proposed training and testing activities are consistent with those described in Section 6.4.5 (Department of Defense Activities) of the *Olympic Coast National Marine Sanctuary Final Management Plan and Environmental Assessment* (2011), authored and published by the National Oceanic and Atmospheric Administration. Further, the Navy would continue to regulate which training and testing activities occur within the Sanctuary based on existing requirements, as discussed above.

6.1.3 Magnuson-Stevens Fishery Conservation and Management Act

The Proposed Action has the potential to impact Essential Fish Habitat (EFH) and managed species within the Study Area. The Navy prepared an EFH Assessment for this Supplemental and submitted it to NMFS on February 11, 2020 (see Appendix I, Agency Correspondence). On July 30, 2020, NMFS provided their draft response letter for review. On August 1, 2020, the Navy submitted clarifying information.

The Navy will continue to coordinate with NMFS to ensure that the best available data is considered for continued compliance with the Magnuson-Stevens Fishery Conservation and Management Act. This consultation is ongoing and the results will be documented in the Record of Decision.

6.2 Relationship Between Short-Term Use of the Environment and Maintenance and Enhancement of Long-Term Productivity

In accordance with the Council on Environmental Quality regulations (Part 1502), this Supplemental analyzes the relationship between the short-term impacts on the environment and the effects those impacts may have on the maintenance and enhancement of the long-term productivity of the affected environment. This analysis has not changed since the analysis conducted in the 2015 NWTT Final

EIS/OEIS. See Section 6.2 (Relationship Between Short-Term Use of the Environment and Maintenance and Enhancement of Long-Term Productivity) of the 2015 NWTT Final EIS/OEIS for more information (U.S. Department of the Navy, 2015).

6.3 Irreversible or Irretrievable Commitment of Resources

NEPA requires that environmental analysis include identification of "any irreversible and irretrievable commitments of resources which would be involved in the Proposed Action should it be implemented" (42 U.S.C. section 4332). This analysis has not changed since it was conducted in the 2015 NWTT Final EIS/OEIS and the Navy's activities have been ongoing and continuous since then. See Section 6.3 (Irreversible or Irretrievable Commitment of Resources) of the 2015 NWTT Final EIS/OEIS for more information (U.S. Department of the Navy, 2015).

6.4 Energy Requirements and Conservation Potential of Alternatives

Pursuant to the operational strategy report in 2011, the Department of Defense (DoD) published an implementation plan to integrate operational energy considerations and transformation into existing programs, processes, and institutions (U.S. Department of Defense, 2012). The DoD consumed approximately 1.3 percent of the total U.S. oil and petroleum consumption in Fiscal Year 2013. It is the largest single user in the nation (Burke, 2014). The Navy consumes approximately 26 percent of the total DoD share (U.S. Department of Defense, 2016). In Fiscal Year 2013, the Navy consumed almost 90 million barrels of liquid fuel (Burke, 2014). In 2016, the DoD published a new Operational Energy Strategy to update the 2011 strategy and transform the way energy is consumed in military operations; the strategy sets the overall direction for operational energy security (U.S. Department of Defense, 2016). The 2016 strategy shifts focus towards three objectives: (1) increasing future warfighting capability by including energy throughout future force development; (2) identifying and reducing logistic and operational risks from operational energy vulnerabilities; (3) and enhancing the force's mission effectiveness through updated equipment and improvements in training, exercises, and operations (U.S. Department of Defense, 2016). These documents provide guidance to the DoD in how to better use energy resources and transform the way we power current and future forces.

Training and testing activities within the Study Area would result in an overall decrease in energy demand over current activities. The energy demand would arise from fuel (e.g., gasoline, diesel) consumption, mainly from aircraft and vessels participating in training and testing. Details of fuel consumption by training and testing activities on an annual basis are set forth in the air quality emissions calculation spreadsheets available on the project website. Total fuel consumption is estimated to decrease by approximately 11 percent and 9 percent per year under Alternative 1 and Alternative 2, respectively, when compared to Baseline rates of aircraft fuel consumption for training and testing activities. The main reason for the overall decrease in fuel consumption is that Baseline training activities include flights supporting the High-Speed Anti-Radiation Missile (HARM) operation. The HARM activity was broken out separately in the 2015 analysis but has since been removed, and the flights that conduct it have been absorbed into the other Electronic Warfare flights, resulting in a decrease in fuel consumption associated with aircraft training exercises. Overall, aircraft fuel consumption is estimated to decrease by 12 percent under Alternative 1 and by 10 percent under Alternative 2, when compared to current rates of aircraft fuel consumption during training and testing activities. Vessel fuel consumption is estimated to increase by 2 percent under Alternative 1 and by 14 percent per year under Alternative 2, when compared to current rates of vessel fuel consumption during training and testing activities. The increase in vessel testing fuel consumption for Alternatives 1 and 2 is due to additional testing operations compared to the baseline, including operations that were previously not analyzed, and a change of methodology for estimating the emissions. The alternatives could result in a net cumulative increase in the global energy (fuel) supply.

Energy requirements would be subject to any established energy conservation practices. The use of energy sources has been minimized wherever possible without compromising safety, training, or testing activities. No additional conservation measures related to direct energy consumption by the proposed training and testing activities are identified. The Navy's energy vision given in the Operational Energy Strategy report (2016) is consistent with energy conservation practices and states that the Navy values energy as a strategic resource, understands how energy security is fundamental to executing our mission afloat and ashore, and is resilient to any potential energy future.

The Navy is committed to improving energy security and environmental stewardship by reducing its reliance on fossil fuels. The Navy is actively developing and participating in energy, environmental, and climate change initiatives that will help conserve the world's resources for future generations. The Navy Climate Change Roadmap identifies actions the Environmental Readiness Division took to implement EO 13653, *Preparing the United States for the Impacts of Climate Change* (which has since been revoked and replaced with EO 13783, *Promoting Energy Independence and Economic Growth*).

Two Navy programs—the Incentivized Energy Conservation Program and the Naval Sea Systems Command's Fleet Readiness, Research and Development Program—are helping the fleet conserve fuel via improved operating procedures and long-term initiatives. The Incentivized Energy Conservation Program encourages the operation of ships in the most efficient manner while conducting their mission and supports the Secretary of the Navy's efforts to reduce total energy consumption on naval ships. The Naval Sea Systems Command's Fleet Readiness, Research, and Development Program includes the High-Efficiency Heating, Ventilating, and Air Conditioning. These initiatives are expected to greatly reduce the consumption of fossil fuels (Section 3.2, Air Quality).

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8 Public Involvement and Distribution

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8 Public Involvement and Distribution

This chapter includes a summary of the public involvement and stakeholder outreach activities conducted by the United States (U.S.) Navy (Navy) during the scoping period and the public review and comment period for the Draft Supplemental Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) (Supplemental) for Northwest Training and Testing (NWTT). The scoping period was held from August 22, 2017, to October 6, 2017. The Draft Supplemental was released for public review March 29, 2019, through May 28, 2019. The public comment period was extended by an additional 15 days, to close on June 12, 2019.

The purpose of public involvement during the public scoping period was to (1) notify and inform stakeholders and the public about the Proposed Action, and (2) provide opportunities for the public to comment on the scope of the analysis, including environmental issues and potential viable alternatives. The purpose of public involvement and outreach during the public review and comment period of the Draft Supplemental was to (1) notify and inform stakeholders and the public about the Proposed Action and the release of the Draft Supplemental, and (2) provide the opportunity for the public and stakeholders to comment on the Draft Supplemental.

Outreach and involvement efforts were conducted in accordance with the National Environmental Policy Act and Navy guidance.

8.1 Project Website

A project website was established to provide the public with project, public meeting, and commenting information, and to accept comments electronically. The project website address is www.NWTTEIS.com and has been active since 2012.

The website address was included in the *Federal Register Notice of Intent to Prepare a Supplemental EIS/OEIS* and the *Federal Register Notice of Public Meetings*. It was also included in newspaper advertisements, stakeholder and federally recognized tribes notification letters, press releases, public service announcements, and postcard mailers disseminated for the Notice of Intent and Notice of Availability.

Public notifications, fact sheet booklets, posters, maps, frequently asked questions, technical reports, informational videos, and other public involvement information are available on the project website and will be available throughout the course of the project. The website is periodically updated with project announcements, which are emailed to website subscribers.

8.2 Scoping Period

The public scoping period began with issuance of the Notice of Intent in the *Federal Register* (FR) August 22, 2017 (82 FR 39779). At the request of the public and elected officials, the Navy extended the public scoping period to October 6, 2017, and a Notice of Extension of Scoping Period was published in the *Federal Register* September 20, 2017 (82 FR 43950). Comments on the scope of the analysis were provided by mail and through the project website. *Federal Register* notices can be found in Appendix G (*Federal Register* Notices).

8.2.1 Public Scoping Notifications

The Navy made significant efforts to notify the public to maximize public participation during the scoping process. A summary of these efforts follows.

8.2.1.1 Notification Letters

Tribal letters were mailed August 18, 2017, via priority mail to 56 tribal chairpersons and presidents of American Indian and Alaska Native tribes across the NWTT Study Area. Stakeholder letters were mailed first-class August 21, 2017, to 614 federal, state, and local elected officials and government agencies. Entities that received the scoping notification letters can be found in Table 8.2-1, and an example of a notification letter is shown in Figure 8.2-1.

Table 8.2-1: Entities that Received the Scoping Notification Letters

Federally Recognized Tribes and Tribal Groups	
Big Lagoon Rancheria, California	Organized Village of Saxman
Cahto Tribe of the Laytonville Rancheria	Pinoleville Pomo Nation, California
Central Council of the Tlingit and Haida Indian Tribes	Port Gamble S'Klallam Tribe
Cher-Ae Heights Indian Community of the Trinidad Rancheria, California	Potter Valley Tribe, California
Confederated Tribes and Bands of the Yakama Nation	Puyallup Tribe of the Puyallup Reservation
Confederated Tribes of Grand Ronde Community of Oregon	Quileute Tribe of the Quileute Reservation
Confederated Tribes of Siletz Indians of Oregon	Quinault Indian Nation
Confederated Tribes of the Chehalis Reservation	Redwood Valley Little River Band of Pomo Indians
Confederated Tribes of the Coos, Lower Umpqua and Siuslaw Indians	Resighini Rancheria, California
Coquille Indian Tribe	Robinson Rancheria
Cow Creek Band of Umpqua Tribe of Indians	Round Valley Indian Tribes, Round Valley Reservation, California
Cowlitz Indian Tribe	Samish Indian Nation
Coyote Valley Band of Pomo Indians of California	Sauk-Suiattle Indian Tribe
Elk Valley Rancheria, California	Scotts Valley Band of Pomo Indians of California
Hoh Indian Tribe	Sherwood Valley Rancheria of Pomo Indians of California
Hoopa Valley Tribe, California	Shoalwater Bay Indian Tribe of the Shoalwater Bay Indian Reservation
Hopland Band of Pomo Indians, California	Skokomish Indian Tribe
InterTribal Sinkyone Wilderness Council	Snoqualmie Indian Tribe
Jamestown S'Klallam Tribe	Squaxin Island Tribe of the Squaxin Island Reservation
Karuk Tribe	Stillaguamish Tribe of Indians of Washington
Ketchikan Indian Corporation	Suquamish Indian Tribe of the Port Madison Reservation
Lower Elwha Tribal Community	Swinomish Indian Tribal Community
Lummi Tribe of the Lummi Reservation	Tolowa Dee-ni' Nation
Makah Indian Tribe of the Makah Reservation	Tulalip Tribes of Washington
Metlakatla Indian Community, Annette Island Reserve	Upper Skagit Indian Tribe
Muckleshoot Indian Tribe	Wiyot Tribe, California
Nisqually Indian Tribe	Yurok Tribe of the Yurok Reservation, California
Nooksack Indian Tribe	

Federal Elected Officials and Federal Agencies
U.S. Senators (Washington, Oregon, California, Alaska) and Staff
U.S. Representatives (Alaska at large; California Districts 1, 2, 5; Oregon Districts 1, 2, 3, 4, 5; Washington Districts 1, 2, 3, 6, 7, 8, 9) and Staff
Battelle Pacific Northwest Laboratory
Bureau of Indian Affairs
Northwest Regional Office
Bureau of Land Management
Coos Bay District Office
Oregon/Washington State Office
Spokane District Office
Bureau of Ocean Energy Management
Pacific Outer Continental Shelf Region
Bureau of Safety and Environmental Enforcement
Office of Offshore Regulatory Programs
Federal Aviation Administration
Western-Pacific Region
Fisheries and Oceans Canada Pacific Region
Marine Mammal Commission
National Marine Protected Areas Center
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Arcata Field Office
Office of Protected Resources
Endangered Species Act Interagency Cooperation Division
Marine Mammal Permitting
West Coast Region
Northwest Regional Office
Northwest Fisheries Science Center
Oregon Office
Southwest Oregon Habitat Branch
Washington Coast/Lower Columbia Habitat Branch
Washington Habitat Branch
Ukiah Field Office
Office of Law Enforcement
National Park Service
Olympic National Park
Olympic Coast National Marine Sanctuary
Advisory Council
Pacific Fishery Management Council
Puget Sound Federal Caucus
U.S. Army Corps of Engineers
U.S. Army National Guard, Boardman Oregon
U.S. Coast Guard
District 13
District 17
Office of Operating and Environmental Standards
U.S. Department of Agriculture Forest Service
Olympic National Forest
Pacific Northwest Region U.S. Department of Commerce
U.S. Environmental Protection Agency Region X
Environmental Review & Sediment Management Unit

- National Environmental Protection Agency Compliance Division

- U.S. Geological Survey
  - Alaska Science Center
  - Northwest Region Office
  - Pacific Region Office
  - Western Fisheries Research Center
- U.S. Fish and Wildlife Service
  - Arcata Office
  - Pacific Region
  - Region 7
  - Washington Maritime Wildlife Refuge Complex
  - Western Washington Office
    - Consultation & Conservation Planning Division
  - Quilcene National Fish Hatchery

State Elected Officials and State Agencies

- Office of the Governor (Washington, Oregon, California, Alaska) and Staff
- State Senators (Washington Districts 1, 2, 7, 10, 19, 21, 23, 24, 25, 26, 27, 28, 29, 31, 32, 35, 38, 39, 44; Oregon Districts 1, 5, 16, 28, 29; California Districts 1, 2, 4; Alaska Districts A, B, C) and Staff
- State Representatives (Washington Districts 1, 2, 7, 10, 19, 21, 23, 24, 25, 26, 27, 28, 29, 31, 32, 35, 38, 39, 44; Oregon Districts 1, 9, 10, 31, 32, 57; California District 1; Alaska Districts 1, 2, 3, 4) and Staff
- Alaska Department of Commerce
  - Community and Economic Development
    - Division of Community and Regional Affairs
- Alaska Department of Environmental Conservation
  - Division of Air Quality
  - Division of Administrative Services
  - Division of Environmental Health
  - Division of Spill Prevention and Response
  - Division of Water
- Alaska Department of Fish & Game
  - Commercial Fisheries Division
  - Division of Wildlife Conservation
  - Habitat
  - Sport Fish Division
  - Sport Fishing
  - Subsistence
- Alaska Department of Military & Veterans Affairs
- Alaska Department of Natural Resources
  - Public Information Center
  - Division of Forestry
  - Division of Geological & Geophysical Surveys
  - Division of Mining, Land, and Water
  - Division of Oil and Gas
  - Division of Parks and Outdoor Recreation
  - Office of History and Archaeology
- Alaska Department of Transportation & Public Facilities
  - Division of Ports and Harbors
  - Division of Statewide Aviation
- Alaska Marine Highway
- Alaska Statement of Cooperation
- California Coastal Commission
- California Department of Fish and Wildlife

