3.5 Marine Mammals

There are 70 species of marine mammals located throughout U.S. coastal and marine waters extending seaward to the limits of the U.S. EEZ (ECOS, No Date-a; NMFS, No Date-a). These species represent four classifications of marine mammals: Cetaceans (52 species of whales, dolphins, and porpoises), Pinnipeds (15 species of seals, sea lions, and walrus), Sirenians (one species of manatee), and Fissipeds (two species: sea otters and polar bears). Listings of species, including current status and region of occurrence, are provided in **Tables 3.5-1, 3.5-2, 3.5-3,** and **3.5-4**.

All marine mammals in U.S. waters are protected under the MMPA of 1972. The MMPA allows for agencies to organize marine mammals into separate stocks for management purposes. A stock is defined by the MMPA as a group of marine mammals of the same species or smaller taxa in a common spatial arrangement that interbreed when mature. Some species are further protected under the ESA of 1973. Under the ESA, a species is considered endangered if it is “in danger of extinction throughout all or a significant portion of its range.” A species is considered threatened if it “is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.” Under the MMPA, species or populations are considered depleted if they are below their optimum sustainable population level, or are listed as endangered or threatened under the ESA.

3.5.1 Affected Environment

The following sections provide discussions of marine mammal species or species group (where appropriate), including sound production and hearing, regional distribution, and descriptions of ESA-listed species. Due to the number of individual species that are present in the action area, this section provides detailed descriptions only of individual ESA-listed species in order to support interagency consultation. All USFWS MMPA species are also ESA-listed. Descriptions of all species in the action area that are not ESA-listed, as shown in **Tables 3.5-1**, **3.5-2**, **3.5-3**, and **3.5-4**, can be found on the NMFS web page at https://www.fisheries.noaa.gov/find-species (NMFS, No Date-a) and are incorporated here by reference.

3.5.1.1 Cetaceans (Baleen Whales and Toothed Whales)

Cetaceans are completely aquatic marine mammals; they feed, mate, calve, and suckle their young in the water. They are the most specialized mammalian swimmers. Some are capable of maintaining speeds up to 40 km (25 mi) per hour, diving to depths of at least 3,000 m (10,000 ft), and remaining submerged for up to 2 hours. The body is streamlined (limbs are tapered or lacking), and the tail is developed into horizontal flukes for propulsion. Cetaceans breathe through blowholes on top of the head (Sea Grant, 2015).

Cetaceans are grouped into two taxonomic suborders: the baleen whales (Mysticeti) and the toothed whales (Odontoceti). Mysticetes have two blowholes (**Figure 3.5-1**) and baleen plates (**Figure 3.5-2**) instead of teeth. They are filter feeders that forage for zooplankton and small fish by skimming or gulping huge amounts of prey and water; the water is then forced back out of the mouth past hundreds of baleen plates that act as sieves to trap the prey, which is then swallowed. Baleen whales are generally found in small groups (e.g., mother-calf pairs) or in loose associations, not in large groups, except during migration when they may be found in small groups of several individuals; large numbers of baleen whales may also congregate in feeding or calving areas. Odontocetes have teeth and one opening at their blowhole. Toothed whales tend to be social and live in groups. They use echolocation to detect objects in their environment, including their prey.

Figure 3.5-1. Humpback Whale with Two Blowholes

Photo credit: NOAA Photo Library

Figure 3.5-2. Humpback Whale Feeding (note Baleen Strainers)

Photo credit: NOAA Photo Library

All cetaceans are protected by the MMPA throughout their ranges, and some are designated as depleted. Many species are also federally listed under the ESA either throughout their ranges or for distinct population segments (DPS). Additionally, some species have critical habitat designated under the ESA. **Table 3.5-1** lists the 52 species of cetaceans (59 distinct species, subspecies, or DPS total) occurring throughout the action area; 15 mysticetes, 10 of which are ESA-listed as endangered, one listed as threatened, and three with designated critical habitat; and 44 odontocetes, four of which are ESA-listed as endangered, and three with designated critical habitat.

Table 3.5-1. Cetaceans Occurring in the Action Area

Common Name	Scientific Name	MMPA Depleted?	ESA Status	Lead Agency	Region*	Critical Habitat	General Habitat
Baleen Whales - Mysticetes							
Bowhead whale	*Balaena mysticetus*	Yes: throughout its range	Endangered	NMFS	AR	No	Seasonal sea ice
Minke whale	*Balaenoptera acutorostrata*	No	--	NMFS	All	--	Shallow to deep waters, often coastal
Sei whale	*Balaenoptera borealis*	Yes: throughout its range	Endangered	NMFS	All	No	Primarily offshore pelagic deep and intermediate waters
Bryde's whale	*Balaenoptera edeni*	No	--	NMFS	GAR, SER, WCR, PIR	--	Shallow to deep waters
Rice's whale**	*Balaenoptera ricei*	Yes	Endangered	NMFS	SER	No	Shallow to deep waters
Blue whale	*Balaenoptera musculus*	Yes: throughout its range	Endangered	NMFS	All	No	Coastal and pelagic shallow, intermediate, and deep waters
Fin whale	*Balaenoptera physalus*	Yes: throughout its range	Endangered	NMFS	All	No	Mostly pelagic, continental slope intermediate and deep waters
Gray whale (Eastern North Pacific DPS)	*Eschrichtius robustus*	No	--	NMFS	WCR, AR	--	Inshore or shallow offshore continental shelf waters
Gray whale (Western North Pacific DPS)	*Eschrichtius robustus*	Yes	Endangered	NMFS	WCR, AR	No	Inshore or shallow offshore continental shelf waters
North Atlantic right whale	*Eubalaena glacialis*	Yes: throughout its range	Endangered	NMFS	GAR, SER	Yes	Coastal, shallow shelf waters, occasionally

Common Name	Scientific Name	MMPA Depleted?	ESA Status	Lead Agency	Region*	Critical Habitat	General Habitat
							offshore intermediate and deep waters
North Pacific right whale	*Eubalaena japonica*	Yes: throughout its range	Endangered	NMFS	WCR, AR	Yes	Coastal, shallow shelf waters, occasionally offshore intermediate and deep waters
Humpback whale	*Megaptera novaeangliae*	Refer to discussion in Section 3.5.1.1.3.9	--	NMFS	All	--	Shallow to deep waters
Humpback whale (Mexico DPS)	*Megaptera novaeangliae*	Refer to discussion in Section 3.5.1.1.3.9	Threatened	NMFS	WCR, AR	Yes	Shallow to deep waters
Humpback whale (Central America DPS)	*Megaptera novaeangliae*	Refer to discussion in Section 3.5.1.1.3.9	Endangered	NMFS	WCR	Yes	Shallow to deep waters
Humpback whale (Western North Pacific DPS)	*Megaptera novaeangliae*	Refer to discussion in Section 3.5.1.1.3.9	Endangered	NMFS	AR, PIR	Yes	Shallow to deep waters
Toothed Whales – Odontocetes							
Baird's beaked whale	*Berardius bairdii*	No	--	NMFS	WCR, AR	--	Cold, deep, oceanic waters, occasionally near shore along narrow continental shelves
Beluga whale	*Delphinapterus leucas*	No	--	NMFS	AR	--	Shallow coastal waters, deep water, estuaries, and large river deltas

Common Name	Scientific Name	MMPA Depleted?	ESA Status	Lead Agency	Region*	Critical Habitat	General Habitat
Beluga whale (Cook Inlet DPS)	*Delphinapterus leucas*	Yes: Cook Inlet stock	Endangered	NMFS	AR	Yes	Shallow coastal waters, deep water, estuaries, and large river deltas
Long-beaked common dolphin	*Delphinus capensis*	No	--	NMFS	WCR	--	Shallow, tropical, subtropical, and warmer temperate waters closer to the coast and on the continental shelf
Short-beaked common dolphin	*Delphinus delphis*	No	--	NMFS	GAR, SER, WCR, PIR	--	Oceanic and offshore, underwater ridges, seamounts, and continental shelf
Pygmy killer whale	*Feresa attenuata*	No	--	NMFS	GAR, SER, PIR	--	Deep water
Long-finned pilot whale	*Globicephala melas*	No	--	NMFS	GAR, SER	--	Pelagic
Short-finned pilot whale	*Globicephala macrorhynchus*	No	--	NMFS	All	--	Pelagic
Risso’s dolphin	*Grampus griseus*	No	--	NMFS	All	--	Pelagic over steep slopes, seamounts, and escarpments
Northern bottlenose whale	*Hyperoodon ampullatus*	No	--	NMFS	GAR	--	Pelagic deep water; known to forage in submarine canyons
Longman's beaked Whale	*Indopacetus pacificus*	No	--	NMFS	PIR	--	Warm, deep pelagic waters
Pygmy sperm whale	*Kogia breviceps*	No	--	NMFS	GAR, SER, WCR, PIR	--	Continental shelf edge, deep water

Common Name	Scientific Name	MMPA Depleted?	ESA Status	Lead Agency	Region*	Critical Habitat	General Habitat
Dwarf sperm whale	*Kogia sima*	No	--	NMFS	GAR, SER, WCR, PIR	--	Continental shelf edge, deep water
Atlantic white-sided dolphin	*Lagenorhynchus acutus*	No	--	NMFS	GAR, SER	--	Continental shelf, slope, and canyons
White-beaked dolphin	*Lagenorhynchus albirostris*	No	--	NMFS	GAR	--	Continental shelf waters, especially along shelf edge
Fraser's dolphin	*Lagenodelphis hosei*	No	--	NMFS	SER, PIR	--	Waters over 1,000 m (3,280 ft) deep
Pacific white-sided dolphin	*Lagenorhynchus obliquidens*	No	--	NMFS	AR, WCR	--	Continental margins, occasionally enter inshore passages
Northern right whale dolphin	*Lissodelphis borealis*	No	--	NMFS	WCR	--	Shelf and slope waters up to and >2,000m
Sowerby's beaked whale	*Mesoplodon bidens*	No	--	NMFS	GAR	--	Pelagic deep water of continental shelf edge and slopes
Hubbs' beaked whale	*Mesoplodon carlhubbsi*	No	--	NMFS	WCR	--	Pelagic deep water
Blainville's beaked whale	*Mesoplodon densirostris*	No	--	NMFS	GAR, SER, WCR, PIR	--	Pelagic deep water
Gervais' beaked whale	*Mesoplodon europaeus*	No	--	NMFS	GAR, SER	--	Pelagic deep water
Ginkgo-toothed beaked whale	*Mesoplodon gingkodens*	No	--	NMFS	WCR	--	Pelagic deep water
True's beaked whale	*Mesoplodon mirus*	No	--	NMFS	GAR, SER	--	Pelagic deep water, occasionally coastal