California Department of Toxic Substances Control
California Environmental Protection Agency
California Resources Agency
Oregon Department of Environmental Quality
Water Quality
Oregon Department of Fish and Wildlife
Oregon Department of Forestry
Oregon Department of Land Conservation and Development
Oregon Department of State Lands
Oregon Military Department
Oregon Parks and Recreation Department
Pacific States Marine Fisheries Commission
Puget Sound Partnership
Regulatory Commission of Alaska
Scappoose Industrial Air Park
Washington Coastal Marine Advisory Council
Washington State Department of Agriculture
Policy and Communications
Washington State Department of Archaeology & Historic Preservation
Washington State Department of Ecology
Northwest Regional Office
Shorelands and Environmental Assistance Program
Southwest Regional Office
Washington State Department of Fish and Wildlife, Region 6
Washington State Department of Natural Resources
Washington State Fish and Wildlife Commission
Washington State Parks and Recreation Commission
Local Elected Officials and Local Agencies
Washington State
City of Aberdeen
City of Bainbridge Island
City of Everett
City of Forks
City of Gig Harbor
City of Hoquiam
City of Oak Harbor
City of Oak Harbor Planning Services Division
City of Ocean Shores
City of Port Angeles
City of Port Orchard
City of Port Townsend
City of Poulsbo
City of Sequim
City of Shelton
City of Tacoma
City of Westport
Clallam County Board of Commissioners
Friday Harbor Airport
Grays Harbor County Board of Commissioners
Island County Board of Commissioners
Jefferson County Board of Commissioners
Kitsap County Board of Commissioners

Mason County
Pacific County Board of Commissioners
Pierce County Council
San Juan County Council
Snohomish County Council

Oregon State

City of Astoria
City of Bandon
City of Bay City
City of Brookings
City of Cannon Beach
City of Coos Bay
City of Depoe Bay
City of Garibaldi
City of Gearhart
City of Gold Beach
City of Lakeside
City of Lincoln City
City of Manzanita
City of Nehalem
City of Newport
City of North Bend
City of Port Orford
City of Reedsport
City of Rockaway Beach
City of Seaside
City of Tillamook
City of Warrenton
City of Wheeler
City of Yachats
Clatsop County Board of Commissioners
Coos County Board of Commissioners
Curry County Board of Commissioners
Depoe Bay Nearshore Action Team
Lane County Board of Commissioners
Lincoln County
Office of Lincoln County
Port Orford Watershed Council
Tillamook County Board of Commissioners

California State

City of Arcata
City of Crescent City
City of Eureka
City of Fort Bragg
City of Point Arena
City of Trinidad
Del Norte County Board of Supervisors
Humboldt County Board of Supervisors
Humboldt County Democratic Central Committee
Mendocino County Board of Supervisors

Alaska State

City of Ketchikan
Ketchikan Gateway

DEPARTMENT OF THE NAVY
COMMANDER
UNITED STATES PACIFIC FLEET
250 MAKALAPA DRIVE
PEARL HARBOR, HAWAII 96860-3131

IN REPLY REFER TO:
5090
Ser N465/0952
August 21, 2017

Dear Sir or Madam:

SUBJECT: NOTICE OF INTENT TO PREPARE A SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT FOR NORTHWEST TRAINING AND TESTING

This letter is to inform you that the Department of the Navy (Navy) is preparing a supplement to the 2015 Northwest Training and Testing (NWTT) Final Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) to assess the potential environmental effects associated with ongoing and future at-sea military readiness activities conducted within the NWTT EIS/OEIS Study Area (hereafter referred to as the "Study Area"). Military readiness activities include training and research, development, testing, and evaluation (hereafter referred to as "training and testing"). The Navy is requesting your comments on the scope of the analysis, including potential environmental issues and viable alternatives to be considered during the development of the Draft Supplemental EIS/OEIS.

The Navy previously completed an EIS/OEIS in 2015, for which a Record of Decision was signed in October 2016, for at-sea training and testing activities occurring within the Study Area. The supplement to the 2015 Final EIS/OEIS is being prepared to support ongoing and future activities conducted at sea within the Study Area beyond 2020. Proposed training and testing activities are generally consistent with those analyzed in the 2015 Final EIS/OEIS and are representative of activities the Navy has been conducting in the Study Area for decades.

The Supplemental EIS/OEIS will include an analysis of training and testing activities using new information available after the release of the 2015 Final EIS/OEIS. New information includes an updated acoustic effects model, updated marine mammal density data, and evolving and emergent best available science. As part of this process, the Navy will seek the issuance of federal regulatory permits and authorizations under the Marine Mammal Protection Act and the Endangered Species Act to support ongoing and future at-sea military readiness activities within the Study Area beyond 2020.

The Study Area remains unchanged since the 2015 Final EIS/OEIS (Enclosure 1). The Study Area is comprised of established maritime operating areas and warning areas in the northeastern Pacific Ocean, including areas within the Strait of Juan de Fuca, Puget Sound, and the Western Behm Canal in southeastern Alaska. The Study Area includes air and water space within and outside Washington state waters, air and water space outside state waters of Oregon and Northern California, and Navy pierside locations where sonar maintenance and testing occur. In the supplement to the 2015 Final EIS/OEIS, the Navy will only analyze those training and testing activities conducted at sea within the Study Area.

Figure 8.2-1: Stakeholder Scoping Notification Letter

5090
Ser N465/0952
August 21, 2017

The Proposed Action is to conduct at-sea training and testing activities within the Study Area. Activities include the use of active sonar and explosives while employing marine species protective mitigation measures. The purpose of the Proposed Action is to maintain a ready force, which is needed to ensure the Navy can accomplish its mission to maintain, train, and equip combat-ready naval forces capable of winning wars, deterring aggression, and maintaining freedom of the seas, consistent with Congressional direction in section 5062 of Title 10 of the U.S. Code.

To achieve and maintain military readiness, the Navy proposes to:

- Conduct at-sea training and testing activities at levels required to support military readiness requirements beyond 2020; and
- Accommodate evolving mission requirements, including those resulting from the development, testing, and introduction of new vessels, aircraft, and weapons systems into the fleet.

Public comments will be accepted during the 30-day scoping period beginning August 22, 2017 and extending through September 21, 2017. Comments must be postmarked or received online by **September 21, 2017** for consideration in the development of the Draft Supplemental EIS/OEIS. Comments may be submitted online at **www.NWTTEIS.com**, or by mail to:

Naval Facilities Engineering Command Northwest
Attention: NWTT Supplemental EIS/OEIS Project Manager
3730 North Charles Porter Avenue, Building 385
Oak Harbor, WA 98278-3500

For more information, please visit the project website at www.NWTTEIS.com or contact Ms. Jackie Queen, NWTT Supplemental EIS/OEIS Project Manager, at 360-257-3852, or email jackie.queen@navy.mil.

Please help the Navy inform the community about the intent to prepare the Supplemental EIS/OEIS for at-sea training and testing in the Pacific Northwest by sharing this information with your staff and interested individuals.

Sincerely,

Larry M. Foster

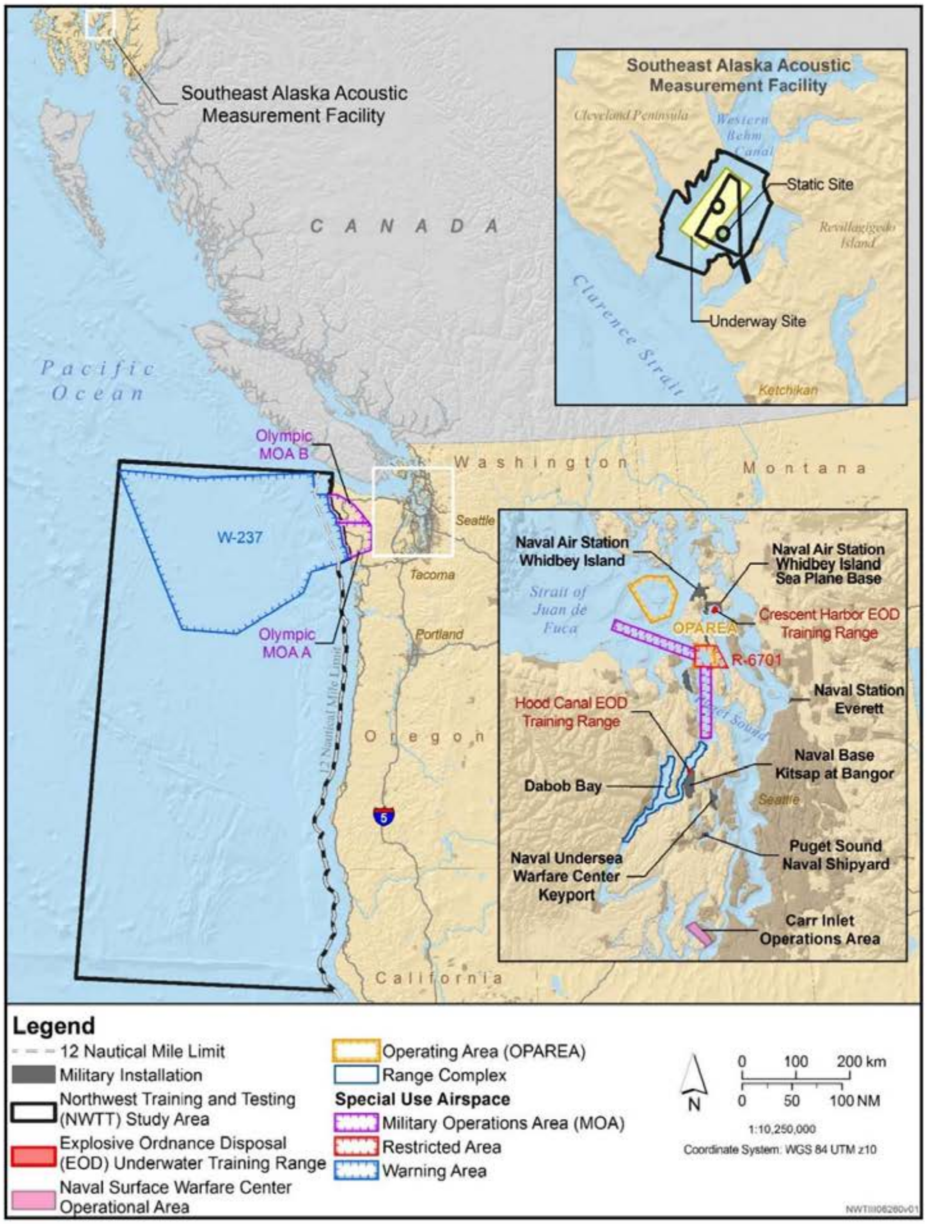
L. M. FOSTER
By direction

Enclosure: 1. Northwest Training and Testing Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement Study Area

2

Figure 8.2-1: Stakeholder Scoping Notification Letter (continued)

Enclosure 1: Northwest Training and Testing Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement Study Area



Enclosure (1)

Figure 8.2-1: Stakeholder Scoping Notification Letter (continued)

8.2.1.2 Postcard Mailer

A postcard was mailed first-class to 1,655 individuals, community groups, tribal staff, and nongovernmental organizations August 21, 2017. The postcard provided information about the Proposed Action, the website address, and how to submit public comments. An example of the postcard is shown in Figure 8.2-2.

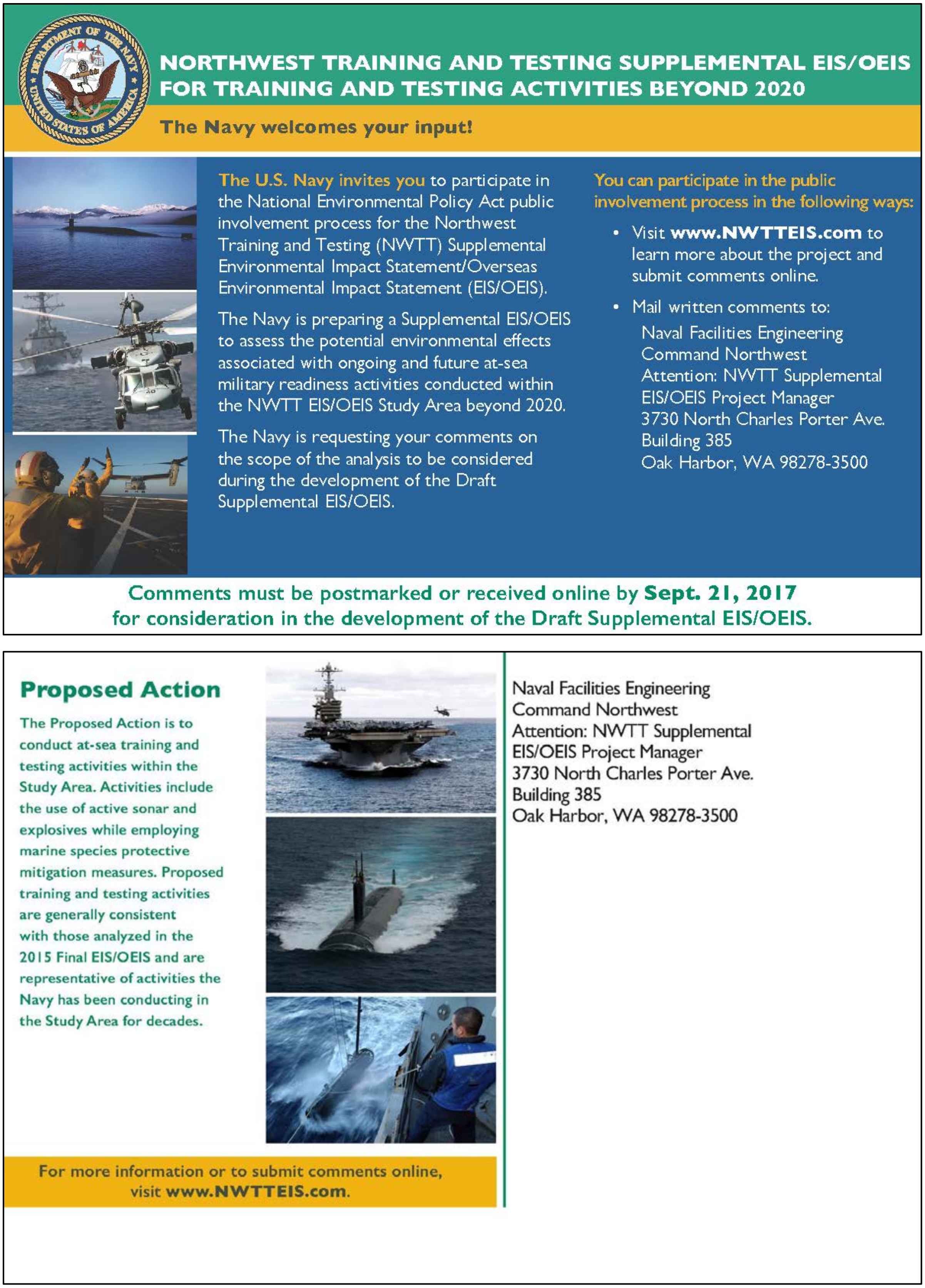


Figure 8.2-2: Postcard Mailer for Scoping (Front and Back)

8.2.1.3 Newspaper Advertisements

Display advertisements were placed in local newspapers to advertise the public's opportunity to comment on the scope of the analysis. The advertisements included a description of the Proposed Action, the address of the project website, the duration of the comment period, and information on how to provide comments. The newspapers and publication dates are indicated in Table 8.2-2. An example of the advertisement is shown in Figure 8.2-3.