Common Name	Scientific Name	MMPA Depleted?	ESA Status	Lead Agency	Region*	Critical Habitat	General Habitat
Perrin's beaked whale	*Mesoplodon perrini*	No	--	NMFS	WCR	--	Pelagic deep water
Lesser beaked whale	*Mesoplodon peruvianus*	No	--	NMFS	WCR	--	Pelagic deep water
Stejneger's beaked whale	*Mesoplodon stejnegeri*	No	--	NMFS	WCR, AR	--	Deep cold, temperate, and subarctic waters
Narwhal	*Monodon monoceros*	No	--	NMFS	AR	--	Deep-water beneath ice pack in winter, shallow water in summer
Killer whale	*Orcinus orca*	Yes: AT1 Transient Stock	--	NMFS	All	--	Open ocean waters to estuaries and fjords
Killer whale (Southern Resident DPS)	*Orcinus orca*	Yes	Endangered	NMFS	WCR	Yes	Open ocean waters to estuaries and fjords
Melon-headed whale	*Peponocephala electra*	No	--	NMFS	GAR, SER, WCR, PIR	--	Pelagic or around oceanic islands
Harbor porpoise	*Phocoena phocoena*	No	--	NMFS	GAR, SER, WCR, AR	--	Shallow coastal and shelf waters
Dall's porpoise	*Phocoenoides dalli*	No	--	NMFS	WCR, AR	--	Inshore to deep oceanic waters
Sperm whale	*Physeter macrocephalus*	Yes: throughout its range	Endangered	NMFS	All	No	Deep water, along continental slope
False killer whale	*Pseudorca crassidens*	No	--	NMFS	AR, SER, WCR, PIR	--	Deep offshore waters
False killer whale (Main Hawaiian Islands Insular DPS)	*Pseudorca crassidens*	Yes: Main Hawaiian Islands Insular stock	Endangered	NMFS	PIR	Yes	Deep offshore waters

Common Name	Scientific Name	MMPA Depleted?	ESA Status	Lead Agency	Region*	Critical Habitat	General Habitat
Pantropical spotted dolphin	*Stenella attenuata*	No	--	NMFS	GAR, SER, PIR	--	Deeper waters
Clymene dolphin	*Stenella clymene*	No	--	NMFS	GAR, SER	--	Deep tropical, subtropical, and temperate waters throughout the Atlantic Ocean
Striped dolphin	*Stenella coeruleoalba*	No	--	NMFS	GAR, SER, WCR, PIR	--	Pelagic edge of continental shelf, occasionally coastal
Atlantic spotted dolphin	*Stenella frontalis*	No	--	NMFS	GAR, SER	--	Continental shelf waters <250 m (820 ft) deep
Spinner dolphin	*Stenella longirostris*	No	--	NMFS	GAR, SER, PIR	--	Pelagic and near oceanic islands
Rough-toothed dolphin	*Steno bredanensis*	No	--	NMFS	GAR, SER, WCR, PIR	--	Deep offshore waters
Bottlenose dolphin	*Tursiops truncatus*	Yes: Western North Atlantic Central Florida Coastal stock, Western North Atlantic Northern Florida Coastal stock, Western North Atlantic Northern Migratory Coastal stock, Western North Atlantic South Carolina-Georgia Coastal	--	NMFS	GAR, SER, WCR, PIR	--	Harbors, bays, gulfs, estuaries, nearshore coastal waters, deeper waters over the continental shelf, and far offshore pelagic

Common Name	Scientific Name	MMPA Depleted?	ESA Status	Lead Agency	Region*	Critical Habitat	General Habitat
		stock, and Western North Atlantic Southern Migratory Coastal stock					
Cuvier’s beaked whale	*Ziphius cavirostris*	No	--	NMFS	All	--	Pelagic deep water

Source: ECOS, No Date-a; NMFS, No Date-a

* GAR = Greater Atlantic Region (includes the U.S. portions of the Great Lakes, New England, and the mid-Atlantic); SER = Southeast Region (includes the southern portion of the U.S. Eastern Seaboard, the U.S. Caribbean Islands [Puerto Rico and the U.S. Virgin Islands], and the Gulf of Mexico); AR = Alaska Region (includes Alaskan waters and the Arctic); WCR = West Coast Region (includes coastal California, Oregon and Washington); PIR = Pacific Islands Region (includes Hawai’i and territories of the U.S.)

**Rice’s whale was referred to as Bryde’s whale in the Draft PEIS.

3.5.1.1.1 Cetacean Sound Production and Hearing

Cetaceans can vocalize and hear in a variety of frequency ranges underwater, but not all species have equal hearing capabilities in terms of absolute hearing sensitivity and the frequency band of hearing (Richardson et al., 1995; Southall et al., 2007; Au and Hastings, 2008). Odontocetes have a melon (mysticetes do not), which is a globular fatty organ that gives shape to the domed forehead, focuses and modulates the animal's vocalizations, and acts as a sound lens (Cranford et al., 1996); it is a key organ involved in communication and echolocation. While hearing measurements are available for a small number of species based on captive animal studies, direct hearing measurements of many odontocetes and all mysticetes do not exist. As a result, hearing ranges for many odontocetes are grouped with similar species, and predictions for mysticetes are based on other methods. In 2007, Southall et al. proposed that marine mammals be divided into hearing groups based on characteristics such as audible frequency range, auditory sensitivity, ear anatomy, and acoustic ecology (i.e., how they use sound). This division was updated by NMFS (2018a) using more recent best available science.

The low-frequency (LF) cetacean group contains all of the mysticetes. Although there have been no direct measurements of hearing sensitivity in any mysticete, an audible frequency range of approximately 10 Hz to 30 kHz has been inferred from observed vocalization frequencies, observed reactions to playback of sounds, and anatomical analyses of the auditory system (Finneran et al., 2017). Functional hearing for mysticetes as a group extends from approximately 7 Hz to 35 kHz, though the hearing range of individual species may not be as wide (Southall et al., 2007, 2019; NMFS, 2018a). A natural division may exist within the mysticetes, with some species (e.g., blue, fin) having better low-frequency sensitivity and others (e.g., humpback, minke) having better sensitivity to higher frequencies; however, at present there is insufficient knowledge to justify separating species into multiple groups (Southall et al., 2019). Therefore, a single species group is used for all mysticetes. Sound production for mysticetes can range between 0.2 kHz and 24 kHz (Southall et al., 2019). As an example, Girola et al. (2019) found source levels varied in humpback whales from 138 to 187 dB re 1 µPa m (root mean squared).

Mid- and high-frequency (HF) cetaceans are all odontocetes. Unlike the mysticetes, all odontocete cetaceans appear to have highly advanced echolocation systems that use intermediate to very high frequencies (tens of kHz to 100+ kHz). Most of them are also proven to produce social sounds in a lower-frequency band, including generally low to intermediate frequencies (1 kHz to tens of kHz) (Southall et al., 2007). Consequently, their functional hearing would be expected to cover a wider absolute frequency range than is assumed for mysticetes; however, their best hearing sensitivity typically occurs at or near the frequency where echolocation signals are strongest (Southall et al., 2007).

The mid-frequency (MF) cetacean group comprises dolphins and beaked whales (NMFS, 2018a). Hearing sensitivity has been directly measured for a number of species within this group using behavioral or auditory evoked potential measurements (Finneran et al., 2017). MF species are estimated to have lower and upper frequency limits of nominal hearing at approximately 150 Hz and 160 kHz (Southall et al., 2007, 2019; NMFS, 2018a). Sound production for MF cetaceans can range between 0.1 kHz and 148 kHz (Southall et al., 2019). As an example, Møhl et al. (2003) found source levels in sperm whales to be up to 236 dB re 1 µPa m (root mean squared).

The HF cetacean group comprises true porpoises, *Kogia*, river dolphins, *Cephalorhynchus*, *Lagenorhynchus cruciger* and *L. australis*. HF cetaceans generally possess a higher upper-frequency limit and better sensitivity at high frequencies compared to the MF cetacean species (Finneran et al., 2017). Functional hearing in this group was estimated to occur between 275 Hz and 160 kHz (Southall et al., 2007, 2019;

NMFS, 2018a). Sound production for HF cetaceans can range between 0.2 kHz and 200 kHz (Southall et al., 2019). As an example, Kyhn et al. (2013) found source levels varied in Dall's and harbor porpoises from 178 to 189 dB re 1 μPa m (root mean squared).

3.5.1.1.2 Regional Distribution of Cetaceans

Cetaceans are known to make wide-ranging movements and may not be present in a specific region year-round; however, some species do not migrate but may still exhibit seasonal movement patterns. The distribution of cetaceans is influenced by many factors, including ecological conditions, prey availability, anthropogenic activities, and physical features such as oceanic shelf edge or canyons; movements are most often associated with feeding or breeding.

Mysticetes are widely distributed throughout all major oceans. They are highly mobile and often move seasonally for food and breeding. Nearly all baleen whales undertake significant seasonal migrations. Many stocks return to the same breeding and/or feeding areas each year including humpback, gray, and the North Atlantic and North Pacific right whales (Reeves et al., 2002). Mysticetes often feed at high latitudes in summer, exploiting biologically productive areas, and move to lower latitudes during the winter to mate and calve. Exceptions include the Bryde's whale, which remains year-round in tropical and subtropical areas, and the pygmy right whale, which appears to remain in southern temperate and sub-polar waters (Reeves et al., 2002). Most baleen whale species calve in offshore areas. A few exceptions are some populations of humpback and right whales that inhabit shallow coastal, reef, or lagoon areas during the calving season.

Odontocetes are also widely distributed and occur in all major oceans. They are highly mobile and often move seasonally for food and breeding (Reeves et al., 2002). Many species remain year-round in tropical and subtropical areas, including the Fraser's dolphin and pygmy killer whale. Some are year-round residents in colder waters, with relatively small seasonal migrations (e.g., harbor porpoise). Others are more widespread, including the killer whale, sperm whale, and Cuvier's beaked whale. Some odontocetes undertake extensive seasonal migrations. For example, adult male sperm whales travel to high latitudes for summer feeding and back toward the equator for winter breeding (Reeves et al., 2002). Numerous odontocetes, such as the Atlantic white-sided dolphin and Pacific white-sided dolphin feed at high latitudes in summer, exploiting biologically productive areas. Calving and/or breeding can occur year-round throughout the range of some odontocetes. Others exhibit specific breeding/calving periods and/or locations. In general, species that occur in colder waters tend to calve in warmer months while those in tropical waters year-round show less seasonality.

Biologically important areas (BIAs) are spatially defined areas where aggregations of individual cetaceans display biologically important behaviors which are region-, species-, and time-specific. Identification of BIAs relates to understanding activities in which cetaceans are likely to be engaged at a certain time and place. For cetacean species with distinct migrations that separate feeding and breeding areas, three types of BIAs have been identified (Ferguson et al., 2015):

- Reproductive Areas: areas and months within which a particular species or population selectively mates, gives birth, or is found with neonates or other sensitive age classes;
- Feeding Areas: areas and months within which a particular species or population selectively feeds. These may either be found consistently in space and time, or may be associated with ephemeral features that are less predictable but can be delineated and are generally located within a larger identifiable area; and

- Migratory Corridors: areas and months within which a substantial portion of a species or population is known to migrate; the corridor is typically delimited on one or both sides by land or ice.

A fourth type of BIA has also been identified:

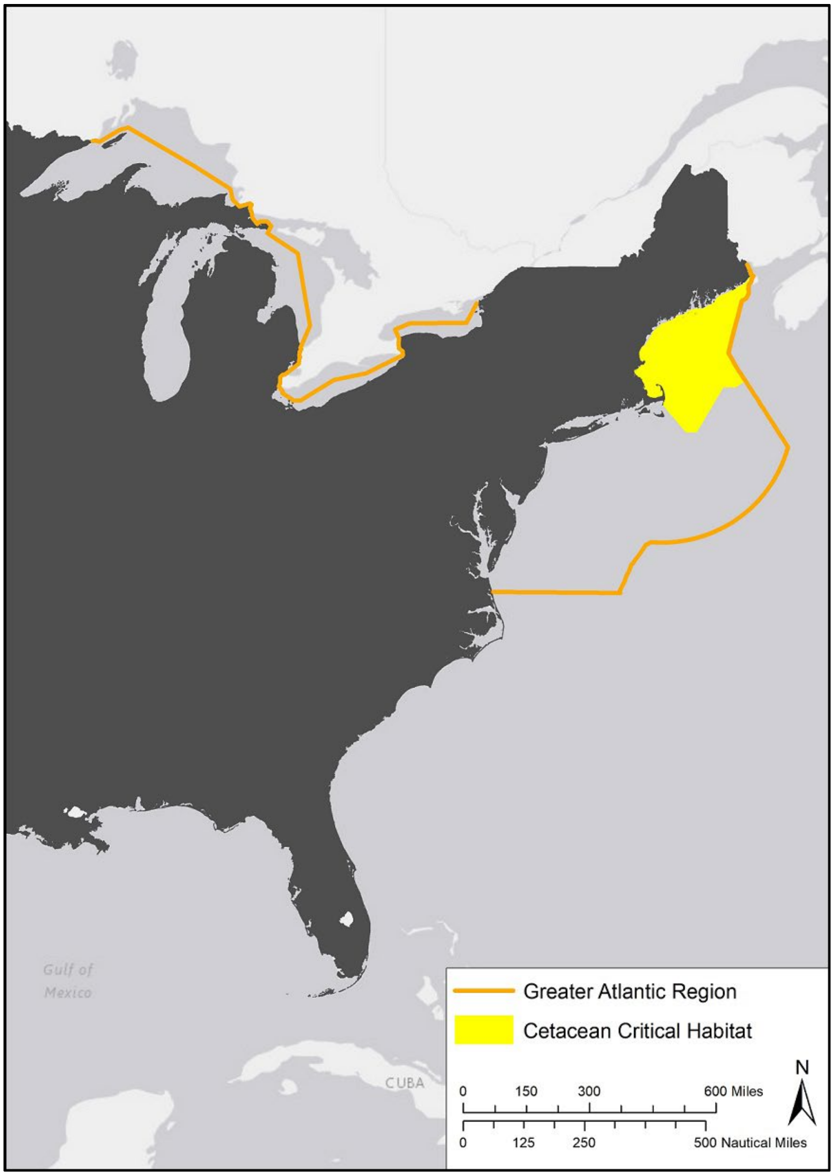
- Small and Resident Population: areas and months within which small and resident populations occupying a limited geographic extent exist.

Recognition of an area as biologically important for some species activity does not cause the area to rise to designation of critical habitat under the ESA. BIAs were created to help NOAA, other federal agencies, and the public in the analyses and planning used to characterize and minimize the impacts of anthropogenic activities on cetaceans and to achieve conservation and protection goals (Ferguson et al., 2015). BIAs occur in every region throughout the NOS action area, but they do not present the totality of important habitat throughout the marine mammals' full range. The stated intention is for the BIAs to serve as a resource management tool and for their currently identified boundaries to be considered dynamic and subject to change based on any new information.

Distribution of cetaceans in the geographic regions that comprise the NOS action area is described below.

3.5.1.1.2.1 Greater Atlantic Region

Thirty-three cetaceans (seven mysticetes and 26 odontocetes) occur in the Greater Atlantic Region, as indicated in **Table 3.5-1**. Four of the mysticetes are ESA-listed: the sei, blue, fin, and North Atlantic right whales. The North Atlantic right whale also has designated critical habitat in the region as shown in **Figure 3.5-3**. One of the odontocetes is ESA-listed: the sperm whale.

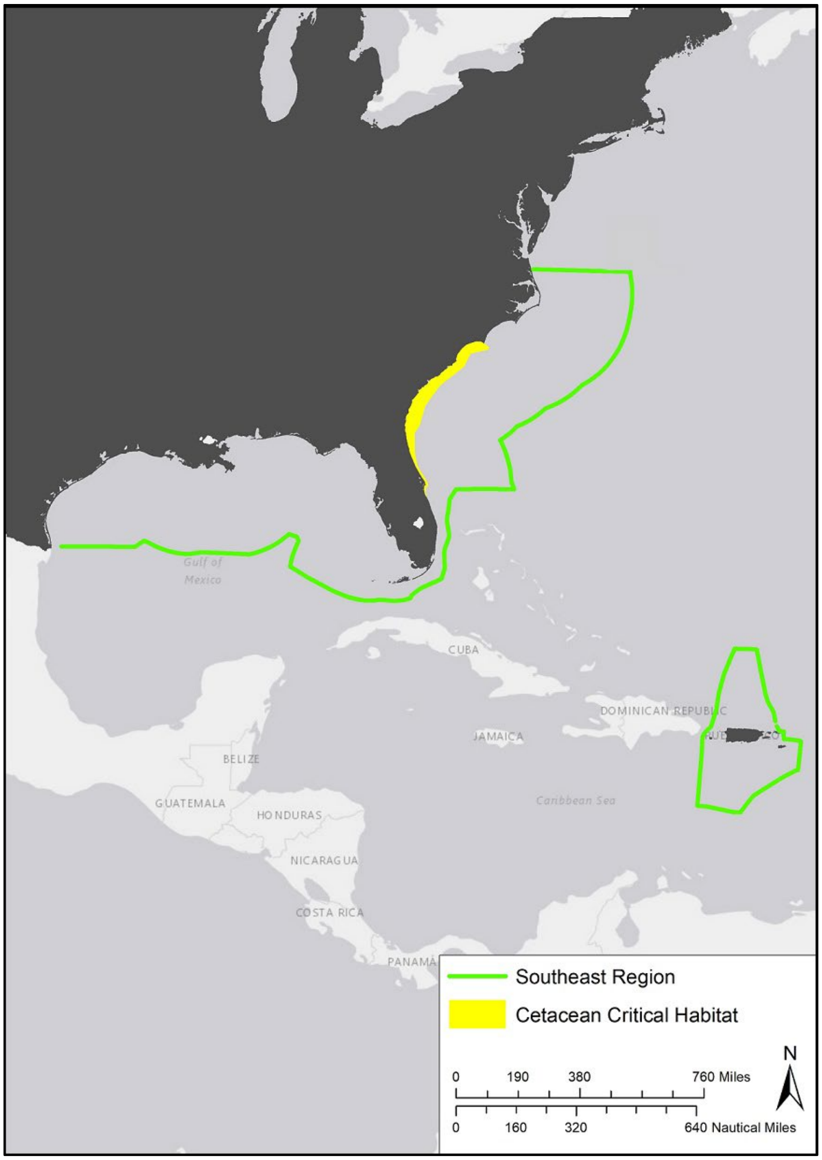


Sources: NMFS, No Date-b; ECOS, No Date-b

Figure 3.5-3. Cetacean Designated Critical Habitat in the Greater Atlantic Region

3.5.1.1.2.2 Southeast Region

Thirty-three cetaceans (eight mysticetes and 25 odontocetes) occur in the Southeast Region, as indicated in **Table 3.5-1**. Five of the mysticetes are ESA-listed: the sei, blue, fin, Rice's whale, and North Atlantic right whales. The North Atlantic right whale also has designated critical habitat in the region as shown in **Figure 3.5-4**. One of the odontocetes is ESA-listed: the sperm whale.

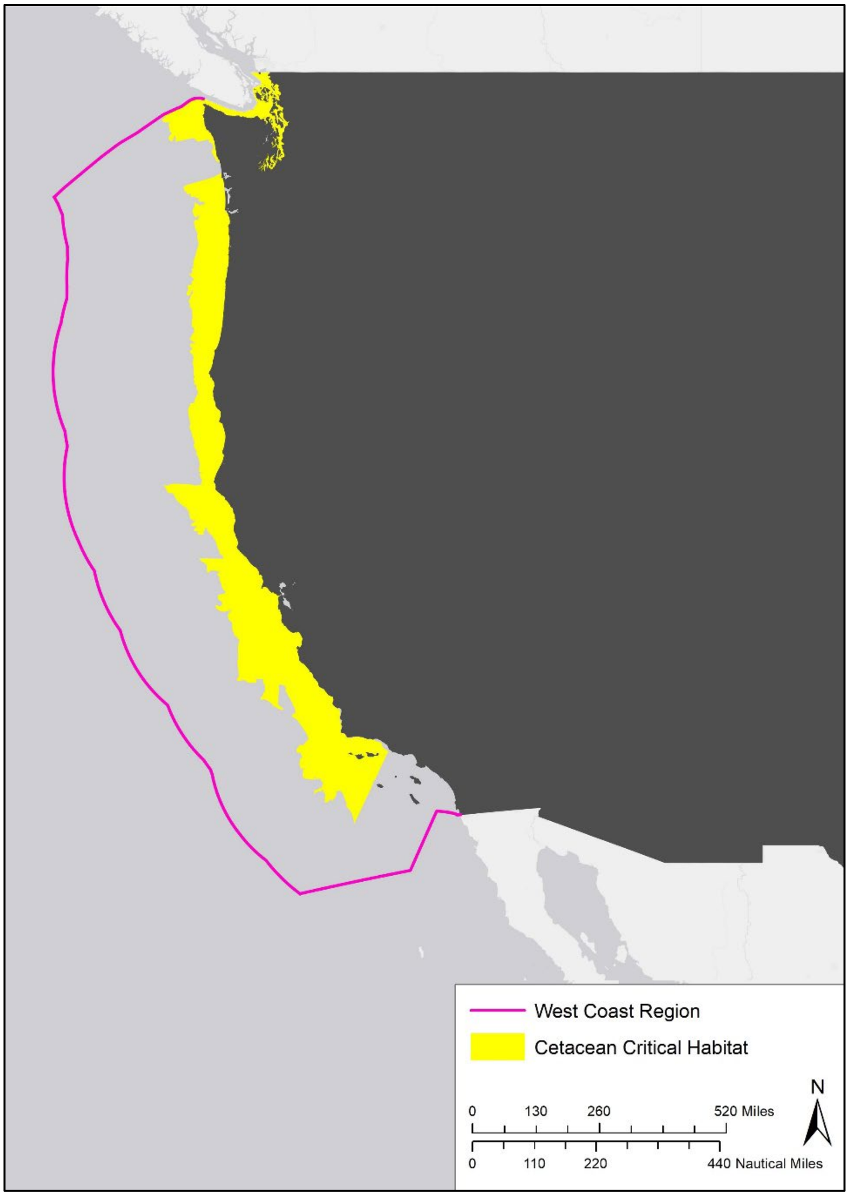


Sources: NMFS, No Date-b; ECOS, No Date-b

Figure 3.5-4. Cetacean Designated Critical Habitat in the Southeast Region

3.5.1.1.2.3 West Coast Region

Thirty-seven cetaceans (11 mysticetes and 26 odontocetes) occur in the West Coast Region, as indicated in **Table 3.5-1**. Seven of the mysticetes are ESA-listed: the sei, blue, fin, gray (Western North Pacific DPS), North Pacific right, humpback (Mexico DPS), and humpback (Central America DPS) whales. Two of the odontocetes are ESA-listed: the sperm and killer (Southern resident DPS) whales. The North Pacific right whale, humpback whale, and killer whale also have designated critical habitat in the region as shown in **Figure 3.5-5**.