Table 8.2-2: Newspaper Publications for Scoping

Newspaper	Newspaper Coverage	Publication Dates
The Juneau Empire	Juneau, Alaska	Tuesday, August 22, 2017 Wednesday, August 23, 2017 Thursday, August 24, 2017
Ketchikan Daily News	Ketchikan, Alaska	Tuesday, August 22, 2017 Wednesday, August 23, 2017 Thursday, August 24, 2017
Eureka Times-Standard	Eureka, California	Tuesday, August 22, 2017 Wednesday, August 23, 2017 Thursday, August 24, 2017
Fort Bragg Advocate-News	Fort Bragg, California	Thursday, August 24, 2017 Thursday, August 31, 2017 Thursday, September 7, 2017
The Daily Astorian	Astoria, Oregon	Tuesday, August 22, 2017 Wednesday, August 23, 2017 Thursday, August 24, 2017
Newport News-Times	Newport, Oregon	Wednesday, August 23, 2017 Friday, August 25, 2017 Wednesday, August 30, 2017
The Oregonian	Portland, Oregon	Wednesday, August 23, 2017 Friday, August 25, 2017 Saturday, August 26, 2017
The Daily Herald	Everett, Washington	Tuesday, August 22, 2017 Wednesday, August 23, 2017 Thursday, August 24, 2017
The Daily World	Aberdeen, Washington	Tuesday, August 22, 2017 Thursday, August 24, 2017 Saturday, August 26, 2017
Forks Forum	Forks, Washington	Thursday, August 24, 2017 Thursday, August 31, 2017 Thursday, September 7, 2017
Journal of the San Juan Islands	San Juan Island, Washington	Wednesday, August 23, 2017 Wednesday, August 30, 2017 Wednesday, September 6, 2017

Newspaper	Newspaper Coverage	Publication Dates
The Kitsap Sun	Kitsap, Washington	Tuesday, August 22, 2017 Wednesday, August 23, 2017 Thursday, August 24, 2017
Peninsula Daily News	Port Angeles, Washington	Tuesday, August 22, 2017 Wednesday, August 23, 2017 Thursday, August 24, 2017
Port Townsend and Jefferson County Leader	Port Townsend, Washington	Wednesday, August 23, 2017 Wednesday, August 30, 2017 Wednesday, September 6, 2017
The Seattle Times	Seattle, Washington	Tuesday, August 22, 2017 Wednesday, August 23, 2017 Thursday, August 24, 2017
Sequim Gazette	Sequim, Washington	Wednesday, August 23, 2017 Wednesday, August 30, 2017 Wednesday, September 6, 2017
Whidbey News-Times	Whidbey Island, Washington	Wednesday, August 23, 2017 Saturday, August 26, 2017 Wednesday, August 30, 2017

The U.S. Navy
INVITES YOU TO PARTICIPATE
in the Northwest
Training and Testing
Supplemental EIS/OEIS Process

The U.S. Navy is preparing a Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) to assess the potential environmental effects associated with ongoing and future at-sea military readiness activities conducted within the Northwest Training and Testing (NWTT) EIS/OEIS Study Area beyond 2020.

Public Involvement Opportunity

The Navy is requesting your comments on the scope of the analysis to be considered during the development of the Draft Supplemental EIS/OEIS. Comments will be accepted online at **www.NWTTEIS.com**, or by mail to:

Naval Facilities Engineering Command Northwest
Attention: NWTT Supplemental EIS/OEIS Project Manager
3730 North Charles Porter Ave., Building 385
Oak Harbor, WA 98278-3500

All comments must be postmarked or received online by Sept. 21, 2017 for consideration in the development of the Draft Supplemental EIS/OEIS.

Figure 8.2-3: Newspaper Announcement for Scoping

8.2.1.4 Press Releases

Commander, Navy Region Northwest Public Affairs Office distributed a press release to local and regional media outlets August 22, 2017. A second news release was distributed to media outlets September 15, 2017, and that same press release was redistributed October 2, 2017. The first press release provided information on the Proposed Action and how to submit comments. The second press release provided information on the public scoping comment period extension, the Proposed Action, and how to submit comments. The press releases from the Commander, Navy Region Northwest are shown in Figure 8.2-4 and Figure 8.2-5.

COMMANDER,
NAVY REGION NORTHWEST
Public Affairs Office
1100 Hunley Rd., Silverdale, WA 98315-1100
Phone: 360-396-1630 Fax: 360-396-7127

Aug. 22, 2017

Release # 0823417

U.S. NAVY SEEKS PUBLIC INPUT ON THE NORTHWEST TRAINING AND TESTING SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT

SILVERDALE, Wash — The U.S. Navy is preparing a supplement to the 2015 Northwest Training and Testing (NWTT) Final Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) to assess the potential environmental effects associated with ongoing and future at-sea military readiness activities conducted within the NWTT EIS/OEIS Study Area (hereafter referred to as the "Study Area"). Military readiness activities include training and research, development, testing, and evaluation (hereafter referred to as "training and testing"). The Navy is requesting public comments on the scope of the analysis, including potential environmental issues and viable alternatives to be considered during the development of the Draft Supplemental EIS/OEIS.

The Navy previously completed an EIS/OEIS in 2015, for which a Record of Decision was signed in October 2016, for at-sea training and testing activities occurring within the Study Area. The supplement to the 2015 Final EIS/OEIS is being prepared to support ongoing and future activities conducted at sea within the Study Area beyond 2020. Proposed training and testing activities are generally consistent with those analyzed in the 2015 Final EIS/OEIS and are representative of activities the Navy has been conducting in the Study Area for decades.

The Supplemental EIS/OEIS will include an analysis of training and testing activities using new information available after the release of the 2015 Final EIS/OEIS. New information includes an updated acoustic effects model, updated marine mammal density data, and evolving and emergent best available science. As part of this process, the Navy will seek the issuance of federal regulatory permits and authorizations under the Marine Mammal Protection Act and the Endangered Species Act to support ongoing and future at-sea military readiness activities within the Study Area beyond 2020.

Proposed Action:

The Proposed Action is to conduct at-sea training and testing activities within the Study Area. Activities include the use of active sound navigation and ranging (sonar) and explosives while employing marine species protective mitigation measures.

The purpose of the Proposed Action is to maintain a ready force, which is needed to ensure the Navy can accomplish its mission to maintain, train, and equip combat-ready naval forces capable of winning wars, deterring aggression, and maintaining freedom of the seas, consistent with Congressional direction in section 5062 of Title 10 of the U.S. Code.

To achieve and maintain military readiness, the Navy proposes to:

-more-

Figure 8.2-4: Scoping Press Release

NWTT SUPPLEMENTAL EIS/OEIS -2-

- Conduct at-sea training and testing activities at levels required to support military readiness requirements beyond 2020; and
- Accommodate evolving mission requirements, including those resulting from the development, testing, and introduction of new vessels, aircraft, and weapons systems into the fleet.

The Study Area remains unchanged since the 2015 Final EIS/OEIS. The Study Area is comprised of established maritime operating areas and warning areas in the northeastern Pacific Ocean, including areas within the Strait of Juan de Fuca, Puget Sound, and the Western Behm Canal in southeastern Alaska. The Study Area includes air and water space within and outside Washington state waters, air and water space outside state waters of Oregon and Northern California, and Navy pierside locations where sonar maintenance and testing occur. In the supplement to the 2015 Final EIS/OEIS, the Navy will only analyze those training and testing activities conducted at sea within the Study Area.

Scoping Comment Period for the Supplemental EIS/OEIS:

The 30-day scoping comment period begins Aug. 22, 2017 through Sept. 21, 2017. Comments must be postmarked or received online by **Sept. 21, 2017** for consideration in the development of the Draft Supplemental EIS/OEIS. Comments may be submitted online at **www.NWTTEIS.com**, or by mail to:

Naval Facilities Engineering Command Northwest
Attention: NWTT Supplemental EIS/OEIS Project Manager
3730 North Charles Porter Ave., Building 385
Oak Harbor, WA 98278-3500

Scoping meetings are not being held at this stage of the process because the Proposed Action does not differ substantially from the 2015 Final EIS/OEIS. However, public meetings are planned to occur following the release of the Draft Supplemental EIS/OEIS in early 2019. For additional project information, please visit the project website at **www.NWTTEIS.com.**

Please help inform your community by sharing the information in this press release.

Should you have trouble accessing the project website, please email ProjectManager@nwtteis.com for assistance. For other information about your Navy in the Northwest Region, please visit the Navy Region Northwest website at www.cnic.navy.mil/cnrnw.

-USN-

Figure 8.2-4: Scoping Press Release (continued)

COMMANDER,
NAVY REGION NORTHWEST

Public Affairs Office
1100 Hunley Road, Silverdale, WA 98315-1100
Phone: 360-396-1630 Fax: 360-396-7127

FOR IMMEDIATE RELEASE **Sept. 15, 2017**
Release #17-258

NAVY EXTENDS PUBLIC SCOPING COMMENT PERIOD FOR NORTHWEST TRAINING AND TESTING SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT

SILVERDALE, Wash. — The U.S. Navy is extending the public scoping comment period for the Northwest Training and Testing (NWTT) Supplemental Environmental Impact Statement/ Overseas Environmental Impact Statement (EIS/OEIS) through Oct. 6, 2017, to allow the public more time to submit substantive comments. Scoping, which is conducted in accordance with the National Environmental Policy Act, is a process where the public is encouraged to participate in the development of an environmental impact statement by identifying the scope of the analysis, including potential environmental issues and viable alternatives.

The Navy is preparing a supplement to the 2015 NWTT Final EIS/OEIS to assess the potential environmental effects associated with military readiness activities conducted within the NWTT EIS/OEIS Study Area (hereafter referred to as the "Study Area"). Military readiness activities include training and research, development, testing, and evaluation (hereafter referred to as "training and testing").

Scoping Comment Period Extension for the Supplemental EIS/OEIS:

The Navy is accepting comments throughout the extended public comment period, which began Aug. 22. 2017, and now runs until Oct. 6, 2017. All comments must be postmarked or received online by **Oct. 6, 2017**, for consideration in the development of the Supplemental EIS/OEIS. Comments may be submitted online at **www.NWTTEIS.com**, or by mail to:

Naval Facilities Engineering Command Northwest
Attention: NWTT Supplemental EIS/OEIS Project Manager
3730 North Charles Porter Ave., Building 385
Oak Harbor, WA 98278-3500

Public meetings are planned to occur following the release of the Draft Supplemental EIS/OEIS in early 2019. For additional project information, please visit the project website at **www.NWTTEIS.com**.

Background:

The Navy completed an EIS/OEIS in 2015 for training and testing activities occurring within the same Study Area, for which a Record of Decision was signed in October 2016. The supplement to the 2015 Final EIS/OEIS is being prepared to support future activities conducted at sea and in associated airspace within the same Study Area beyond 2020. As part of this process, the Navy will seek the issuance of federal regulatory permits and authorizations under the Marine Mammal Protection Act and Endangered Species Act. Proposed training and testing activities are generally

-more-

Figure 8.2-5: Scoping Comment Extension Press Release

NWTT Supplemental EIS/OEIS -2-2-2

consistent with those analyzed in the previous EIS/OEIS and approved in the 2016 Record of Decision, and are representative of activities the Navy has been conducting in the Study Area for decades.

Proposed Action:

The Proposed Action is to conduct training and testing activities at sea and in associated airspace within the Study Area. At-sea activities include the use of active sound navigation and ranging (sonar) and explosives while employing marine species protective measures.

The purpose of the Proposed Action is to maintain a ready force, which is needed to ensure the Navy can accomplish its mission to maintain, train, and equip combat-ready naval forces capable of winning wars, deterring aggression, and maintaining freedom of the seas, consistent with Congressional direction in section 5062 of Title 10 of the U.S. Code.

To achieve and maintain military readiness, the Navy proposes to:

- Conduct training and testing activities at sea and in associated airspace to support military readiness requirements beyond 2020; and
- Accommodate evolving mission requirements, including those resulting from the development, testing, and introduction of new vessels, aircraft, and weapons systems into the fleet.

The Study Area remains unchanged from the 2015 Final EIS/OEIS. The Study Area is comprised of established maritime operating areas and warning areas in the northeastern Pacific Ocean, including areas within the Strait of Juan de Fuca, Puget Sound, and the Western Behm Canal in southeastern Alaska. The Study Area includes air and water space within and outside Washington state waters, air and water space outside state waters of Oregon and Northern California, and Navy pierside locations.

Visit the project website at **www.NWTTEIS.com** to view a map of the Study Area, learn more about the project, and submit substantive comments online.

Should you have trouble accessing the project website, please email ProjectManager@nwtteis.com for assistance. For other information about your Navy in the Northwest Region, please visit the Navy Region Northwest website at www.cnic.navy.mil/cnrnw.

Please help inform your community by sharing the information in this press release.

-USN-

Figure 8.2-5: Scoping Comment Extension Press Release (continued)

8.2.1.5 Subscriber Email Notifications

Email subscribers from Phase II were carried forward into Phase III to start with 166 initial website subscribers. An email notification was sent to these 166 website subscribers August 22, 2017, announcing the Navy's Intent to Prepare a Draft Supplemental. A second email notification was sent to 181 website subscribers September 15, 2017. The email informed the subscribers of the public scoping comment period extension dates.

8.2.2 Summary of Public Scoping Comments

Scoping comments were submitted in two ways:

- Written letters (received any time during the public comment period).
- Comments submitted directly on the project website (received any time during the public comment period).

The Navy received written and electronic comments from federal agencies, state agencies, federally recognized tribes, nongovernmental organizations, individuals, and community groups. A total of 786 comments were received. Seven hundred forty-five comments were submitted using the electronic comment form on the project website. Forty-one written comments were mailed. A sampling of some of the specific areas of concerns follows.

8.2.2.1 Proposed Action and Alternatives

- Need for clarity on the Navy's Proposed Action.
- Overview requested on how the Proposed Action fits within the broader Department of Defense training and testing occurring throughout the Pacific Northwest, western regions and states, marine coastal and oceanic environments, and Alaska.
- Concern about expansion.
- Opposition to expansion of the use of sonar and explosives.
- Concern about the impacts of dipping sonar.
- Concern for activities that are perceived as a waste of taxpayer dollars.
- Concern about the Navy conducting war games in the Pacific Northwest and creating war zones in the area.
- Recommendation to evaluate the efficacy of sonar with computer modeling rather than performing experiments in the ocean.
- Consider an alternative that maximizes opportunities to limit sound exposures to marine mammals to a level that would likely result in behavioral harassment only.
- Include a range of alternatives that meet the stated purpose and need, goals and objectives, and responds to issues identified during the scoping process.
- Encourage selection of alternatives that protect, restore, and enhance the environment.
- Provide greater details on whether Navy exercises would expand onto public beaches.
- Develop reasonable alternatives that inform decision-makers and the public of how the agencies can, in accordance with Council on Environmental Quality regulations, avoid or minimize adverse impacts or enhance the quality of the human environment.
- Evaluate an alternative that would exclude ocean waters off the California coast from all training and testing.

- Request for the Navy to broadly define the scope of the project and re-evaluate the spectrum of naval training exercises conducted in the Pacific Northwest.