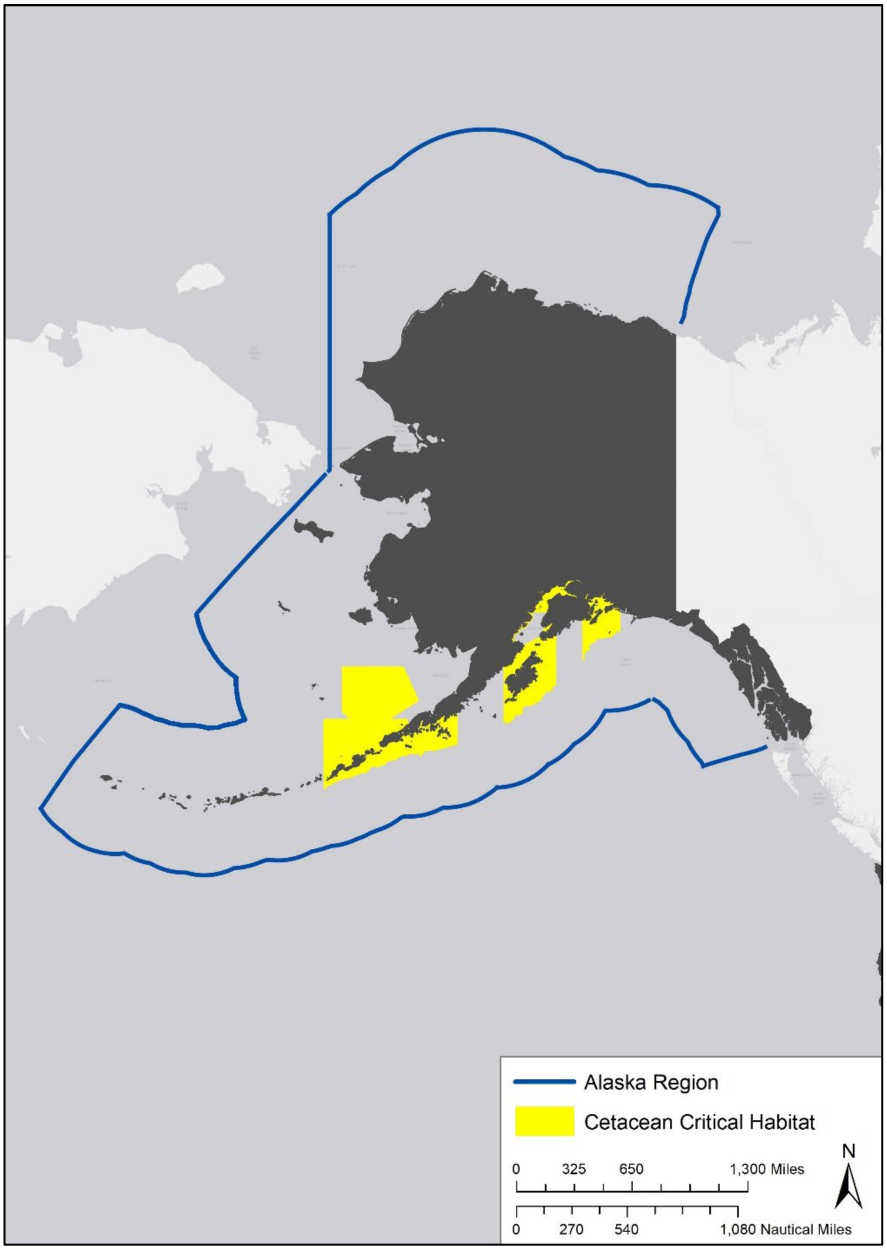


Sources: NMFS, No Date-b; ECOS, No Date-b

Figure 3.5-5. Cetacean Designated Critical Habitat in the West Coast Region

3.5.1.1.2.4 Alaska Region

Twenty-five cetaceans (11 mysticetes and 14 odontocetes) occur in the Alaska Region, as indicated in **Table 3.5-1**. Eight of the mysticetes are ESA-listed: the bowhead, sei, blue, fin, gray (Western North Pacific DPS), North Pacific right, humpback (Mexico DPS), and humpback (Western North Pacific DPS) whales. Two of the odontocetes are ESA-listed: the beluga (Cook Inlet DPS) and sperm whales. The North Pacific right whale, humpback whale, and beluga whale also have designated critical habitat in the region as shown in **Figure 3.5-6**.

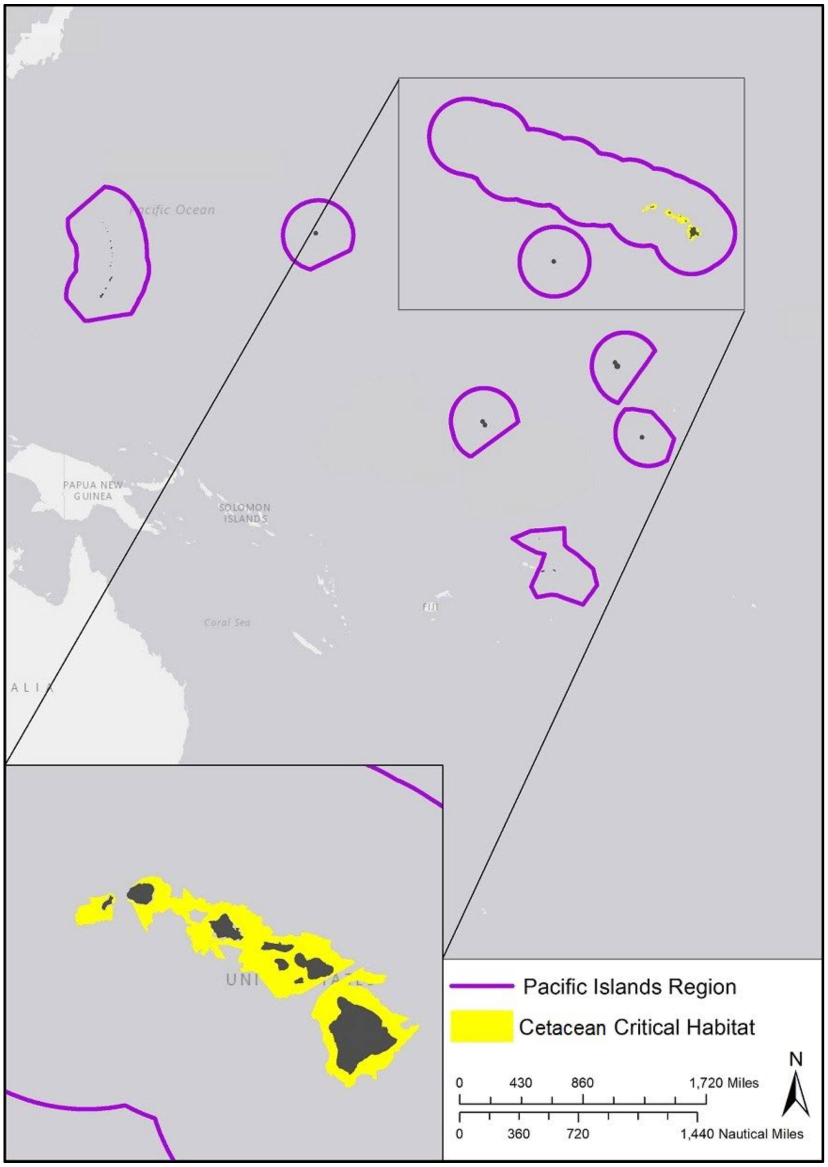


Sources: NMFS, No Date-b; ECOS, No Date-b

Figure 3.5-6. Cetacean Designated Critical Habitat in the Alaska Region

3.5.1.1.2.5 Pacific Islands Region

Twenty-seven cetaceans (seven mysticetes and 20 odontocetes) occur in the Pacific Islands Region, as indicated in **Table 3.5-1**. Four of the mysticetes are ESA-listed: the sei, blue, fin, and humpback (Western North Pacific DPS) whales. Two of the odontocetes are ESA-listed: sperm and false killer (Main Hawaiian Islands Insular DPS) whales. The false killer whale also has critical habitat in this region as shown in **Figure 3.5-7**.



Note: The critical habitat polygons shown in this map were digitized by hand and may contain manual errors. Care has been taken to align the polygons, to the extent practicable, with the *Main Hawaiian Islands Insular False Killer Whale Critical Habitat Designation Map* found at https://www.fisheries.noaa.gov/resource/map/main-hawaiian-islands-insular-false-killer-whale-critical-habitat-designation-map.

Figure 3.5-7. Cetacean Designated Critical Habitat in the Pacific Islands Region

3.5.1.1.3 Threatened and Endangered Cetaceans

Fifteen distinct populations of cetaceans are ESA-listed in the action area; eleven are mysticetes and four are odontocetes. Two listed mysticetes and three listed odontocetes also have designated critical habitat. These species are shown in **Table 3.5-1** and described in detail below. In some of the species descriptions below, species abundance is given as a best estimate of population size (due to sampling uncertainty), but also as a minimum population size, which is the lowest number of animals calculated to currently occur.

3.5.1.1.3.1 Bowhead Whale

Bowhead whales (**Figure 3.5-8**) are one of the few whale species that reside almost exclusively in Arctic and subarctic waters experiencing seasonal sea ice coverage, primarily between 60° and 75° north latitude (NMFS, No Date-a). Commercial whaling severely reduced bowhead whale numbers from historical levels. The economic value of the bowheads’ oil and baleen, combined with their slow swimming speeds and tendency to float when killed, made them a prime target for whalers. By the time commercial whaling of bowheads effectively ended in 1921, the worldwide bowhead abundance had declined to less than 3,000 whales. Today, bowhead whales may be still threatened by loss of food sources, climate change, vessel strikes, entanglement in fishing gear, ocean noise, sound and activity from offshore oil and gas development, and chemical pollution.

The worldwide number of bowheads prior to commercial exploitation is estimated at a minimum of 50,000, including an estimated 10,400 to 23,000 whales in the Western Arctic stock, the stock found in U.S. waters (NMFS, No Date-a). The bowhead whale was listed as endangered under the ESA in 1973. Bowhead whales are also listed as depleted under the MMPA (i.e., they have fallen below their optimum sustainable population levels). Western Arctic bowheads have shown considerable recovery since the end of commercial whaling, and they now comprise the largest population of bowheads in the world. The most recent stock assessment reports abundance data for the Western Arctic bowhead stock, collected during spring 2011, indicating that there are over 16,000 Western Arctic bowheads (Muto et al., 2020).

Figure 3.5-8. Bowhead Whale and Calf

Photo Credit: NOAA National Ocean Service

Bowhead whales inhabit the Bering, Chukchi, and Beaufort seas, Hudson Bay and Foxe Basin, Baffin Bay and Davis Strait, the Sea of Okhotsk, and waters from eastern Greenland and Spitsbergen to eastern Siberia. They spend the winter near the southern limit of the pack ice and move north as the sea ice breaks up and recedes during spring. The bowhead whale’s migration begins in the winter months from November to March. They travel from winter breeding grounds in the northern Bering Sea to the Chukchi Sea in the spring between March and June when most calving occurs. Between May and September they travel to the Canadian Beaufort Sea and spend the remainder of the summer in these waters. From September through December they return back to the Bering Sea to overwinter (Muto et al., 2020).