8.2.2.2 National Environmental Policy Act and Public Involvement

- Request for a 60-day comment period extension.
- Request the Navy issue revised notices clarifying specific actions the Navy will analyze in this Supplemental to provide clarity on the scope of analysis.
- Request the Navy issue a revised Notice of Intent mentioning the Proposed Action's potential effects and proximity to Olympic National Park.
- Objection to developing a Supplemental rather than a new EIS/OEIS.
- Determination of whether a revised or updated Coastal Zone Management Act compliance document is required.
- Request Navy invite U.S. Fish and Wildlife Service, National Park Service, and U.S. Forest Service to be cooperating agencies to more comprehensively evaluate impacts.

8.2.2.3 Location of Activities

- Request the Navy research other locations for training and testing.
- Request to use other areas where the Navy trains and conducts tests, and not in the marine waters of the Pacific Northwest, Alaska, and California.
- Concern about ocean areas off the Northern California coast being used for chemical tests.
- Recommendation that the Navy not test live ammunition or explosions of aerial or underwater ordnance.
- Evaluate alternate areas that would have less impact on residents and economy.

8.2.2.4 Segmentation

- Request to conduct EISs associated with the geographic area being impacted, rather than by broad resource category.
- Concern the Navy is segmenting and limiting its analysis to individual training exercises or actions to characterize its activities as minimal.
- Request aircraft training be split into a separate analysis to allow the public to engage in a more meaningful way.
- Provide information on impacts of the EA-18G Growlers in the analysis.

8.2.2.5 Environmental Impact Analysis

- Evaluate direct and indirect impacts.
- Recommend a detailed table identifying the proposed type and frequency of specific potential stressors be developed; provide to the public in advance of the release of the Draft Supplemental.
- Monitor depleted uranium in the ocean.
- Evaluate impacts of aircraft noise and the use of sonar and live explosives on humans, animals, and marine life.
- Request for comparison of baseline activities versus proposed activities.

- Concerns that training and testing exercises involving marine vessels and aircraft, explosives, electromagnetic devices, or sonar technology have the potential to negatively impact terrestrial and marine resources and diminish visitor enjoyment of national parks in the Pacific Northwest.
- Natural and cultural resources and visitor experience in three units of the National Park System may be impacted by the activities identified in this Supplemental and should be evaluated in detail:
  - Ebey's Landing National Historical Reserve,
  - Olympic National Park, and
  - San Juan Island National Historical Park.
- Request for appropriate density estimates for expended training debris, which should be calculated using the footprint area of the specific exercise.
- Focus impact discussion on specific resources and locales and avoid basing significance conclusions on averaging impacts over large areas of ocean.
- Avoid equating a lack of information with a lack of impact.
- Use project-specific thresholds to determine levels of impact to focus analysis on potentially significant environmental impacts.
- Concern over aircraft training and expansion of training areas over Olympic National Park.
- Concern that the disruption to National Parks would result in increased noise complaints from the public.
- Assess impacts of alternative on the resources and values of Olympic National Park.
- Develop and fully analyze alternatives that avoid aviation training over Olympic National Park and that minimize impacts on the Park.
- Include Olympic National Park World Heritage Site and the International Biosphere Reserve designation of Olympic National Park in the analysis.

8.2.2.6 Cumulative Impacts

- Assess cumulative impacts of naval activities on marine biota.
- Assess impacts at sea and throughout the region.
- Characterize resources, ecosystems, and communities in terms of their response to change and capacity to withstand stress.

8.2.2.7 Sediments and Water Quality Impacts

- Discuss the applicability of national standards under development by the Environmental Protection Agency under Section 312(n) of the Clean Water Act to establish the Uniform National Discharge Standards to control discharges incidental to the normal operation of military vessels.
- Include relevant updates to the fate, transport, and bioaccumulation of toxics in expended materials.
- Include relevant updates on areas that contain hazardous materials, and evaluate the potential for training and testing to resuspend contaminants.
- Evaluate whether the Navy is putting depleted uranium into marine waters.
- Concerns for groundwater or other contamination associated with Navy operations on Whidbey Island.

8.2.2.8 Air Quality

- Quantify the contribution of carbon pollution from projected military activities.
- Concerns about aerosol spraying and resulting impacts on critical habitat and species.
- Include in the scope of the analysis the greenhouse gas emissions resulting from the project, and all the effects of those emissions, including ocean acidification, climate change, and loss of species.
- Consider in the analysis the following:
    - Any adverse impact on air-quality-related values in a federal Class I area or state wilderness area.
    - Whether there are annual emissions greater than the basic Prevention of Significant Deterioration emission thresholds.
    - Any new violation of state or federal ambient air quality standards.
    - Interference with the maintenance or attainment of any state or federal ambient air quality standard in the project area.
    - Increases in the frequency or severity of existing violations of state or federal ambient air quality standard in the analysis area.
    - Exposure of nearby populations to increased levels of diesel particulate matter and other air toxics.
    - Delays in the timely attainment of any standard, interim emission reduction, or other air quality milestone.
    - Exposure of sensitive receptors to substantial pollutant concentrations.

8.2.2.9 Airborne Noise

- Develop on-the-ground noise data instead of a model.
- Include health impacts from noise, including effects of post-traumatic stress disorder.
- Analyze Growler noise complaints and impacts noise would have on tourism, residents, health, and quality of life.
- Recognize predicted noise and actual noise produced by aircraft deviates significantly.
- Concerns that models are producing wrong results.
- Request the Navy fund the collection of baseline ambient acoustic data in Olympic National Park and include the results in this Supplemental.
- Request to continue Navy flight training in Montana and other locations already disrupted by jet noise.
- Impact of aircraft and helicopter noise on farm animals and other species found in National Parks, such as the Olympic marmot.
- Analyze the impact noise would have on property values.
- Analyze effects related to the scenic, aesthetic, and cultural components of the Olympic Peninsula, including impacts on visitors to Olympic National Park who are seeking solitude and/or natural ambient noise levels.
- Analyze the impacts on nesting colonies of gulls as a result of aircraft noise over Lopez Island.

8.2.2.10 Socioeconomic Resources

- Evaluate economic impacts on tourism, property values, health, and well-being.
- Impacts on commercial fishing industry.

8.2.2.11 Terrestrial Species and Habitats/Marine Birds

- Concern that the analysis may be limited to just effects at sea, but proposed analysis of impacts on terrestrial environments should be included.
- Analyze the impacts on terrestrial species from Navy overflights.
- Impacts on wildlife that may experience increased and prolonged stress levels.

8.2.2.12 Marine Resources

- Evaluate the pollution from activities in marine waters, and state what pollutants are being added to marine waters from Navy activities.
- Concerns about disruption to the marine environment and marine species, especially from the use of active sonar and explosives.
- Refrain from measuring impacts on the marine environment according to whether population impacts would occur; harm to smaller areas and groups should be considered.
- Analyze how stressors affect habitat, as well as the physiology and behavior of marine life.
- Revise thresholds and weighting system for auditory impacts.
- Revise behavioral impact thresholds to incorporate best available science.

8.2.2.13 Marine Mammal Impacts

- Request for the Navy and National Marine Fisheries Service to include information needed to evaluate compliance with the Marine Mammal Protection Act/Endangered Species Act.
- Concerns that the Navy lies about marine species takes and mortalities to gain permits from federal agencies.
- Concerns on incidental takes and general impacts on marine species.
- Analyze the impact of pinniped colonies found near Lopez Island as a result of aircraft noise.
- Impacts on the ocean food chain due to the loss of large mammals.
- Concern that low-frequency active sonar systems violate the Marine Mammal Protection Act.

8.2.2.14 Fish/Marine Habitat

- Impacts on migrating salmon populations, damage to honing mechanisms, and takes of endangered species, including salmon and steelhead.
- Analyze impacts of noise on fish and stress hormone production from sound.
- Reach out to the Alaska Ocean Observing System for fish population/migration data.
- Incorporate latest understanding of important marine habitats reflected in current management documents.

8.2.2.15 American Indian and Alaska Native Traditional Resources

- Concerns about the evaluation of impacts on the cultural resources, and areas of importance.
- Consider impacts on cultural practices, which have religious and spiritual meaning.
- Request for best available science to include Tribal Traditional Knowledge.

- Request the Navy continue to fulfill its obligation for meaningful government-to-government tribal consultation.
- Concern about impacts on usual and accustomed treaty rights.
- Consider a tribe's human-environmental relationship.
- Consider the economic impact on the tribe.
- Concern about diminished treaty rights.
- Evaluate the possible disruption to tribal cultural practices.
- Determine impacts of noise on the cultural landscape.
- Impacts on salmon and other fish that provide subsistence to neighboring indigenous populations.

8.2.2.16 Public Health and Safety

- Determine public health effects from chaff and other toxins.
- Determine impacts from exposure to electromagnetic radiation.

8.2.2.17 Mitigation Measures

- Recommendations to establish additional mitigation areas (geographic) and time-area management (temporal) areas.
- Provide specific clean up measures that will be taken on the terrestrial and marine environment.
- Recommendation to use thermal detection for marine species.
- Concerns about inefficiencies and inadequacies of human Lookouts, and requests to analyze the effectiveness of visual monitoring.
- Move training and testing activities outside of the annual gray whale migration path, and suspend training activities during gray whale migration.
- Recommendation for Navy to engage in direct dialogue with the trawling community and develop a mutually acceptable warning system to alert trawlers when submarines are operating in the area.
- Follow current mitigation measures, including but not limited to:
  - Do not operate at night or in specific ocean areas.
  - Conduct air flights to search for species.
  - Do not operate when a species is within a certain range.
  - Do not operate when bow-riding dolphins are present.
  - Operate at less than full power.
  - Reduce speeds as directed.
- Reduce impacts to the lowest possible level.
- Provide training to Navy personnel on a tribe's history, culture, and subsistence uses.
- Consider habitat-based management and important feeding areas.
- Concerns that cultural mitigation measures are inadequate.
- Avoid areas of biological and ecological importance.
- Include an adaptive management plan, including monitoring the effectiveness of mitigation commitments.
- Include more monitoring results in this Supplemental.
- Include the public in mitigation planning.

8.3 Draft Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement Public Review and Comment Period

The Draft Supplemental public review and comment period began with issuance of the Notice of Availability (84 FR 11972) and Notice of Public Meetings (84 FR 11936) in the *Federal Register* March 29, 2019. At the request of U.S. Representative Derek Kilmer, Washington's Sixth Congressional District, the Navy extended the public comment period by 15 days to June 12, 2019, and notices announcing the extension of the public review and comment period were published in the *Federal Register* April 18, 2019 (84 FR 16250), and April 26, 2019 (84 FR 17826). The *Federal Register* notices included notification of the availability of the Draft Supplemental and where it can be accessed; an overview of the Proposed Action and its purpose and need; public commenting information; and the locations, dates, and times of public meetings. Comments were accepted by mail, through the project website at www.NWTTEIS.com, and at the public meetings. *Federal Register* notices can be found in Appendix G (*Federal Register* Notices).

8.3.1 Notification of the Draft Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement Public Review and Comment Period and Public Meetings

The Navy made significant efforts to notify the public of the release of the Draft Supplemental and the dates and locations of public meetings to maximize participation during the Draft Supplemental public review and comment period. A summary of these efforts follows.

8.3.1.1 Notification Letters

Tribal notification letters, which included a copy of the Draft Supplemental on CD-ROM, were mailed priority mail March 27, 2019, to a total of 56 tribal chairpersons and presidents of American Indian and Alaska Native tribes across the NWTT Study Area. Stakeholder letters were mailed first class March 28, 2019, to 607 federal, state, and local government agencies and elected officials. A unique letter was sent to the Washington State Historic Preservation Officer March 27, 2019. The mailing list was created using stakeholders and federally recognized tribes identified during Phase II, including all commenters and meetings attendees; Phase III Scoping commenters; and potential stakeholders and federally recognized tribes from previous Navy projects in the Pacific Northwest and Alaska. Entities that received the notification letters are listed in Table 8.3-1, and Figure 8.3-1 provides an example of the notification letter.

Table 8.3-1: Entities that Received the Draft Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement Notification Letters

Federally Recognized Tribes and Tribal Groups	
Big Lagoon Rancheria, California Cahto Tribe of the Laytonville Rancheria Central Council of the Tlingit and Haida Indian Tribes Cher-Ae Heights Indian Community of the Trinidad Rancheria, California Confederated Tribes and Bands of the Yakama Nation Confederated Tribes of Grand Ronde Community of Oregon Confederated Tribes of Siletz Indians of Oregon Confederated Tribes of the Chehalis Reservation	Pinoleville Pomo Nation, California Port Gamble S'Klallam Tribe Potter Valley Tribe, California Puyallup Tribe of the Puyallup Reservation Quileute Tribe of the Quileute Reservation Quinault Indian Nation Redwood Valley Little River Band of Pomo Indians Resighini Rancheria, California Robinson Rancheria Round Valley Indian Tribes, Round Valley Reservation, California

Confederated Tribes of the Coos, Lower Umpqua and Siuslaw Indians Coquille Indian Tribe Cow Creek Band of Umpqua Tribe of Indians Cowlitz Indian Tribe Coyote Valley Band of Pomo Indians of California Elk Valley Rancheria, California Hoh Indian Tribe Hoopa Valley Tribe, California Hopland Band of Pomo Indians, California InterTribal Sinkyone Wilderness Council Jamestown S'Klallam Tribe Karuk Tribe Ketchikan Indian Corporation Lower Elwha Tribal Community Lummi Tribe of the Lummi Reservation Makah Indian Tribe of the Makah Reservation Metlakatla Indian Community, Annette Island Reserve Muckleshoot Indian Tribe Nisqually Indian Tribe Nooksack Indian Tribe Organized Village of Saxman	Samish Indian Nation Sauk-Suiattle Indian Tribe Scotts Valley Band of Pomo Indians of California Sherwood Valley Rancheria of Pomo Indians of California Shoalwater Bay Indian Tribe of the Shoalwater Bay Indian Reservation Skokomish Indian Tribe Snoqualmie Indian Tribe Squaxin Island Tribe of the Squaxin Island Reservation Stillaguamish Tribe of Indians of Washington Suquamish Indian Tribe of the Port Madison Reservation Swinomish Indian Tribal Community Tolowa Dee-ni' Nation Tulalip Tribes of Washington Upper Skagit Indian Tribe Wiyot Tribe, California Yurok Tribe of the Yurok Reservation, California
Federal Elected Officials and Federal Agencies	

U.S. Senators (Washington, Oregon, California, Alaska) and Staff
U.S. Representatives (Alaska at large; California Districts 1, 2, 5; Oregon Districts 1, 2, 3, 4, 5; Washington Districts 1, 2, 3, 6, 7, 8, 9) and Staff
Battelle Pacific Northwest Laboratory
Bureau of Indian Affairs
    Northwest Regional Office
Bureau of Land Management
    Coos Bay District Office
    Oregon/Washington State Office
    San Juan Islands National Monument
    Spokane District Office
Bureau of Ocean Energy Management
    Pacific Outer Continental Shelf Region
Bureau of Safety and Environmental Enforcement
    Office of Offshore Regulatory Programs
Federal Aviation Administration
    Office of Policy, International Affairs, Environment and Energy
    Western-Pacific Region
Fisheries and Oceans Canada
    Pacific Region
Marine Mammal Commission
National Marine Protected Areas Center
National Park Service
    Olympic National Park
    Pacific West Region
National Oceanic and Atmospheric Administration
    National Marine Fisheries Service
        Arcata Field Office	