Bowhead whales live in areas often covered in thick ice and are capable of breaking through ice up to 60 centimeters (cm) (23 inches [in]) thick to manufacture breathing holes. They feed throughout the water column at the surface and on the bottom; the most prevalent prey are copepods, euphausiids, mysids, and gammarid amphipods. They may stay submerged for over an hour (Rugh and Shelden, 2009). Bowheads likely mate in late winter or early spring, although mating behavior has been observed at other times of the year. Calves are usually born between April and June, during the spring migration. The calving interval is about three to four years. Bowheads are exceedingly long-lived and may live to greater than 100-150 years of age (George et al., 1999).

3.5.1.1.3.2 Sei Whale

Sei whales occur in subtropical, temperate, and subpolar waters around the world, but they are most common in mid-latitude temperate zones. During the 19th and 20th centuries, sei whales were targeted and greatly depleted by commercial hunting and whaling, with an estimated 300,000 animals killed for their meat and oil (NMFS, No Date-a). Commercial whaling ended for this species in 1980. Although whaling is no longer a major threat, some scientific whaling continues today by Iceland and Japan. Vessel strikes, ocean noise, and entanglement with fishing gear pose the biggest threats to sei whales today. The sei whale was listed as endangered under the ESA in 1970, and it is listed as depleted under the MMPA.

Sei whales are usually observed alone or in small groups of two to five animals. They are fast swimmers that can reach speeds of over 55 km (34 mi) per hour. Sei whales dive differently than most whales as they do not arch their backs or show their flukes before diving; they simply sink below the surface. They can dive for five to 20 minutes to feed on plankton (including copepods and krill), small schooling fish, and cephalopods (including squid). They prefer to feed at dawn and may exhibit unpredictable behavior while foraging and feeding on prey (NMFS, No Date-a).

Sei whales prefer temperate waters in the mid-latitudes and can be found in the Atlantic, Indian, and Pacific Oceans. Sei whales have an unpredictable distribution. Many whales may be found in one area for a period and then not return for years or decades. This behavior is unusual for large whales, which generally have a predictable distribution. Sei whales are distributed far out to sea, most often over the continental slope, and do not often appear to be associated with coastal features (Carretta et al., 2020). At times, this general offshore pattern of sei whale distribution can be disrupted during episodic incursions into shallower, more inshore waters.

Sei whales within the Pacific U.S. EEZ are divided into three discrete, non-contiguous areas: 1) waters around Hawai'i; 2) California, Oregon, and Washington waters; and 3) Alaskan waters. Sei whales migrate to lower latitudes for breeding and calving in the winter and to higher latitudes in summer for feeding, including in the Gulf of Alaska and along the Aleutian Islands and the southern Bering Sea. The abundance of the eastern North Pacific stock is estimated at 519 animals with a minimum of 374 whales. The abundance of the Hawai'i stock is estimated at 391 with a minimum of 204 (Carretta et al., 2020).

There are two classified sei whale stocks within the Atlantic, the Nova Scotia stock and the Labrador Sea stock. The range of the Nova Scotia stock includes the continental shelf waters of the northeastern U.S. and extends northeastward to the south of Newfoundland. Sei whales are commonly sighted off Nova Scotia, the Gulf of Maine, and Georges Bank in spring and summer. The Nova Scotia stock size is estimated at 6,292 individuals with a minimum population of 3,098 (Hayes et al., 2020).

3.5.1.1.3.3 Rice's Whale

In 2019, NMFS listed the Gulf of Mexico Bryde's whale as an endangered subspecies under the ESA. It is also protected under the MMPA and designated as strategic and depleted. In 2021, NMFS revised the common and scientific name of the listed entity to Rice's whale and classification to species to reflect the new scientifically accepted taxonomy and nomenclature of the species. Thus, the previous Gulf of Mexico subspecies of Bryde's whale is now officially named Rice's whale. There is currently no designated critical habitat for this species; however, **Figure 3.5-9** shows the Rice's whale Core Distribution Area (CDA) and the 100 – 400 m (325 – 1,300 ft) isobath (i.e., depth contour) that the species occupies along the northwestern Gulf of Mexico shelf break (NMFS, No Date-a; Roberts et al., 2015a; 2016a; Soldevilla et al., 2022).

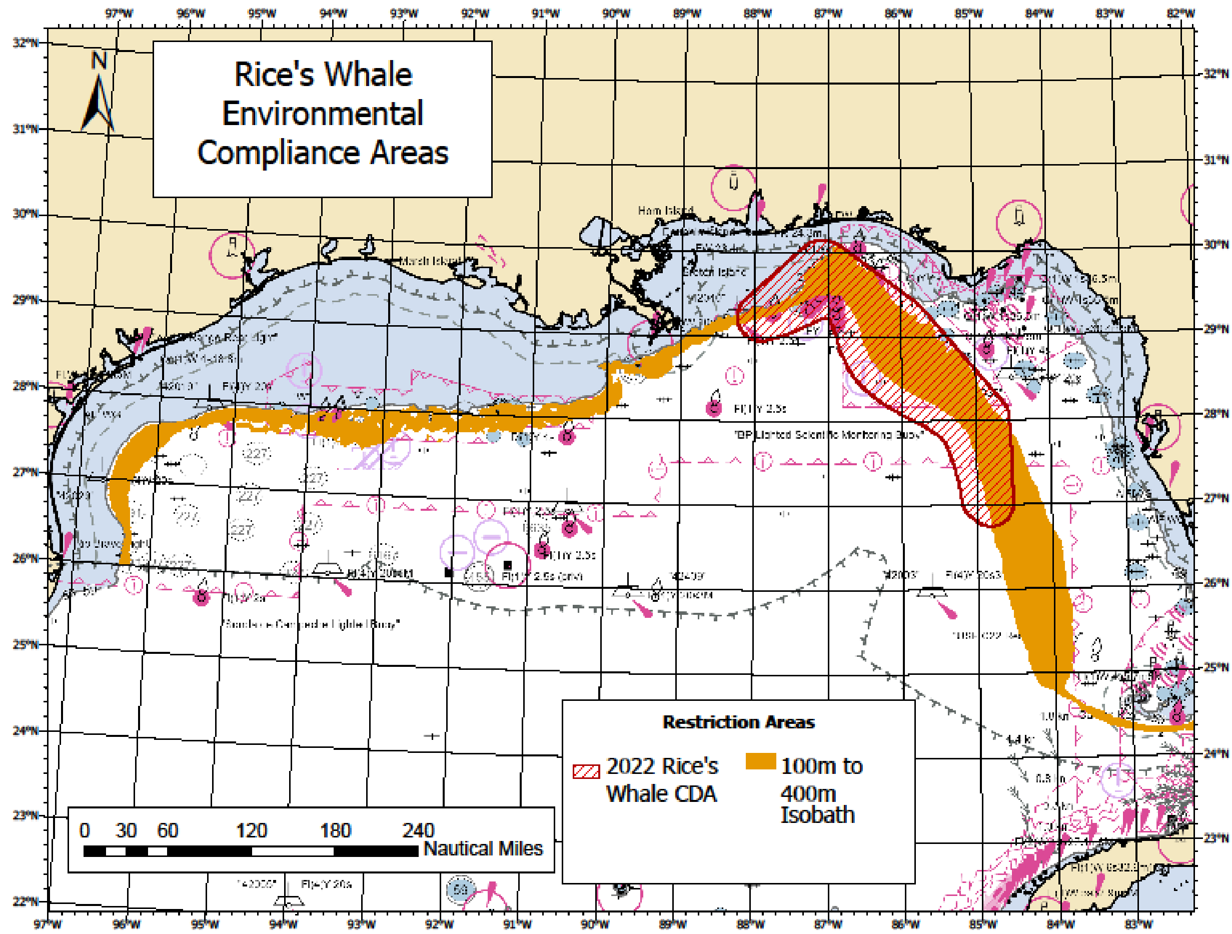


Figure 3.5-9. Core Distribution Area for the Rice's Whale in the Gulf of Mexico

Rice's whale is the only resident baleen whale in the Gulf of Mexico and is most closely related to Bryde's whales. In 2021 scientists determined that the Rice's whale was a unique species, genetically and morphologically distinct from Bryde's whales (NMFS, No Date-a). The Rice's whale's very small population size and limited distribution increase its vulnerability to threats. The most significant threats they face are energy exploration and development, oil spills and spill response, vessel strikes, ocean noise, ocean debris, aquaculture, and entanglement in fishing gear (NMFS, No Date-a). With such a small population size, the death of a single whale due to any of these stressors could have devastating consequences for the population's recovery.

The historical distribution of Rice's whales may have once encompassed the northern and southern Gulf of Mexico (NMFS, No Date-a). For the past 25 years, Rice's whale has been consistently located in the northeastern Gulf of Mexico, along the continental shelf break between 100 and about 400 m (325 to 1,300 ft) depth. A single Rice's whale was observed in the western Gulf of Mexico off the coast of Texas, suggesting that their distribution may occasionally include waters elsewhere in the Gulf of Mexico. Research is currently being conducted to better understand Rice's whales' distribution (e.g., if they use the western Gulf of Mexico and Mexican waters of the southern Gulf of Mexico, and how frequently they may occur in these other areas). Rice's whale is one of the few types of baleen whales to prefer warmer, tropical waters and that does not make long-distance migrations. Rice's whale is one of the few types of baleen whales that does not migrate; they remain in the Gulf of Mexico year-round.

Rice's whales are usually seen alone or in pairs, but may form larger, loose groups associated with feeding (NMFS, No Date-a). Limited data suggest that Rice's whales spend the daytime diving near the sea floor bottom and the majority of their time at night near the water's surface. Little is known about their foraging ecology and diet. However, data from two Rice's whales suggest they may mostly forage at or near the sea floor. This is in contrast to Bryde's whales that have been observed feeding in the water column and near the surface on small crustaceans and schooling fish such as anchovy, sardine, mackerel, and herring.

When the ESA status review was completed in 2016, the team of scientists conducting the review concluded that there were likely fewer than 100 individual Rice's whales throughout the Gulf of Mexico, with 50 or fewer being mature individuals (NMFS, No Date-a). The most recent abundance estimate from 2017–2018 surveys in the northeastern Gulf of Mexico is approximately 51 individual Rice's whales. With the minimum population estimate for the northern Gulf of Mexico at 34 animals (Hayes et al., 2022), Rice's whales are one of the most endangered whales in the world. Recovery of the species depends upon the protection of each remaining whale.

3.5.1.1.3.4 Blue Whale

Blue whales are found in all oceans except the Arctic Ocean. They are the largest cetacean, and they feed almost exclusively on krill. Fish and copepods may also occasionally be part of the blue whale's diet. The number of blue whales in the world's oceans is only a small fraction of what it was before modern commercial whaling significantly reduced their numbers during the early 1900s, but populations are increasing globally (NMFS, No Date-a). The northern hemisphere subspecies of blue whale was listed as endangered under the ESA in 1970, and they are listed as depleted under the MMPA. The primary threats currently facing blue whales are vessel strikes and entanglements in fishing gear.