Northwest Regional Office
Northwest Fisheries Science Center
Office of Protected Resources
Endangered Species Act Interagency Cooperation Division
Marine Mammal Permitting
West Coast Region
Oregon Office
Southwest Oregon Habitat Branch
Washington Coast/Lower Columbia Habitat Branch
Washington Habitat Branch
Office of Law Enforcement Olympic Coast National Marine Sanctuary
Advisory Council
Pacific Fishery Management Council
U.S. Army Corps of Engineers
U.S. Army National Guard
U.S. Coast Guard
District 13
District 17
Office of Environmental Management
Office of Operating and Environmental Standards
U.S. Department of Agriculture Forest Service
Olympic National Forest
Pacific Northwest Region
U.S. Department of Commerce
U.S. Department of the Interior
Regional Office (Portland)
U.S. Environmental Protection Agency Region X
Environmental Review & Sediment Management Unit
National Environmental Protection Agency Compliance Division
Puget Sound Federal Caucus
U.S. Geological Survey
Alaska Science Center
California Water Science Center
Western Fisheries Research Center
Western Region Office
U.S. Fish and Wildlife Service
Arcata Office
Pacific Region
Region 7
Washington Maritime Wildlife Refuge Complex
Western Washington Office
Consultation & Conservation Planning Division
Quilcene National Fish Hatchery
(DCS 1) State Elected Officials and State Agencies
Office of the Governor (Washington, Oregon, California, Alaska) and Staff
State Senators (Washington Districts 1, 2, 7, 10, 19, 21, 23, 24, 25, 26, 27, 28, 29, 31, 32, 35, 38, 39, 44; Oregon Districts 1, 5, 16, 28, 29; California Districts 1, 2, 4; Alaska Districts A, B, C) and Staff
State Representatives (Washington Districts 1, 2, 7, 10, 19, 21, 23, 24, 25, 26, 27, 28, 29, 31, 32, 35, 38, 39, 44; Oregon Districts 1, 9, 10, 31, 32, 57; California District 1; Alaska Districts 1, 2, 3, 4, 5) and Staff
Alaska Department of Commerce
Community and Economic Development
Division of Community and Regional Affairs

Alaska Department of Environmental Conservation
- Division of Administrative Services
- Division of Air Quality
- Division of Environmental Health
- Division of Spill Prevention and Response
- Division of Water

Alaska Department of Fish & Game
- Commercial Fisheries Division
- Division of Wildlife Conservation
- Habitat
- Sport Fish Division
- Sport Fishing
- Subsistence

Alaska Department of Military & Veterans Affairs

Alaska Department of Natural Resources
- Division of Forestry
- Division of Geological & Geophysical Surveys
- Division of Mining, Land, and Water
- Division of Oil and Gas
- Division of Parks and Outdoor Recreation
- Office of History and Archaeology
- Public Information Center

Alaska Department of Transportation & Public Facilities
- Division of Ports and Harbors
- Division of Statewide Aviation

Alaska Marine Highway

California Coastal Commission

California Department of Fish and Wildlife

California Department of Toxic Substances Control

California Environmental Protection Agency

California Natural Resources Agency

Ebey's Landing National Historic Reserve

Oregon Department of Environmental Quality
- Water Quality

Oregon Department of Fish and Wildlife

Oregon Department of Forestry

Oregon Department of Land Conservation and Development

Oregon Department of State Lands

Oregon Military Department
- Public Affairs Office

Oregon Parks and Recreation Department

Oregon Water Resources Department

Pacific States Marine Fisheries Commission

Puget Sound Partnership

Regulatory Commission of Alaska

Washington Coastal Marine Advisory Council

Washington State Department of Agriculture
- Policy and Communications

Washington State Department of Archaeology & Historic Preservation

Washington State Department of Ecology
- Northwest Regional Office
- Shorelands and Environmental Assistance Program
- Southwest Regional Office

Washington State Department of Fish and Wildlife, Region 6 Washington State Department of Natural Resources Washington State Fish and Wildlife Commission Washington State Parks and Recreation Commission
Local Elected Officials and Local Agencies
Central Whidbey Island Fire & Rescue Station 53 City of Aberdeen City of Anacortes Building Department City of Bainbridge Island City of Bremerton City of Everett City of Forks City of Gig Harbor City of Hoquiam City of Oak Harbor City of Oak Harbor Planning Services Division City of Ocean Shores City of Port Angeles City of Port Orchard City of Port Townsend City of Poulsbo City of Sequim City of Shelton City of Tacoma City of Westport Clallam County Board of Commissioners Friday Harbor Airport Grays Harbor County Board of Commissioners Island County Board of Commissioners Jefferson County Board of Commissioners Kitsap County Board of Commissioners Mason County Pacific County Board of Commissioners Pierce County Council San Juan County Council Snohomish County Council
Oregon State
City of Astoria City of Bandon City of Bay City City of Brookings City of Cannon Beach City of Coos Bay City of Depoe Bay City of Garibaldi City of Gearhart City of Gold Beach City of Lakeside City of Lincoln City City of Manzanita City of Nehalem City of Newport

- City of North Bend
- City of Port Orford
- City of Reedsport
- City of Rockaway Beach
- City of Seaside
- City of Tillamook
- City of Waldport
- City of Warrenton
- City of Wheeler
- City of Yachats
- Clatsop County Board of Commissioners
- Coos County Board of Commissioners
- Curry County Board of Commissioners
- Depoe Bay Nearshore Action Team
- Lane County Board of Commissioners
- Lincoln County
- Tillamook County Board of Commissioners
- Office of Lincoln County Legal Counsel
- Port Orford Watershed Council

California State

- City of Arcata
- City of Crescent City
- City of Eureka
- City of Fort Bragg
- City of Point Arena
- City of Trinidad
- Del Norte County Board of Supervisors
- Humboldt County Board of Supervisors
- Humboldt County Democratic Central Committee
- Mendocino County Board of Supervisors

Alaska State

- City of Ketchikan
- Ketchikan Gateway Borough

DEPARTMENT OF THE NAVY
COMMANDER
UNITED STATES PACIFIC FLEET
250 MAKALAPA DRIVE
PEARL HARBOR, HAWAII 96860-3131

IN REPLY REFER TO:
5090
Ser N465/0352
March 22, 2019

Dear Sir or Madam:

SUBJECT: NOTICE OF AVAILABILITY OF THE NORTHWEST TRAINING AND TESTING DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT AND PUBLIC MEETING ANNOUNCEMENT

This letter is to inform you that the Department of the Navy (Navy) has prepared a draft supplement to the 2015 Northwest Training and Testing (NWTT) Final Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) to assess the potential environmental impacts associated with military readiness activities within the NWTT Study Area, referred to as the "Study Area." Military readiness activities include training and research, development, testing, and evaluation activities, referred to as "training and testing." The Navy welcomes your review and comments on the Draft Supplemental EIS/OEIS.

In October 2015, the Navy completed an EIS/OEIS for training and testing activities occurring within the Study Area from 2015 through 2020, for which a Record of Decision was signed in October 2016. The supplement to the 2015 NWTT Final EIS/OEIS supports proposed ongoing and future activities conducted at sea and in associated airspace within the Study Area beyond 2020. Proposed activities are similar to those conducted in the Study Area for decades and analyzed in the 2015 document.

In the Draft Supplemental EIS/OEIS, the Navy evaluated new, relevant information, such as more recent marine mammal density data and new scientific information, and updated the environmental analyses as appropriate. The Navy prepared the Draft Supplemental EIS/OEIS to support the issuance of federal regulatory permits and authorizations under the Marine Mammal Protection Act and the Endangered Species Act.

The Study Area remains unchanged since the 2015 analysis, and is comprised of established maritime operating areas and warning areas in the northeastern Pacific Ocean, including areas within the Strait of Juan de Fuca, Puget Sound, and the Western Behm Canal in southeastern Alaska. The Study Area includes air and water space within and outside Washington state waters and established special use airspace, Navy pierside and harbor locations within Washington state waters, and air and water space outside the state waters of Oregon and Northern California (Enclosure 1).

Figure 8.3-1: Stakeholder Letter for the Notification of Availability of the Draft Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement

5090
Ser N465/0352
March 22, 2019

The Navy's Proposed Action includes the continued use of active sound navigation and ranging, known as sonar, and explosives while employing marine species mitigation measures. The purpose of the Proposed Action is to conduct training and testing activities to ensure the Navy can accomplish its mission to maintain, train, and equip combat-ready naval forces capable of winning wars, deterring aggression, and maintaining freedom of the seas, consistent with Congressional direction in section 8062 of Title 10 of the U.S. Code.

To achieve and maintain military readiness, the Navy proposes to:

- Conduct training and testing activities, at sea and in associated airspace, at levels required to support military readiness requirements beyond 2020.
- Accommodate evolving mission requirements, including those resulting from the development, testing, and introduction of new vessels, aircraft, and weapons systems into the fleet.

The Navy will hold eight open house public meetings to provide information, answer questions, and give the public an opportunity to comment on the Draft Supplemental EIS/OEIS. The public may arrive at any time between 5 and 8 p.m., as there will not be a presentation or public oral comment session. A stenographer will be available for the public to facilitate one-on-one oral comments; written comments can be submitted at any time during the meetings.

Concurrent with the National Environmental Policy Act public involvement process, the Navy is identifying additional consulting parties to participate in the Section 106 process under the National Historic Preservation Act regarding potential effects of the Proposed Action and alternatives on historic properties. Historic properties include districts, sites, buildings, structures, or objects listed or eligible for listing in the National Register of Historic Places. During each of the public meetings, an information station will be available where individuals can learn more about the Section 106 process.

Open house public meetings will be held from 5 to 8 p.m., at the following locations:

Date: **Wednesday, April 24, 2019**
Location: Hampton Inn Seattle/Everett Downtown Salish Room
2931 W. Marine View Drive
Everett, WA

Date: **Thursday, April 25, 2019**
Location: Ridgetop Middle School Cafeteria
10600 Hillsboro Drive NW
Silverdale, WA

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Figure 8.3-1: Stakeholder Letter for the Notification of Availability of the Draft Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement (continued)

5090
Ser N465/0352
March 22, 2019

Date: **Friday, April 26, 2019**
Location: Naval Elks Lodge #353
131 E. First St.
Port Angeles, WA

Date: **Monday, April 29, 2019**
Location: Astoria High School Student Commons
1001 W. Marine Drive
Astoria, OR

Date: **Tuesday, April 30, 2019**
Location: Newport Performing Arts Center Lobby
777 W. Olive Street
Newport, OR

Date: **Thursday, May 2, 2019**
Location: Red Lion Hotel Eureka Ballroom
1929 Fourth Street
Eureka, CA

Date: **Friday, May 3, 2019**
Location: Dana Grey Elementary School Multipurpose Room
1197 Chestnut Street
Fort Bragg, CA

Date: **Wednesday, May 8, 2019**
Location: Ted Ferry Civic Center Naha and Alava Bays
888 Venetia Avenue
Ketchikan, AK

To review the Draft Supplemental EIS/OEIS and for additional project information, including details on the key differences between the 2015 NWTT Final EIS/OEIS and the 2019 Draft Supplemental EIS/OEIS, please visit the project website at **www.NWTTEIS.com**.

The Navy will accept comments throughout the public comment period from March 29, 2019 to May 28, 2019. All comments must be postmarked or received online by **May 28, 2019** for consideration in the Final Supplemental EIS/OEIS. All comments submitted during the comment period will become part of the public record, and substantive comments will be addressed in the Final Supplemental EIS/OEIS.

Comments may be submitted online at **www.NWTTEIS.com**, at the open house public meetings, or by mail to:

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Figure 8.3-1: Stakeholder Letter for the Notification of Availability of the Draft Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement (continued)

5090
Ser N465/0352
March 22, 2019

Naval Facilities Engineering Command Northwest
Attention: NWTT Supplemental EIS/OEIS Project Manager
3730 N. Charles Porter Avenue
Building 385
Oak Harbor, WA 98278-3500

If you would like additional information, please contact Ms. Jackie Queen, NWTT Supplemental EIS/OEIS Project Manager, at projectmanager@nwtteis.com.

Please help the Navy inform the community about the availability of the Draft Supplemental EIS/OEIS and public meetings by sharing this information with your staff and interested individuals.

Sincerely,

D. A. MCNAIR
Director, Environmental Readiness Division
By direction of the Commander

Enclosure: 1. Northwest Training and Testing Study Area

4

Figure 8.3-1: Stakeholder Letter for the Notification of Availability of the Draft Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement (continued)

Enclosure 1: Northwest Training and Testing Study Area

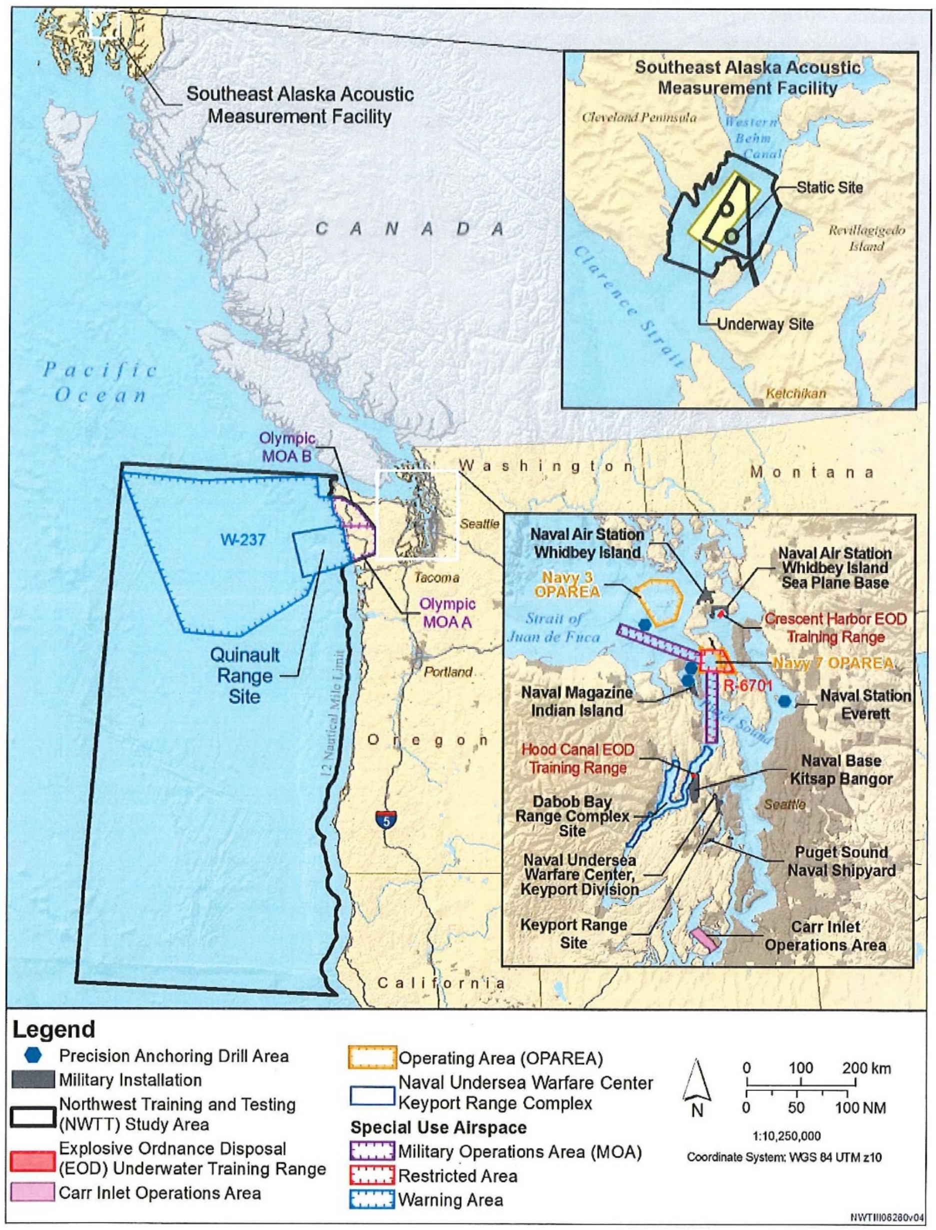


Figure 8.3-1: Stakeholder Letter for the Notification of Availability of the Draft Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement (continued)

8.3.1.2 Postcard Mailers

Postcards were mailed first class March 28, 2019, to a total of 2,205 recipients on the project mailing list, including individuals; federally recognized tribes staff; community and business groups; private companies; media, researchers, and universities; fishing, recreational, and marina groups; and nongovernmental organizations. A second postcard mailer announcing the public review and comment period extension was mailed first class April 22, 2019, to a total of 2,836 recipients, including the individuals and groups from the March 28, 2019, postcard mailing, in addition to the following recipients: federal, state, and local elected officials and government agencies; and federally recognized tribes chairpersons. The postcards included the dates, locations, and times of the public meetings, as well as the project website address for more information, commenting information, and a brief summary of the Proposed Action. The mailing list was created using stakeholders and federally recognized tribes identified during Phase II, including all commenters and meetings attendees; Phase III Scoping commenters; and potential stakeholders and federally recognized tribes from previous Navy projects in the Pacific Northwest and Alaska. The postcard mailers are shown on Figure 8.3-2 and Figure 8.3-3.