There are five currently recognized subspecies of blue whales; the subspecies *Balaenoptera musculus* is present in the U.S. EEZ. On the west coast, there are two populations of North Pacific blue whales with some degree of geographic overlap – the Eastern North Pacific stock and the Central North Pacific stock (Carretta et al., 2020). The regional occurrence patterns suggest that blue whales from the Eastern North Pacific stock winter off Mexico, Central America, and as far south as 8° south, and feed during summer off the U.S. West Coast and to a lesser extent in the Gulf of Alaska. Blue whales belonging to the Central Pacific stock appear to feed in summer southwest of the Kamchatka Peninsula, in the Russian Far East, south of the Aleutians, and in the Gulf of Alaska, and in winter migrate to lower latitudes in the western and central Pacific, including Hawai'i. Both populations occur in lower latitudes in the central North Pacific, but differ in their seasonal patterns.

The best population estimate for blue whales in the Eastern North Pacific stock is 1,898 animals, with a minimum estimate of 1,767 animals (Carretta et al., 2022). Because whales in this stock spend approximately three quarters of their time outside the U.S. EEZ, the potential biological removal level allocation for U.S. waters is one-quarter of this total. The best population estimate for blue whales in the Central North Pacific stock is 133 animals, with a minimum estimate of 63 animals; this is based on a summer/fall abundance estimate, but the majority of blue whales would be expected to be at higher latitudes feeding grounds at this time of year (Carretta et al., 2020).

Blue whales sometimes swim in small groups but are mostly found alone or in pairs. Blue whales generally migrate seasonally between summer feeding grounds in polar waters and winter breeding grounds towards the equator, but some evidence suggests that individuals remain in certain areas year-round (NMFS, No Date-a). Information about distribution and movement varies with location, and migratory routes are not well-known. In general, distribution is driven largely by food requirements as they occur in waters where krill is concentrated. In the North Atlantic Ocean, their range extends from the subtropics to the Greenland Sea. Blue whales have been sighted in the waters off eastern Canada, in the shelf waters off the eastern U.S., and infrequently in the Gulf of Mexico and the Caribbean. Along the west coast of the U.S., eastern North Pacific blue whales are believed to spend winters off of Mexico and Central America. They likely feed during summer off the U.S. west coast and, to a lesser extent, in the Gulf of Alaska and central North Pacific waters. Blue whales with young calves have been observed often in the Gulf of California (Sea of Cortez) from December through March. Thus, at least some calves may be born in or near the Gulf of California; this area is probably an important calving and nursing area for the species.

The blue whale is an occasional visitor in U.S. Atlantic EEZ waters, which may represent the current southern limit of its feeding range in the Atlantic. In the western North Atlantic Ocean, the blue whale's range extends from the Arctic to Cape Cod, Massachusetts, and it is frequently sighted off eastern Canada (e.g., Newfoundland). Blue whales have been identified as far south as Bermuda. Blue whales show a strong preference for shelf breaks, sea mounts, or other areas where food resources are known to occur, even during summer months. Blue whales do not have specific breeding or calving areas.

3.5.1.1.3.5 Fin Whale

The fin whale is the second-largest species of cetacean. It is found throughout the world's oceans. During the summer, fin whales feed on krill, small schooling fish (including herring, capelin, and sand lance), and squid. Fin whales fast in the winter while they migrate to warmer waters. Like all large whales, fin whales were hunted by commercial whalers, which greatly lowered their population. Whaling is no longer a major threat for this species as commercial whaling ended in the 1970s and 1980s, though some hunting continues today in Greenland through subsistence whaling allowances (NMFS, No Date-a). The biggest threat to fin whales comes from vessel strikes; entanglement in fishing gear, lack of prey due to overfishing, and ocean noise also threaten this species. The fin whale was listed as endangered under the ESA in 1970, and it is listed as depleted under the MMPA.

Fin whales are found in deep, offshore waters of all major oceans, primarily in temperate to polar latitudes. They are less common in the tropics. They occur year-round in a wide range of locations, but the density of individuals in any one area changes seasonally. Most migrate from the Arctic and Antarctic feeding areas in the summer to tropical breeding and calving areas in the winter. The overall migration pattern is complex and specific routes have not been documented (NMFS, No Date-a).

The location of winter breeding grounds is not known. Surveys indicate a southward flow pattern in the fall from the Labrador-Newfoundland region, past Bermuda, and into the West Indies. The fin whale is the most common whale sighted in northwest Atlantic waters from Cape Hatteras, North Carolina to Maine; New England waters represent a major feeding ground (Hayes et al., 2020). Within the U.S. waters in the Pacific Ocean, fin whales are found seasonally off the coast of North America and in the Bering Sea during the summer (Muto et al., 2020). Some fin whales feed in the Gulf of Alaska, including near the entrance to Cook Inlet, and during the months of July and August they are concentrated in the Bering Sea and eastern Aleutian Island area. From September to October, most fin whales are in the Bering Sea, Gulf of Alaska, and along the U.S. coast as far south as Baja, California. There may be resident groups of fin whales in some areas, such as the Gulf of California. Fin whales have been considered rare in Hawaiian waters and are absent to rare in eastern tropical Pacific waters (Carretta et al., 2020). Fin whales travel in the open seas, away from the coast, so they are difficult to track.

For management purposes, fin whales in U.S. waters are divided into four stocks: Hawai'i, California/ Oregon/Washington, Alaska (Northeast Pacific), and Western North Atlantic. Reliable, recent population estimates are available for much of the North Atlantic Ocean, but not for most of the North Pacific or the South Pacific. Population estimates are 6,802 fin whales in the Western North Atlantic stock with a minimum estimate of 5,573 animals; 3,168 individuals in the Northeast Pacific stock with a minimum estimate of 2,554 animals with a minimum estimate of 2,554 animals; 11,065 in the waters off of California, Oregon, and Washington with a minimum estimate of 7,970 animals; and 203 for the Hawai'i stock with a minimum estimate of 101 animals (Carretta et al., 2022; Muto et al., 2022; Hayes et al., 2022). The estimate for the entire North Pacific is between 14,000 and 18,000. The number of fin whales in the southern hemisphere is around 82,000 (NMFS, No Date-a).

3.5.1.1.3.6 Gray Whale (Western North Pacific Distinct Population Segment)

Once common throughout the Northern Hemisphere, gray whales are now mainly found in the shallow coastal waters in the North Pacific Ocean. Commercial whaling brought both Pacific populations to near extinction. Conservation measures were enacted in the 1930s and 1940s to protect whales from over exploitation, and in the mid-1980s, the International Whaling Commission instituted a moratorium on commercial whaling (NMFS, No Date-a). Gray whales are known for their curiosity toward boats and are the focus of whale watching; thus, they face threats from vessel strikes and disturbance on their migration route. The eastern population of gray whales which occurs in the action area was once listed as endangered under the ESA but successfully recovered and delisted in 1994. The species is protected under the MMPA throughout its range, but the eastern population is non-strategic and is not considered depleted (Carretta et al., 2020). The western population remains very low and is listed as endangered under the ESA and depleted under the MMPA.

There are two geographic distributions of gray whales in the North Pacific: the Eastern North Pacific stock, found along the west coast of North America, and the Western North Pacific stock, found along the coast of eastern Asia. Most eastern North Pacific gray whales spend the summer in the shallow waters of the northern and western Bering Sea and in the adjacent waters of the Arctic Ocean; however, some remain throughout the summer and fall along the Pacific coast as far south as southern California (NMFS, No Date-a). In the fall, gray whales migrate from their summer feeding grounds, heading south along the coast of North America to spend the winter in their wintering and calving areas in sheltered waters off the coast of Baja California, Mexico. From mid-February to May, eastern North Pacific gray whales can be seen migrating northward along the U.S. west coast. Gray whales are by far the most coastal of all the great whales and inhabit primarily inshore or shallow, offshore continental shelf waters of the North Pacific. They tend to be nomadic, highly migratory, and tolerant of climate extremes (Caretta et al., 2020).

The presence of individuals from the Western North Pacific stock of gray whales in the action area is considered extralimital. During summer and fall, the Western North Pacific stock feeds in the Okhotsk Sea, Russia. Historically, wintering areas included waters off Korea, Japan, and China. Recent tagging, photo-identification, and genetics studies revealed that some gray whales from this stock migrate to the eastern North Pacific in winter, including waters off Canada, the U.S., and Mexico (Caretta et al., 2020).

The population size of the Eastern North Pacific stock has increased over several decades and is stable or still increasing (Carretta et al, 2020). Monitoring over the last 30 years has provided data that have indicated the Eastern North Pacific population and stock is within range of its optimum sustainable population, which is consistent with a population approaching the carrying capacity of the environment. The current estimated abundance for the Eastern North Pacific stock is 26,960 whales, with a minimum population estimate of 25,849 (Carretta et al., 2020). The Western North Pacific stock of gray whales was once considered extinct, but now small numbers are known to exist (Carretta et al., 2020). Based on photo-identification studies off Sakhalin Island, Russia, estimated abundance of the Western North Pacific stock is 290, with a minimum estimate of 271 gray whales off Sakhalin (Carretta et al., 2020).

3.5.1.1.3.7 North Atlantic Right Whale

The North Atlantic right whale (**Figure 3.5-10**) is one of the world's most endangered large whale species. By the early 1890s, commercial whalers had hunted right whales in the Atlantic to the brink of extinction. Whaling is no longer a threat, but human interactions still present the greatest danger to this species (NMFS, No Date-a). The leading causes of known mortality for North Atlantic right whales are entanglement in fishing gear and vessel strikes; for the period 2011 through 2015, the minimum rate of annual human-caused mortality and serious injury to right whales averaged 5.36 per year (Hayes et al., 2020). Other threats include ocean noise, climate change, disturbance from whale watching activities, and lack of food.

Figure 3.5-10. North Atlantic Right Whale

Photo credit: NOAA Photo Library

North Atlantic right whales were listed as endangered under the ESA in 1970, and they are listed as depleted under the MMPA. North Atlantic right whales represent one of the most intensely studied populations of cetaceans in the world, supported by a rigorously maintained individual sightings database and considerable surveys throughout their range. The current estimated abundance for this species is 368 whales, with a minimum population estimate of 364 animals (Hayes et al., 2022).

North Atlantic right whales primarily occur in Atlantic coastal waters or close to the continental shelf, although movements over deep waters are known (NMFS, No Date-a). New England waters are important feeding habitats for right whales, where they feed primarily on copepods. Right whales feed anywhere from the water's surface to the bottom of the water column.

Right whales migrate seasonally and may travel alone or in small groups. In the spring, summer, and fall they are found in their northern habitats, where they feed and mate. Each fall, some right whales travel more than 1,600 km (1,000 mi) from their feeding grounds off the Canadian Maritimes and New England to the warm coastal waters off South Carolina, Georgia, and northeastern Florida. During winter, pregnant females give birth in the only known North Atlantic right whale calving area off the southeastern U.S. in shallow, coastal waters. However, the location of much of the population is unknown during the winter.

Surveys have demonstrated the existence of seven areas where western North Atlantic right whales aggregate seasonally: the coastal waters of the southeastern U.S.; the Great South Channel (south of the Gulf of Maine); Jordan Basin (within the Gulf of Maine); Georges Basin along the northeastern edge of Georges Bank; Cape Cod and Massachusetts Bays; the Bay of Fundy; and the Roseway Basin on the Scotian Shelf (Hayes et al., 2020). They are present year-round in the Gulf of Maine. Movements within and between habitats are extensive, and the area off the mid-Atlantic states is an important migratory corridor.

There are two designated critical habitat areas determined to provide important feeding, nursery, and calving habitat for the North Atlantic population of right whales. One is a foraging area off the coast of New England; the other is a calving area off the southeast U.S. coast from Cape Fear, North Carolina to below Cape Canaveral, Florida (NMFS, No Date-a).

3.5.1.1.3.8 North Pacific Right Whale

North Pacific right whales are the rarest of all large whale species and among the rarest of all marine mammal species. In past years, commercial whaling greatly reduced right whale populations in the Pacific Ocean. Whaling is no longer a threat, but human activity such as entanglement in fishing gear and marine debris, vessel strikes, impacts from climate change, and ocean noise continue to endanger this species (NMFS, No Date-a). Subsistence hunters in Alaska and Russia do not hunt animals from the Eastern North Pacific right whale stock (Muto et al., 2020).

North Pacific right whales have been listed as endangered under the ESA since 1970, and they are designated as depleted under the MMPA. In 2008, NMFS relisted the North Pacific right whale as endangered as a separate species (*Eubalaena japonica*) from the North Atlantic species (*E. glacialis*). The principal habitat requirements for right whales are dense concentrations of prey, so on this basis, two areas of critical habitat were proposed: one in the southeastern Bering Sea and another south of Kodiak Island. (The primary prey for right whales on the Bering Sea shelf is the copepod *Calanus marshallae* [Muto et al., 2020]). In 2006, NMFS issued a final rule designating these two areas as northern right whale critical habitat. In 2008, the same two areas were redesignated as Eastern North Pacific right whale critical habitat under the newly recognized species name, *E. japonica*.

The North Pacific right whale population is very small, and most sightings have been of single whales, though small groups have been sighted (Muto et al., 2018; NMFS, No Date-a). From 1962 to 1999, there were only 82 published sightings of right whales in the entire eastern North Pacific, with the majority of these occurring in the Bering Sea and adjacent areas of the Aleutian Islands; this surprising lack of sightings ultimately led to the discovery that right whales had been subject to large illegal catches by the former U.S.S.R. (Muto et al., 2020). The current estimated abundance for the Eastern North Pacific stock is 31 whales, with a minimum population estimate of 26 individuals (Muto et al., 2020).

North Pacific right whales have occurred historically in all the world's oceans from temperate to subpolar latitudes. Most right whale sightings since 1996 have occurred in the southeastern Bering Sea, with a few records in the Gulf of Alaska near Kodiak Island, Alaska (Muto et al., 2020). Since 1996, right whales have been observed repeatedly in their critical habitat in the southeastern Bering Sea during the summer months. Migration patterns of the North Pacific right whale are unknown, although it is thought that the whales spend the summer in far northern feeding grounds and migrate south to warmer waters, such as southern California, during the winter. Right whales calve in coastal waters during the winter months, but calving grounds have not been identified in the eastern North Pacific. Worldwide, most known right whale nursery areas are in shallow, coastal waters (Muto et al., 2020; NMFS, No Date-a).

3.5.1.1.3.9 Humpback Whale (Mexico DPS, Central America DPS, and Western North Pacific DPS)

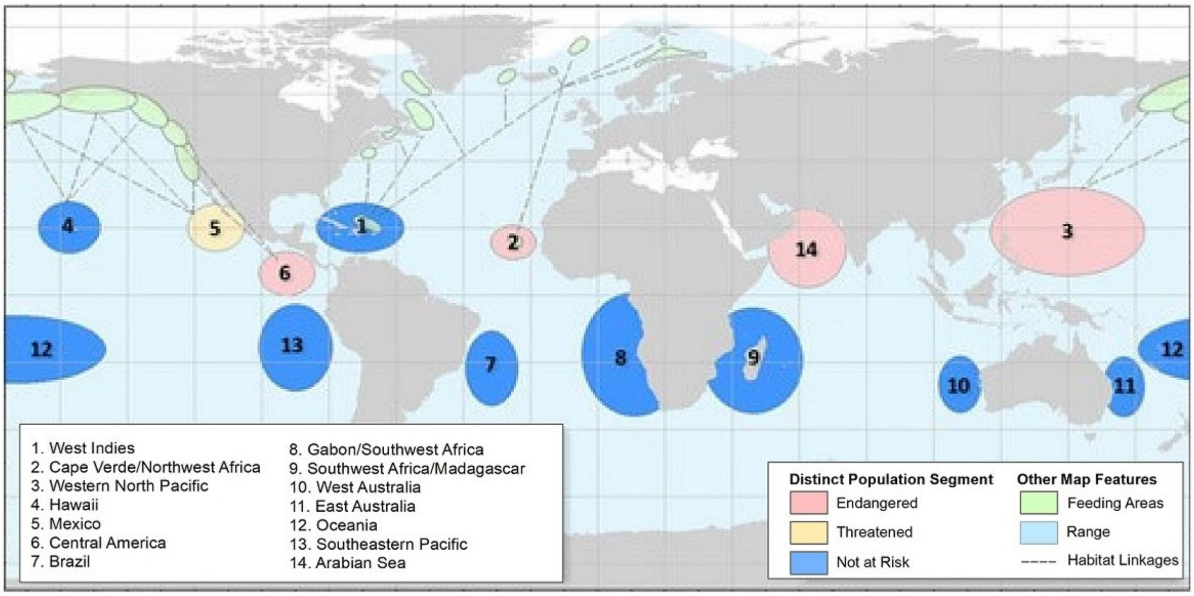
Humpback whales live in oceans around the world. They travel extensive distances every year and have one of the longest migrations of any mammal. Some populations swim 8,000 km (5,000 mi) from tropical breeding grounds in winter to high-latitude feeding grounds in summer. Humpback whales feed on shrimp-like krill and small fish. They are generally found close to shore and are commonly active on the surface, including breaching (leaping above the water) or slapping the surface with their pectoral fins and tails (NMFS, No Date-a). Commercial whaling severely reduced humpback whale numbers from historical levels. Before a moratorium on commercial whaling in 1985, all populations of humpback whales were greatly reduced, some by more than 95 percent. The species is increasing in abundance in much of its range but still faces threats from entanglement in fishing gear, vessel strikes, vessel-based harassment, underwater noise, and habitat impacts.

All humpback whales were listed as endangered under the Endangered Species Conservation Act in 1970, and then again under the ESA in 1973. NMFS has conducted a global status review of humpback whales, and in 2016 revised the ESA listing of the species. Currently, four out of the 14 DPS (**Figure 3.5-11**) are still protected as endangered (including two occurring in the action area: the Western North Pacific DPS and Central American DPS), and one is listed as threatened (the Mexico DPS, which occurs in the action area). Critical habitat for the endangered Western North Pacific distinct population segment (DPS), the endangered Central America DPS, and the threatened Mexico DPS of humpback whales (Megaptera novaeangliae) was designated in 2021 (86 FR 20632, April 21, 2021. Specific areas designated as critical habitat for the Western North Pacific DPS of humpback whales contain approximately 59,411 square nautical miles (nm^2) of marine habitat in the North Pacific Ocean, including areas within the eastern Bering Sea and Gulf of Alaska. Specific areas designated as critical habitat for the Central America DPS of humpback whales contain approximately 48,521 nm^2 of marine habitat in the North Pacific Ocean within the portions of the California Current Ecosystem off the coasts of Washington, Oregon, and California. Specific areas designated as critical habitat for the Mexico DPS of humpback whales contain approximately 116,098 nm^2 of marine habitat in the North Pacific Ocean, including areas within portions of the eastern Bering Sea, Gulf of Alaska, and California Current Ecosystem.

The stock structure of humpback whales is defined by NMFS based on the stock's fidelity to feeding grounds (Muto et al., 2020). As a result, the stock designations are inconsistent with the DPS designations.

Of the stocks occurring in the action area, the Western North Pacific stock, the Central North Pacific stock, the California/Oregon/Washington stock, and the American Samoa stock are designated as strategic and depleted under the MMPA; the Gulf of Maine stock is non-strategic.

Mexico DPS whales breed along the Pacific coast of Mexico, the Baja California Peninsula, and the Revillagigedos Islands, and feed across a broad range from California to the Aleutian Islands (Alaska). The Central America DPS breeds along the Pacific coast of Costa Rica, Panama, Guatemala, El Salvador, Honduras, and Nicaragua and feeds almost exclusively off California and Oregon. The Western North Pacific DPS breeds in the areas of Okinawa, Japan, and the Philippines, and feeds in the northern Pacific, primarily off the Russian coast, but also in the Bering Sea and Aleutian Islands of Alaska (NMFS, No Date; Muto et al., 2020).



Source: NMFS, No Date-a

Figure 3.5-11. Locations of the 14 Distinct Population Segments of Humpback Whales Worldwide

While calving, humpback whales prefer shallow, warm waters commonly near offshore reef systems or shores. Humpback whale feeding grounds are generally in cold, productive waters (NMFS, No Date). Along the U.S. west coast, three relatively distinct stocks migrate between their summer/fall feeding areas and winter/spring calving and mating areas: 1) the California/Oregon/Washington stock, consisting of winter/spring populations in coastal Central America and coastal Mexico which migrate to the coast of California to southern British Columbia in summer/fall; 2) the Central North Pacific stock, consisting of winter/spring populations of the Hawaiian Islands which migrate primarily to northern British Columbia/Southeast Alaska, the Gulf of Alaska, and the Bering Sea/Aleutian Islands; and 3) the Western North Pacific stock, consisting of winter/spring populations off Asia which migrate primarily to Russia and the Bering Sea/Aleutian Islands (Caretta et al., 2020). Humpback whales from the Western and Central North Pacific stocks mix to a limited extent on summer feeding grounds ranging from British Columbia through the central Gulf of Alaska and up to the Bering Sea.

Most North Atlantic humpback whales, including the Gulf of Maine stock, migrate to the West Indies during the winter to mate and calve. Not all migrate south, however, as significant numbers occur in mid- and high-latitude regions in winter. Humpback whales in the western North Atlantic feed during spring, summer, and fall over a range which encompasses the eastern coast of the U.S., the Gulf of St. Lawrence, Newfoundland/Labrador, and western Greenland (Hayes et al., 2020). Additional feeding areas are off Iceland and northern Norway. These areas represent six relatively discrete subpopulations. Based on genetic analyses, the Gulf of Maine feeding stock is treated as a separate management stock.

The American Samoa stock comes from the Oceania subpopulation of humpback whales which ranges throughout the South Pacific, except the west coast of South America, and from the equator to the edges of the Antarctic ice (Caretta et al., 2020).

North Pacific humpback whales (*M. novaeangliae kuzira*) comprise a distinct subspecies based on DNA relationships and distribution compared to North Atlantic humpback whales (*M. n. novaeangliae*) and those in the Southern Hemisphere (Carretta et al., 2020). Humpback whales occur throughout the North Pacific, with multiple populations currently recognized based on low-latitude winter breeding areas. Exchange of animals between breeding areas rarely occurs, based on photo-identification data of individual whales; photo-identification evidence also suggests strong site fidelity to feeding areas (Carretta et al., 2020).