NORTHWEST TRAINING AND TESTING
DRAFT SUPPLEMENTAL EIS/OEIS

The U.S. Navy invites you to attend public meetings for the Northwest Training and Testing (NWTT) Draft Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS).

The Navy reassessed the potential environmental impacts associated with conducting proposed ongoing and future training and testing activities within the NWTT Study Area. The Navy welcomes substantive public comments on the Draft Supplemental EIS/OEIS.

You can participate in a variety of ways:

- Visit **www.NWTTEIS.com** to learn more about the project, download a copy of the Draft Supplemental EIS/OEIS, and submit comments online.
- Attend the open house public meetings and provide comments.
- Access the Draft Supplemental EIS/OEIS at public locations listed on **www.NWTTEIS.com**.
- Mail written comments to:
  Naval Facilities Engineering Command Northwest
  Attention: NWTT Supplemental EIS/OEIS Project Manager
  3730 N. Charles Porter Ave., Building 385
  Oak Harbor, WA 98278-3500

Comments must be postmarked or received online by **May 28, 2019**, for consideration in the development of the Final Supplemental EIS/OEIS.

OPEN HOUSE PUBLIC MEETINGS 5 TO 8 P.M.

The public may arrive anytime during the open house public meetings. Navy representatives will be available to discuss the Proposed Action and the Draft Supplemental EIS/OEIS. No presentation or formal oral comment session will be conducted.

WASHINGTON:

Wednesday, April 24, 2019
Hampton Inn Seattle/Everett
Downtown Salish Room
2931 W. Marine View Drive
Everett, Wash.

Thursday, April 25, 2019
Ridgetop Middle
School Cafeteria
10600 Hillsboro Drive NW
Silverdale, Wash.

Friday, April 26, 2019
Naval Elks Lodge #353
131 E. First St.
Port Angeles, Wash.

OREGON:

Monday, April 29, 2019
Astoria High School
Student Commons
1001 W. Marine Drive
Astoria, Ore.

Tuesday, April 30, 2019
Newport Performing Arts
Center Lobby
777 W. Olive St.
Newport, Ore.

NORTHERN CALIFORNIA:

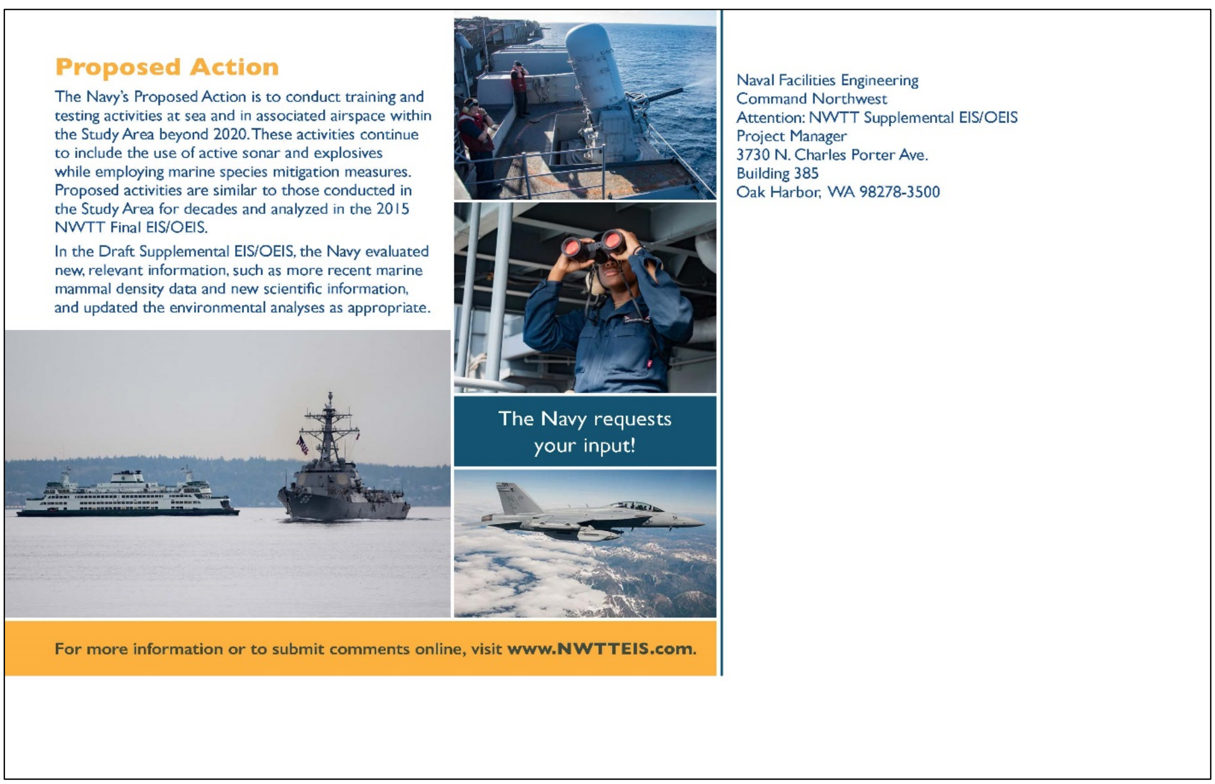
Thursday, May 2, 2019
Red Lion Hotel
Eureka Ballroom
1929 Fourth St.
Eureka, Calif.

Friday, May 3, 2019
Dana Grey Elementary School
Multipurpose Room
1197 Chestnut St.
Fort Bragg, Calif.

SOUTHEASTERN ALASKA:

Wednesday, May 8, 2019
Ted Ferry Civic Center Naha and Alava Bays
888 Venetia Ave.
Ketchikan, Alaska

Individuals requiring reasonable accommodations, please contact Julianne Stanford, Public Affairs Officer, at 360-396-1630 or julianne.stanford@navy.mil.



Proposed Action

The Navy's Proposed Action is to conduct training and testing activities at sea and in associated airspace within the Study Area beyond 2020. These activities continue to include the use of active sonar and explosives while employing marine species mitigation measures. Proposed activities are similar to those conducted in the Study Area for decades and analyzed in the 2015 NWTT Final EIS/OEIS.

In the Draft Supplemental EIS/OEIS, the Navy evaluated new, relevant information, such as more recent marine mammal density data and new scientific information, and updated the environmental analyses as appropriate.

The Navy requests your input!

For more information or to submit comments online, visit **www.NWTTEIS.com**.

Naval Facilities Engineering
Command Northwest
Attention: NWTT Supplemental EIS/OEIS
Project Manager
3730 N. Charles Porter Ave.
Building 385
Oak Harbor, WA 98278-3500

Figure 8.3-2: Notice of Draft Supplemental Public Meetings Postcard Mailer (Front and Back)

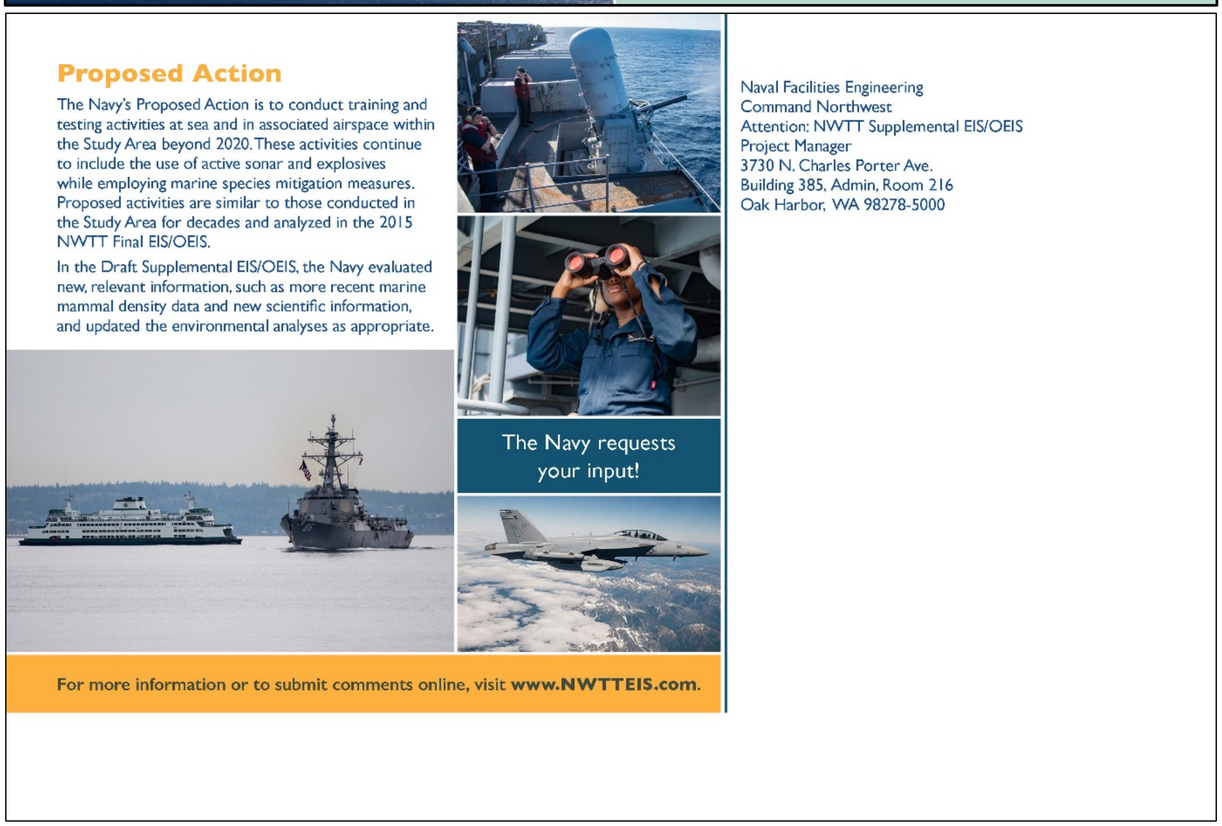


Figure 8.3-3: Notice of Draft Supplemental Comment Period Extension Postcard Mailer (Front and Back)

8.3.1.3 Newspaper Advertisements

To announce the availability of the Draft Supplemental, public meetings, and comment period extension, display advertisements were placed in local newspapers, as shown in Table 8.3-2. The advertisements included a brief description of the Proposed Action, the public meeting dates and locations (meeting location was tailored for each state: Washington, Oregon, Northern California, and southeastern Alaska), the project website address, the duration of the comment period, and information on how to provide comments. Examples of the advertisements that ran in Washington State are shown in Figure 8.3-4 and Figure 8.3-5.

Table 8.3-2: Newspaper Publications for Draft Supplemental Public Review and Comment Period and Extension of Public Comment Period

Newspaper	Newspaper Coverage	Publication Dates
The Juneau Empire	Juneau, Alaska	**Notice of Availability/Notice of Public Meetings:** Friday, March 29, 2019 **Comment Period Extension Notice:** Sunday, May 5, 2019 Tuesday, May 7, 2019 Wednesday, May 8, 2019
Ketchikan Daily News	Ketchikan, Alaska	**Notice of Availability/Notice of Public Meetings:** Friday, March 29, 2019 **Comment Period Extension Notice:** Monday, May 6, 2019 Tuesday, May 7, 2019 Wednesday, May 8, 2019
Eureka Times-Standard	Eureka, California	**Notice of Availability/Notice of Public Meetings:** Friday, March 29, 2019 **Comment Period Extension Notice:** Sunday, April 28, 2019 Wednesday, May 1, 2019 Thursday, May 2, 2019
Fort Bragg Advocate-News	Fort Bragg, California	**Notice of Availability/Notice of Public Meetings:** Thursday, April 4, 2019 Thursday, April 11, 2019 **Comment Period Extension Notice:** Thursday, April 18, 2019 Thursday, April 25, 2019
The Daily Astorian	Astoria, Oregon	**Notice of Availability/Notice of Public Meetings:** Friday, March 29, 2019 **Comment Period Extension Notice:** Thursday, April 25, 2019 Friday, April 26, 2019 Monday, April 29, 2019

Newspaper	Newspaper Coverage	Publication Dates
Newport News-Times	Newport, Oregon	**Notice of Availability/Notice of Public Meetings:** Friday, March 29, 2019 **Comment Period Extension Notice:** Friday, April 19, 2019 Wednesday, April 24, 2019 Friday, April 26, 2019
The Oregonian	Portland, Oregon	**Notice of Availability/Notice of Public Meetings:** Friday, March 29, 2019 **Comment Period Extension Notice:** Friday, April 26, 2019 Saturday, April 27, 2019 Sunday, April 28, 2019
The Daily Herald	Everett, Washington	**Notice of Availability/Notice of Public Meetings:** Friday, March 29, 2019 **Comment Period Extension Notice:** Sunday, April 21, 2019 Tuesday, April 23, 2019 Wednesday, April 24, 2019
The Daily World	Aberdeen, Washington	**Notice of Availability/Notice of Public Meetings:** Saturday, March 30, 2019 **Comment Period Extension Notice:** Saturday, April 20, 2019 Tuesday, April 23, 2019 Thursday, April 25, 2019
Forks Forum	Forks, Washington	**Notice of Availability/Notice of Public Meetings:** Thursday, April 4, 2019 Thursday, April 11, 2019 **Comment Period Extension Notice:** Thursday, April 18, 2019 Thursday, April 25, 2019
Journal of the San Juan Islands	San Juan Island, Washington	**Notice of Availability/Notice of Public Meetings:** Wednesday, April 3, 2019 Wednesday, April 10, 2019 **Comment Period Extension Notice:** Wednesday, April 17, 2019 Wednesday, April 24, 2019
The Kitsap Sun	Kitsap, Washington	**Notice of Availability/Notice of Public Meetings:** Friday, March 29, 2019 **Comment Period Extension Notice:** Sunday, April 21, 2019 Wednesday, April 24, 2019 Thursday, April 25, 2019

Newspaper	Newspaper Coverage	Publication Dates
Peninsula Daily News	Port Angeles, Washington	**Notice of Availability/Notice of Public Meetings:** Friday, March 29, 2019 **Comment Period Extension Notice:** Sunday, April 21, 2019 Thursday, April 25, 2019 Friday, April 26, 2019
Port Townsend and Jefferson County Leader	Port Townsend, Washington	**Notice of Availability/Notice of Public Meetings:** Wednesday, April 3, 2019 Wednesday, April 10, 2019 **Comment Period Extension Notice:** Wednesday, April 17, 2019 Wednesday, April 24, 2019
The Seattle Times	Seattle, Washington	**Notice of Availability/Notice of Public Meetings:** Friday, March 29, 2019 **Comment Period Extension Notice:** Sunday, April 21, 2019 Tuesday, April 23, 2019 Wednesday, April 24, 2019
Sequim Gazette	Sequim, Washington	**Notice of Availability/Notice of Public Meetings:** Wednesday, April 3, 2019 Wednesday, April 10, 2019 **Comment Period Extension Notice:** Wednesday, April 17, 2019 Wednesday, April 24, 2019
Whidbey News-Times	Whidbey Island, Washington	**Notice of Availability/Notice of Public Meetings:** Saturday, March 30, 2019 **Comment Period Extension Notice:** Wednesday, April 17, 2019 Saturday, April 20, 2019 Wednesday, April 24, 2019

The U.S. Navy
INVITES YOU TO PARTICIPATE
in the Northwest Training and Testing
Supplemental EIS/OEIS Public Involvement Process

The U.S. Navy has prepared a Draft Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) to reassess the potential environmental impacts associated with conducting proposed ongoing and future training and testing activities within the Northwest Training and Testing (NWTT) Study Area beyond 2020.

Public Involvement

The Navy welcomes substantive comments on the Draft Supplemental EIS/OEIS. Comments may be submitted at the public meetings, online at **www.NWTTEIS.com**, or by mail to:

Naval Facilities Engineering Command Northwest
Attention: NWTT Supplemental EIS/OEIS Project Manager
3730 N. Charles Porter Ave., Building 385
Oak Harbor, WA 98278-3500

Comments must be postmarked or received online by May 28, 2019, for consideration in the Final Supplemental EIS/OEIS.

Individuals requiring reasonable accommodations, please contact Julianne Stanford, Public Affairs Officer, at 360-396-1630 or julianne.stanford@navy.mil.

Open House Public Meetings: 5 to 8 p.m.

Arrive and submit comments anytime during the open house. No presentation or formal oral comment session will be conducted.

Wednesday, April 24, 2019
Hampton Inn Seattle/Everett Downtown
Salish Room
2931 W. Marine View Drive
Everett, Wash.

Thursday, April 25, 2019
Ridgetop Middle School Cafeteria
10600 Hillsboro Drive NW
Silverdale, Wash.

Friday, April 26, 2019
Naval Elks Lodge #353
131 E. First St.
Port Angeles, Wash.

The draft supplement is available online at www.NWTTEIS.com or at the following public libraries in Washington: Everett Main Library; Gig Harbor Library; Jefferson County Library, Port Hadlock; Kitsap Regional Library, Poulsbo; Kitsap Regional Library, Sylvan Way, Bremerton; North Olympic Library System, Forks Branch; Lopez Island Library; Oak Harbor Public Library; Port Angeles Main Library; Port Townsend Public Library; San Juan Island Library; Timberland Regional Library, Aberdeen; and Timberland Regional Library, Hoquiam. Additional public meetings will be held in Oregon, Northern California, and southeastern Alaska.

Figure 8.3-4: Newspaper Announcement of Draft Supplemental Availability and Public Meetings (Washington State Version)

The U.S. Navy
INVITES YOU TO PARTICIPATE
in the Northwest Training and Testing Supplemental EIS/OEIS
Public Involvement Process
This notice announces a 15-day extension of the public comment period.

The U.S. Navy has prepared a Draft Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) to reassess the potential environmental impacts associated with conducting proposed ongoing and future training and testing activities within the Northwest Training and Testing (NWTT) Study Area beyond 2020.

Public Involvement

The Navy welcomes substantive comments on the Draft Supplemental EIS/OEIS. Comments may be submitted at the public meetings, online at **www.NWTTEIS.com**, or by mail to:

Naval Facilities Engineering Command Northwest
Attention: NWTT Supplemental EIS/OEIS Project Manager
3730 N. Charles Porter Ave., Building 385
Oak Harbor, WA 98278-3500

Comment Period Extended: **Comments must be postmarked or received online by June 12, 2019, for consideration in the Final Supplemental EIS/OEIS.**

Individuals requiring reasonable accommodations, please contact Julianne Stanford, Public Affairs Officer, at 360-396-1630 or julianne.stanford@navy.mil.

The draft supplement is available online at **www.NWTTEIS.com** or at the following public libraries in Washington: Everett Main Library; Gig Harbor Library; Jefferson County Library, Port Hadlock; Kitsap Regional Library, Poulsbo; Kitsap Regional Library, Sylvan Way, Bremerton; Lopez Island Library; North Olympic Library System, Forks Branch; Oak Harbor Public Library; Port Angeles Main Library; Port Townsend Public Library; San Juan Island Library; Timberland Regional Library, Aberdeen; and Timberland Regional Library, Hoquiam. Additional public meetings will be held in Oregon, Northern California, and southeastern Alaska.

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5 to 8 p.m.

Arrive and submit comments anytime during the open house. No presentation or formal oral comment session will be conducted.

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Salish Room
2931 W. Marine View Drive
Everett, Wash.

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Ridgetop Middle School Cafeteria
10600 Hillsboro Drive NW
Silverdale, Wash.

Friday, April 26, 2019
Naval Elks Lodge #353
131 E. First St.
Port Angeles, Wash.

Figure 8.3-5: Newspaper Announcement for Draft Supplemental Comment Period Extension (Washington State Version)

8.3.1.4 Press Releases and Public Service Announcements

Commander, Navy Region Northwest Public Affairs Office distributed a press release to local and regional media outlets (newspapers, television, and radio news stations), ListServs, environmental-related blogs, and congressional staffers March 29, 2019. The press release provided a description of the Proposed Action; project website address; duration of the comment period and commenting methods; information repositories; and location, dates, and times of the public meetings. The press release also provided information on the availability of the Navy to meet with the media in advance of the public meetings. A comment period extension press release was distributed to media outlets April 18, 2019. A third press release, which included the new comment period end date, was distributed to media outlets April 23, 2019. Examples of the press releases are shown in Figure 8.3-6, Figure 8.3-7, and Figure 8.3-8.

A public service announcement was distributed to local television and radio news stations in Washington April 23, 2019; in Oregon April 29, 2019; in Northern California May 2, 2019; and in southeastern Alaska May 6, 2019, to announce the public meeting dates, times, and locations. An example of the Washington State public service announcement is shown in Figure 8.3-9.

COMMANDER,
NAVY REGION NORTHWEST

Public Affairs Office
1100 Hunley Road, Silverdale, WA 98315-1100
Phone: (360) 396-1630 Fax: (360) 396-7127

FOR IMMEDIATE RELEASE **March 29, 2019**
Release #19-0329

NORTHWEST TRAINING AND TESTING DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT AVAILABLE FOR PUBLIC REVIEW AND COMMENT; NAVY TO HOLD OPEN HOUSE PUBLIC MEETINGS

SILVERDALE, Wash — The U.S. Navy has prepared a draft supplement to the 2015 Northwest Training and Testing (NWTT) Final Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) to reassess the potential environmental impacts associated with conducting proposed ongoing and future military readiness activities within the NWTT Study Area, referred to as the "Study Area." Military readiness activities include training and research, development, testing, and evaluation activities, referred to as "training and testing." The Navy welcomes substantive public comments on the Draft Supplemental EIS/OEIS.

Proposed Action:
The Navy's Proposed Action is to conduct training and testing activities at sea and in associated airspace within the Study Area beyond 2020. These activities continue to include the use of active sound navigation and ranging, known as sonar, and explosives while employing marine species mitigation measures. Proposed activities are similar to those conducted in the Study Area for decades and analyzed in the 2015 document.

The purpose of the Proposed Action, which remains the same as the 2015 analysis, is to conduct training and testing activities to ensure the Navy can accomplish its mission to maintain, train, and equip combat-ready naval forces capable of winning wars, deterring aggression, and maintaining freedom of the seas, consistent with Congressional direction in section 8062 of Title 10 of the U.S. Code.

In the Draft Supplemental EIS/OEIS, the Navy evaluated new, relevant information, such as more recent marine mammal density data and new scientific information, and updated the environmental analyses as appropriate. The Navy prepared the Draft Supplemental EIS/OEIS to support the issuance of federal regulatory permits and authorizations under the Marine Mammal Protection Act and the Endangered Species Act.

To achieve and maintain military readiness, the Navy proposes to:

- Conduct training and testing activities, at sea and in associated airspace, at levels required to support military readiness requirements beyond 2020.
- Accommodate evolving mission requirements, including those resulting from the development, testing, and introduction of new vessels, aircraft, and weapons systems into the fleet.

The Study Area remains unchanged since the 2015 NWTT Final EIS/OEIS. The Study Area is comprised of established maritime operating areas and warning areas in the northeastern Pacific

-more-

Figure 8.3-6: Press Release of Notification of Availability of the Draft Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement

NWTT SUPPLEMENTAL EIS/OEIS -2-

Ocean, including areas within the Strait of Juan de Fuca, Puget Sound, and the Western Behm Canal in southeastern Alaska. The Study Area includes air and water space within and outside Washington state waters and established special use airspace, Navy pierside and harbor locations within Washington state waters, and air and water space outside the state waters of Oregon and Northern California. In the Draft Supplemental EIS/OEIS, the Navy analyzed only those training and testing activities conducted at sea and in associated airspace within the Study Area.

Visit the project website at **www.NWTTEIS.com** to download the Draft Supplemental EIS/OEIS, view other project information, and submit substantive comments online.

Availability of the Draft Supplemental EIS/OEIS and public comment period:
The Navy is seeking public review and comment on the Proposed Action and alternatives as well as the accuracy and adequacy of the environmental analysis. The Draft Supplemental EIS/OEIS is available for public review online at **www.NWTTEIS.com** and at the following locations:

Washington:
- Everett Main Library
- Gig Harbor Library
- Jefferson County Library, Port Hadlock
- Kitsap Regional Library, Poulsbo
- Kitsap Regional Library, Sylvan Way, Bremerton
- North Olympic Library System, Forks Branch
- Lopez Island Library
- Oak Harbor Public Library
- Port Angeles Main Library
- Port Townsend Public Library
- San Juan Island Library
- Timberland Regional Library, Aberdeen
- Timberland Regional Library, Hoquiam

Oregon:
- Astoria Public Library
- Driftwood Public Library
- Newport Public Library
- Oregon State University, Guin Library Hatfield Marine Science Center
- Tillamook Main Library

Northern California:
- Fort Bragg Branch Library
- Humboldt County Public Library, Arcata Branch Library
- Humboldt County Public Library, Eureka Main Library
- Redwood Coast Senior Center

Southeastern Alaska:
- Juneau Public Library, Downtown Branch
- Ketchikan Public Library

The Navy will accept comments throughout the public comment period from **March 29, 2019**, to **May 28, 2019**. All comments must be postmarked or received online by **May 28, 2019**, for consideration in the Final Supplemental EIS/OEIS. All comments submitted during the public comment period will become part of the public record, and substantive comments will be addressed in the Final Supplemental EIS/OEIS.

Comments may be submitted online at **www.NWTTEIS.com**, at the public meetings, or by mail to:

Naval Facilities Engineering Command Northwest
Attention: NWTT Supplemental EIS/OEIS Project Manager
3730 N. Charles Porter Ave.
Building 385
Oak Harbor, WA 98278-3500

Figure 8.3-6: Press Release of Notification of Availability of the Draft Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement (continued)

NWTT SUPPLEMENTAL EIS/OEIS -2-

Open house public meetings:
The Navy will hold eight open house public meetings to provide information, answer questions, and give the public an opportunity to comment on the Draft Supplemental EIS/OEIS. The public may arrive at any time between **5 and 8 p.m.**, as there will not be a presentation or formal oral comment session. A stenographer will be available for the public to facilitate one-on-one oral comments; written comments can be submitted at any time during the meetings.

The open house public meetings will be held at the following locations:

Washington:

Wednesday, April 24, 2019
Hampton Inn Seattle/Everett
Downtown Salish Room
2931 W. Marine View Drive
Everett, Wash.

Thursday, April 25, 2019
Ridgetop Middle School Cafeteria
10600 Hillsboro Drive NW
Silverdale, Wash.

Friday, April 26, 2019
Naval Elks Lodge #353
131 E. First St.
Port Angeles, Wash.

Oregon:

Monday, April 29, 2019
Astoria High School Student Commons
1001 W. Marine Drive
Astoria, Ore.

Tuesday, April 30, 2019
Newport Performing Arts Center Lobby
777 W. Olive St.
Newport, Ore.

Northern California:

Thursday, May 2, 2019
Red Lion Hotel Eureka Ballroom
1929 Fourth St.
Eureka, Calif.

Friday, May 3, 2019
Dana Grey Elementary School
Multipurpose Room
1197 Chestnut St.
Fort Bragg, Calif.

Southeastern Alaska:

Wednesday, May 8, 2019
Ted Ferry Civic Center Naha and Alava Bays
888 Venetia Ave.
Ketchikan, Alaska

Individuals requiring reasonable accommodations, please contact Ms. Julianne Stanford, Public Affairs Officer, at 360-396-1630 or julianne.stanford@navy.mil.

Media availability:
Media will have an opportunity to speak with key project personnel before each meeting at 4:30 p.m. Media interested in attending or seeking further information should contact Ms. Julianne Stanford, 360-396-1630 or julianne.stanford@navy.mil.

-USN-

Figure 8.3-6: Press Release of Notification of Availability of the Draft Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement (continued)

COMMANDER, NAVY REGION NORTHWEST

Public Affairs Office
1100 Hunley Road, Silverdale, WA 98315-1100
Phone: (360) 396-1630 Fax: (360) 396-7127

FOR IMMEDIATE RELEASE **April 18, 2019**
Release #19-0418

PUBLIC COMMENT PERIOD EXTENDED FOR THE NORTHWEST TRAINING AND TESTING DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT

SILVERDALE, Wash — The U.S. Navy has extended the public comment period by an additional 15 days for the Northwest Training and Testing (NWTT) Draft Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS). Public comments may now be submitted until **June 12, 2019**, for consideration in the Final Supplemental EIS/OEIS.

In the Draft Supplemental EIS/OEIS, the Navy evaluated new, relevant information, such as more recent marine species density data and new scientific information, and updated the environmental analyses as appropriate. The Navy prepared the Draft Supplemental EIS/OEIS to support the issuance of federal regulatory permits and authorizations under the Marine Mammal Protection Act and the Endangered Species Act. The Navy requests and welcomes substantive public comments on the Draft Supplemental EIS/OEIS.

Proposed Action:
The Navy's Proposed Action is to conduct training and testing activities at sea and in associated airspace within the Study Area beyond 2020. These activities continue to include the use of active sound navigation and ranging, known as sonar, and explosives while employing marine species mitigation measures. Proposed activities are similar to those conducted in the Study Area for decades and analyzed in the 2015 document.

The purpose of the Proposed Action, which remains the same as the 2015 analysis, is to conduct training and testing activities to ensure the Navy can accomplish its mission to maintain, train, and equip combat-ready naval forces capable of winning wars, deterring aggression, and maintaining freedom of the seas, consistent with Congressional direction in section 8062 of Title 10 of the U.S. Code.

To achieve and maintain military readiness, the Navy proposes to:

- Conduct training and testing activities, at sea and in associated airspace, at levels required to support military readiness requirements beyond 2020.
- Accommodate evolving mission requirements, including those resulting from the development, testing, and introduction of new vessels, aircraft, and weapons systems into the fleet.

The Study Area remains unchanged since the 2015 NWTT Final EIS/OEIS. The Study Area is comprised of established maritime operating areas and warning areas in the northeastern Pacific Ocean, including areas within the Strait of Juan de Fuca, Puget Sound, and the Western Behm Canal in southeastern Alaska. The Study Area includes air and water space within and outside Washington

-more-

Figure 8.3-7: Press Release of Public Comment Period Extension for the Draft Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement

NWTT SUPPLEMENTAL EIS/OEIS -2-

state waters and established special use airspace, Navy pierside and harbor locations within Washington state waters, and air and water space outside the state waters of Oregon and Northern California. In the Draft Supplemental EIS/OEIS, the Navy analyzed only those training and testing activities conducted at sea and in associated airspace within the Study Area.

Visit the project website at **www.NWTTEIS.com** to download the Draft Supplemental EIS/OEIS, view other project information, and submit substantive comments online.

Availability of the Draft Supplemental EIS/OEIS and public comment period:
The Navy is seeking public review and comment on the Proposed Action and alternatives as well as the accuracy and adequacy of the environmental analysis. The Draft Supplemental EIS/OEIS is available for public review online at **www.NWTTEIS.com** and at the following locations:

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Southeastern Alaska:
- Juneau Public Library, Downtown Branch
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The Navy will accept comments throughout the public comment period from **March 29, 2019**, to **June 12, 2019**. All comments must be postmarked or received online by **June 12, 2019**, for consideration in the Final Supplemental EIS/OEIS. All comments submitted during the public comment period will become part of the public record, and substantive comments will be addressed in the Final Supplemental EIS/OEIS.

Comments may be submitted online at **www.NWTTEIS.com**, at the public meetings, or by mail to:

Naval Facilities Engineering Command Northwest
Attention: NWTT Supplemental EIS/OEIS Project Manager
3730 N. Charles Porter Ave.
Building 385, Admin, Room 216
Oak Harbor, WA 98278-5000

Open house public meetings:
The Navy will hold eight open house public meetings to provide information, answer questions, and give the public an opportunity to comment on the Draft Supplemental EIS/OEIS. The public may arrive

Figure 8.3-7: Press Release of Public Comment Period Extension for the Draft Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement (continued)

NWTT SUPPLEMENTAL EIS/OEIS -2-

at any time between **5 and 8 p.m.**, as there will not be a presentation or formal oral comment session. A stenographer will be available to transcribe one-on-one oral comments; written comments may be submitted at any time during the meetings.

The open house public meetings will be held at the following locations:

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-USN-

Figure 8.3-7: Press Release of Public Comment Period Extension for the Draft Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement (continued)

COMMANDER,
NAVY REGION NORTHWEST

Public Affairs Office
1100 Hunley Road, Silverdale, WA 98315-1100
Phone: (360) 396-1630 Fax: (360) 396-7127

FOR IMMEDIATE RELEASE **April 23, 2019**
Release #19-0423

NAVY TO HOLD OPEN HOUSE PUBLIC MEETINGS FOR THE NORTHWEST TRAINING AND TESTING DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT

SILVERDALE, Wash — The U.S. Navy will hold eight open house public meetings to provide information, answer questions, and give the public an opportunity to comment on the 2015 Northwest Training and Testing (NWTT) Final Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS). The Navy prepared the Draft Supplemental EIS/OEIS to reassess the potential environmental impacts associated with conducting proposed ongoing and future military readiness activities within the NWTT Study Area, referred to as the "Study Area." Military readiness activities include training and research, development, testing, and evaluation activities, referred to as "training and testing." The Navy welcomes substantive public comments on the Draft Supplemental EIS/OEIS.

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The Study Area remains unchanged since the 2015 NWTT Final EIS/OEIS. The Study Area is comprised of established maritime operating areas and warning areas in the northeastern Pacific

-more-

Figure 8.3-8: Press Release of Notification of Public Meetings for the Draft Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement

NWTT SUPPLEMENTAL EIS/OEIS -2-

Ocean, including areas within the Strait of Juan de Fuca, Puget Sound, and the Western Behm Canal in southeastern Alaska. The Study Area includes air and water space within and outside Washington state waters and established special use airspace, Navy pierside and harbor locations within Washington state waters, and air and water space outside the state waters of Oregon and Northern California. In the Draft Supplemental EIS/OEIS, the Navy analyzed only those training and testing activities conducted at sea and in associated airspace within the Study Area.

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10600 Hillsboro Drive NW
Silverdale, Wash.

Friday, April 26, 2019
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Port Angeles, Wash.

Oregon:

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Tuesday, April 30, 2019
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Northern California:

Thursday, May 2, 2019
Red Lion Hotel Eureka Ballroom
1929 Fourth St.
Eureka, Calif.

Friday, May 3, 2019
Dana Grey Elementary School Multipurpose Room
1197 Chestnut St.
Fort Bragg, Calif.

Southeastern Alaska:

Wednesday, May 8, 2019
Ted Ferry Civic Center Naha and Alava Bays
888 Venetia Ave.
Ketchikan, Alaska

Individuals requiring reasonable accommodations, please contact Ms. Julianne Stanford, Public Affairs Officer, at 360-867-8525 or julianne.stanford@navy.mil.

Media availability:
Media will have an opportunity to speak with key project personnel before each meeting at 4:30 p.m. Media interested in attending or seeking further information should contact Ms. Julianne Stanford, 360-867-8525 or julianne.stanford@navy.mil.

-more-

Figure 8.3-8: Press Release of Notification of Public Meetings for the Draft Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement (continued)

NWTT SUPPLEMENTAL EIS/OEIS -2-

Availability of the Draft Supplemental EIS/OEIS and public comment period:
The Navy is seeking public review and comment on the Proposed Action and alternatives as well as the accuracy and adequacy of the environmental analysis. The Draft Supplemental EIS/OEIS is available for public review online at **www.NWTTEIS.com** and at the following locations:

Washington:
- Everett Main Library
- Gig Harbor Library
- Jefferson County Library, Port Hadlock
- Kitsap Regional Library, Poulsbo
- Kitsap Regional Library, Sylvan Way, Bremerton
- North Olympic Library System, Forks Branch
- Lopez Island Library
- Oak Harbor Public Library
- Port Angeles Main Library
- Port Townsend Public Library
- San Juan Island Library
- Timberland Regional Library, Aberdeen
- Timberland Regional Library, Hoquiam

Oregon:
- Astoria Public Library
- Driftwood Public Library
- Newport Public Library
- Oregon State University, Guin Library Hatfield Marine Science Center
- Tillamook Main Library

Northern California:
- Fort Bragg Branch Library
- Humboldt County Public Library, Arcata Branch Library
- Humboldt County Public Library, Eureka Main Library
- Redwood Coast Senior Center

Southeastern Alaska:
- Juneau Public Library, Downtown Branch
- Ketchikan Public Library

The Navy will accept comments throughout the public comment period from **March 29, 2019**, to **June 12, 2019**. All comments must be postmarked or received online by **June 12, 2019**, for consideration in the Final Supplemental EIS/OEIS. All comments submitted during the public comment period will become part of the public record, and substantive comments will be addressed in the Final Supplemental EIS/OEIS.

Comments may be submitted online at **www.NWTTEIS.com**, at the public meetings, or by mail to:

Naval Facilities Engineering Command Northwest
Attention: NWTT Supplemental EIS/OEIS Project Manager
3730 N. Charles Porter Ave.
Building 385, Admin, Room 216
Oak Harbor, WA 98278-3500

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Figure 8.3-8: Press Release of Notification of Public Meetings for the Draft Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement (continued)

Press Release

Commander, Navy Region Northwest
1100 Hunley Road, Silverdale, WA 98315-1100

Contact: Julianne Stanford
Navy Region Northwest Public Affairs Specialist
(T) 360-867-8525
julianne.stanford@navy.mil

PUBLIC SERVICE ANNOUNCEMENT
April 23, 2019

Public Meetings for the Northwest Training and Testing Draft Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement

(39 Seconds) **FOR IMMEDIATE RELEASE**

ANNOUNCER:

THE U-S NAVY INVITES YOU TO ATTEND PUBLIC MEETINGS TO LEARN ABOUT AND COMMENT ON POTENTIAL ENVIRONMENTAL IMPACTS ASSOCIATED WITH CONDUCTING PROPOSED ONGOING AND FUTURE TRAINING AND TESTING ACTIVITIES WITHIN THE NORTHWEST TRAINING AND TESTING STUDY AREA.

THE OPEN HOUSE PUBLIC MEETINGS WILL BE HELD FROM FIVE TO EIGHT P-M ON:

APRIL TWENTY-FOURTH AT THE HAMPTON INN SALISH ROOM IN DOWNTOWN EVERETT, APRIL TWENTY-FIFTH AT THE RIDGETOP MIDDLE SCHOOL CAFETERIA IN SILVERDALE, AND APRIL TWENTY-SIXTH AT THE NAVAL ELKS LODGE NUMBER THREE-FIVE-THREE IN PORT ANGELES.

YOU CAN LEARN MORE ABOUT THE PROJECT AND PROVIDE COMMENTS AT THE PUBLIC MEETINGS OR AT W-W-W DOT N-W-T-T E-I-S DOT COM.

-30-

Figure 8.3-9: Public Service Announcement of Public Meetings (Washington State Version)

8.3.1.5 Subscriber Email Notifications

Project information was also distributed via the project website subscriber's email distribution list. Website subscribers from the scoping phase were carried forward into the Draft Supplemental phase to start with an initial 195 website subscribers. An email notification was sent to these 195 website subscribers March 29, 2019. The email informed the subscribers of the availability of the Draft Supplemental; the public meeting dates, times, and locations; and ways to submit comments. A second email notification announcing the public comment period extension was sent to 200 website subscribers April 19, 2019. As of August 2020, there are 247 subscribers.

8.3.2 Public Meetings

The Navy held eight open house public meetings to inform the public about the Proposed Action and environmental analysis, and to solicit public comments on the Draft Supplemental. The public meetings included informational poster and video stations staffed by Navy representatives. A stenographer was available to transcribe one-on-one oral comments; written comments were submitted at any time during the meetings. Members of the public could arrive at any time during the public meetings, which were held from 5:00 to 8:00 p.m. In total, 340 people attended the eight public meetings. The public meeting locations and dates are shown in Table 8.3-3.

Table 8.3-3: Public Meeting Locations

Area Location	Meeting Venue	Date
Everett, Washington	Hampton Inn Seattle/Everett Downtown Salish Room	Wednesday, April 24, 2019
Silverdale, Washington	Ridgetop Middle School Cafeteria	Thursday, April 25, 2019
Port Angeles, Washington	Naval Elks Lodge #353	Friday, April 26, 2019
Astoria, Oregon	Astoria High School Student Commons	Monday, April 29, 2019
Newport, Oregon	Newport Performing Arts Center Lobby	Tuesday, April 30, 2019
Eureka, California	Red Lion Hotel Eureka Ballroom	Thursday, May 2, 2019
Fort Bragg, California	Dana Grey Elementary School Multipurpose Room	Friday, May 3, 2019
Ketchikan, Alaska	Ted Ferry Civic Center Naha and Alava Bays	Wednesday, May 8, 2019

8.4 Comments on the Draft Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement

Throughout the public comment period, a total of 2,062 unique comments were received. Public comments on the Draft Supplemental were submitted in three ways:

- Written letters (received any time during the public comment period) (72 comments).
- Comments submitted at a public meeting (written or oral) (written: 46 comments; oral: 30 comments).

- Comments submitted directly on the project website (received any time during the public comment period) (1,904 comments).

Additionally, 10 comments were received via email. Form letters (with 31,949 signatures) were also received from various nongovernmental organizations.

Comments on the Draft Supplemental were received from 2 state elected officials, 11 local elected officials, 3 federal agencies, 6 state government agencies, 31 nongovernmental organizations, 10 Native American tribes, 1 community/business group, 1 media group (newspaper), 6 private companies, 1 research/university, and approximately 1,911 private individuals. All public comments can be accessed on the project website at www.NWTTEIS.com.

Each comment was reviewed and categorized into specific resource areas or topics. One comment may include comments on multiple resource areas or topics. Appendix H (Public Comments and Responses) contains the comments received on the Draft Supplemental and the Navy's responses.

8.5 Distribution of the Draft and Final Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement

All of the parties notified of the availability of the Draft and Final Supplemental were directed to view the document electronically on the project website (www.NWTTEIS.com), or to access printed and CD/DVD copies available at the information repositories discussed in Section 8.5.2 (Information Repositories). Chairpersons of federally recognized tribes received a CD/DVD copy of the Draft and Final Supplemental.

8.5.1 Federal Agencies

The U.S. Environmental Protection Agency received a printed copy and electronic version (CD/DVD) of the Draft and Final Supplemental. Regional offices of the U.S. Environmental Protection Agency received electronic versions of the Draft and Final Supplemental. The National Marine Fisheries Service headquarters office, U.S. Fish and Wildlife Service office, and U.S. Coast Guard office received printed and electronic copies of the Draft and Final Supplemental.

8.5.2 Information Repositories

The Draft and Final Supplemental were mailed in printed copy form, along with a CD/DVD to the information repository locations shown in Table 8.5-1: Information Repositories.

Table 8.5-1: Information Repositories

Repository Name	Physical Address
Everett Main Library	2702 Hoyt Ave., Everett, WA 98201
Gig Harbor Library	4424 Point Fosdick Drive NW, Gig Harbor, WA 98335
Jefferson County Library, Port Hadlock	620 Cedar Ave., Port Hadlock, WA 98339
Kitsap Regional Library, Poulsbo	700 NE Lincoln Road, Poulsbo, WA 98370
Kitsap Regional Library, Sylvan Way, Bremerton	1301 Sylvan Way, Bremerton, WA 98310
North Olympic Library System, Forks Branch	171 S. Forks Ave., Forks, WA 98331

Repository Name	Physical Address
Lopez Island Library	2225 Fisherman Bay Road, Lopez Island, WA 98261
Oak Harbor Public Library	1000 SE Regatta Drive, Oak Harbor, WA 98277
Port Angeles Main Library	2210 S. Peabody St., Port Angeles, WA 98362
Port Townsend Public Library	1220 Lawrence St., Port Townsend, WA 98368
San Juan Island Library	1010 Guard St., Friday Harbor, WA 98250
Timberland Regional Library, Aberdeen	121 E. Market St., Aberdeen, WA 98520
Timberland Regional Library, Hoquiam	420 Seventh St., Hoquiam, WA 98550
Astoria Public Library	450 10th St., Astoria, OR 97103
Driftwood Public Library	801 SW Highway 101 #201, Lincoln City, OR 97367
Newport Public Library	35 NW Nye St., Newport, OR 97365
Oregon State University, Guin Library Hatfield Marine Science Center	2030 SE Marine Science Drive, Newport, OR 97365
Tillamook Main Library	1716 Third St., Tillamook, OR 97141
Fort Bragg Branch Library	499 Laurel St., Fort Bragg, CA 95437
Humboldt County Public Library, Arcata Branch Library	500 Seventh St., Arcata, CA 95521
Humboldt County Public Library, Eureka Main Library	1313 Third St., Eureka, CA 95501
Redwood Coast Senior Center	490 N. Harold St., Fort Bragg, CA 95437
Juneau Public Library, Downtown Branch	292 Marine Way, Juneau, AK 99801
Ketchikan Public Library	1110 Copper Ridge Lane, Ketchikan, AK 99901

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