The current population estimate for the Western North Pacific stock is 1,107 animals, with a minimum population estimate of 865 (Muto et al., 2020). The current population estimate for the Central North Pacific stock is 10,103 animals, with a minimum population estimate of 7,891 (Muto et al., 2020). The current population estimate for the California/Oregon/Washington stock is 4,973 animals, with a minimum population estimate of 4,776 (Carretta et al., 2022).

Recent abundance estimates indicate continued population growth, but the size of the humpback whale Gulf of Maine stock off the U.S. east coast may still be below its optimum sustainable population. The current estimated abundance for the Gulf of Maine stock is 1,396 whales, with a minimum population estimate of 1,380 individuals (Hayes et al., 2020).

The status of humpback whales in American Samoan EEZ waters is unknown, and there are insufficient data to estimate trends in abundance. However, the minimum population estimate for the American Samoa stock is 150 whales, which is the number of unique humpbacks identified in the waters around American Samoa via photo identification (Caretta et al., 2020).

3.5.1.1.3.10 Beluga Whale (Cook Inlet DPS)

Beluga whales are known for their white color and range of vocal sounds. They are very social animals, forming groups to hunt, migrate, and interact with each other. Beluga whales are found in the U.S. in Alaska and globally throughout the Arctic Ocean. They are also at home in large rivers and can move between salt and fresh water. Beluga whales are vulnerable to many stressors and threats, including pollution, habitat degradation, harassment, interactions with commercial and recreational fisheries, sound and activity from oil and gas exploration, disease, and other types of human disturbance such as underwater noise (NMFS, No Date-a).

There are five management stocks in Alaska based on distributional separation, distinct population trends between regions occupied in summer, and genetic differences. These five stocks of beluga whales in Alaskan waters are: the Beaufort Sea, Bristol Bay, Cook Inlet, eastern Bering Sea, and eastern Chukchi Sea stocks. Each stock is unique, isolated from one another genetically and/or physically by migration routes and preferred habitats. Worldwide, belugas may number in the hundreds of thousands; however, some stocks are small, numbering in the low hundreds.

The endangered Cook Inlet beluga whale population has declined by nearly 75 percent since 1979, from about 1,300 whales to an estimated 328 whales in 2016 (NMFS, No Date-a). The current population estimate for the Cook Inlet stock is 279 animals, with a minimum population estimate of 267 individuals (Muto et al., 2022).

Commercial and sport hunting once threatened beluga whale populations. These activities are now banned, though Alaska Natives still hunt beluga whales for subsistence. Beluga subsistence harvest in the Cook Inlet of south-central Alaska is now regulated because of the lack of recovery in the area (NMFS, No

Date-a). Alaska Natives last hunted Cook Inlet beluga whales in 2005. All beluga whale populations are protected under the MMPA. NMFS has designated the Cook Inlet beluga whale population in Alaska and the Sakhalin Bay-Nikolaya Bay-Amur River stock off the coast of Russia as depleted under the MMPA. In addition, the Cook Inlet DPS was listed as endangered under the ESA in 2011.

Beluga whales inhabit cold waters of the Arctic and subarctic. The northernmost extent is off Alaska, northwest Canada, and off Ellesmere Island, West Greenland, and Svalbard (>80° north); the southern limit of distribution is in the St. Lawrence River in eastern Canada (47° – 49° north). Depending on season and region, beluga whales can occur in both offshore and coastal waters. During the winter, beluga whales generally occur in offshore waters associated with the ice pack; in the spring, many migrate to warmer coastal estuaries, bays, and rivers for molting and calving. Breeding occurs in March and April, with calves born the following May through July, usually when pods are at or near summer concentration areas (**Figure 3.5-12**). The Cook Inlet DPS occurs near river mouths in the northern Cook Inlet during the spring and summer months and in mid-Inlet waters in the winter. The stock remains in Cook Inlet throughout the year (Muto et al., 2022).

Figure 3.5-12. Pod of Beluga Whales

Photo Credit: LCDR Gary Barone, NOAA

NMFS has designated 7,800 km^2 (3,013 mi^2) of critical habitat for the Cook Inlet DPS (76 Federal Register [FR] 20180, April 11, 2011). Critical Habitat Area 1 occurs in the upper portion of Cook Inlet that contains a number of shallow tidal flats, river mouths, and estuarine areas important for foraging, calving, molting, and escaping predators. This area contains the highest concentration of beluga whales from spring through fall. Critical Habitat Area 2, which includes near and offshore areas of the mid- and upper Inlet and nearshore areas of the lower Inlet, is used less during spring and summer, but it is used in fall and winter. Dispersed fall and winter feeding and transit areas occur in Critical Habitat Area 2.

3.5.1.1.3.11 Killer Whale (Southern Resident DPS)

The killer whale (**Figure 3.5-13**), also known as the orca, is one of the top marine predators. They are found in every ocean in the world, with the highest densities found in coastal temperate waters, and are the most widely distributed of all whales and dolphins. Killer whales can adapt to almost any condition, and are found in both open seas and coastal waters. Killer whales are highly social, and most live in social groups called pods. Pod members communicate with each other through clicks, whistles, and pulsed calls. Each pod in the eastern North Pacific possesses a unique set of calls that are learned and culturally transmitted among individuals. These calls maintain group cohesion and serve as family badges. Taken as a whole, the species has the most varied diet of all cetaceans, but different populations are usually specialized in their foraging behavior and diet. Resident killer whales exclusively eat fish, while Transient killer whales primarily eat marine mammals and squid (NMFS, No Date-a).

Figure 3.5-13. Killer Whale Breaching

Photo Credit: NOAA Central Library Historical Image

Hunters and fishermen once targeted killer whales. As a result, historical threats to killer whales included commercial hunting, and culling to protect fisheries from killer whales. In addition, although live capture of killer whales for aquarium display and marine parks no longer occurs in the U.S., it remains a threat globally. Today, some killer whale populations face many other threats, including food limitations, chemical contaminants, and disturbances from vessel traffic and sound (NMFS, No Date-a).

All killer whale populations are protected under the MMPA. Additionally, the Southern Resident population was listed as endangered under the ESA in 2006, and, along with the AT1 Transient population, is listed as depleted under the MMPA. AT1 Transients, a subgroup of transient killer whales in the eastern North Pacific, has been reduced from 22 to seven whales since the 1989 *Exxon Valdez* oil spill (NMFS, No Date-a). The minimum historical population size of Southern Residents in the eastern North Pacific was about 140 animals. Following a live-capture fishery in the 1960s for use in marine mammal parks, 71 animals remained in 1974. Although there was some growth in the population in the 1970s and 1980s, the population experienced a decline of almost 20 percent in the late 1990s (NMFS, No Date-a). The population increased to 99 whales in 1995, then declined to 79 whales in 2001, and 83 whales in 2016 (Carretta et al., 2018). The current population estimate for the Eastern North Pacific Southern Resident stock is 72 animals, with a minimum population estimate of 72 individuals (Caretta et al., 2021).

The Southern Resident stock is a trans-boundary stock including killer whales in inland Washington and southern British Columbia waters. Southern Resident killer whales range from central California to southeast Alaska. Most sightings have occurred in the summer in inland waters of Washington and southern British Columbia. However, pods belonging to this stock have also been sighted in coastal waters off southern Vancouver Island and Washington. The complete winter range of this stock is uncertain. Of the three pods comprising this stock, one is commonly sighted in inshore waters in winter, while the other two apparently spend more time offshore. These latter two pods have been sighted as far south as Monterey Bay and central California in recent years. They sometimes have also been seen entering the inland waters of Vancouver Island through Johnstone Strait in the spring (Carretta et al., 2020).

The Southern Residents spend large amounts of time in core inland marine waters coinciding with congregations of migratory salmon returning from the Pacific Ocean to spawn in U.S. and Canadian rivers. The topographic and oceanographic features in these core areas include channels and shorelines used to assist with foraging. In November 2006, a final rule was issued designating approximately 6,630 km^2 (2,560 mi^2) of inland waters of Washington State as critical habitat for the Southern Resident killer whale DPS. In 2014, NMFS accepted a petition requesting that critical habitat be revised to include Pacific Ocean marine waters along the west coast of the U.S. that constitute essential foraging and wintering areas for Southern Resident killer whales. Additionally, the petition requests that a primary constituent element (PCE) (i.e., the physical and biological features of a habitat that a species needs to survive and reproduce) for protective in-water sound levels be adopted for both currently designated critical habitat and the proposed revised critical habitat (NMFS, 2018b). In 2019, NMFS proposed to revise this critical habitat designation by expanding it to include six new areas along the U.S. west coast, while maintaining the currently designated critical habitat in inland waters of Washington. Specific new areas included 40,471 km^2 (15,626 mi^2) of marine waters between the 6.1-m (20-ft) depth contour and the 200-m (656-ft) depth contour from the U.S. international border with Canada south to Point Sur, California (NMFS, 2018b). The final rule for this revised critical habitat designation came out in 2021 (86 FR 41668, August 2, 2021).

3.5.1.1.3.12 Sperm Whale

Sperm whales are the largest of the toothed whales and have one of the widest global distributions of any marine mammal species. They are found in all deep oceans, from the equator to the edge of the pack ice in the Arctic and Antarctic. They are named after the waxy substance, spermaceti, found in their heads. Spermaceti was used in oil lamps, lubricants, and candles. Sperm whales were a prime target of the commercial whaling industry from 1800 to 1987. Whaling greatly reduced the sperm whale population. Whaling is no longer a major threat and its population is still recovering. Current threats include vessel strikes, entanglement in fishing gear, ocean noise, marine debris, climate change, and oil spills and contaminants (NMFS, No Date-a).

The sperm whale was listed as endangered under the Endangered Species Conservation Act in 1970. When the ESA was passed in 1973, the sperm whale was listed as endangered throughout its range. It is also listed as depleted under the MMPA. Currently, there is no exact accounting of the total number of sperm whales worldwide. The best estimate of worldwide sperm whale population is between 300,000 and 450,000 individuals (NMFS, No Date-a). Sperm whales within the Pacific U.S. EEZ are divided into three discrete, non-contiguous areas: 1) California, Oregon and Washington waters, 2) waters around Hawai'i, and 3) Alaska waters. In the Atlantic U.S. EEZ, they are divided into the North Atlantic stock and the Gulf of Mexico stock.

The current population estimate for the North Pacific stock in Alaska is 345 animals, with a minimum population estimate of 244 individuals (Muto et al., 2020). However, current and historical abundance estimates of sperm whales in the North Pacific are based on limited data and are considered unreliable. Further, sperm whales are far-ranging and exhibit sex segregation and stock overlap that together make population size estimation difficult. The existing estimates are caveated and do not cover consistent areas.

The current population estimate for the California/Oregon/Washington stock is 1,997 animals, with a minimum population estimate of 1,270 individuals (Caretta et al., 2020). Sperm whales in the California Current have been identified as demographically independent from animals in Hawai'i and the Eastern Tropical Pacific, based on genetic analyses.

The current population estimate for the Hawai'i stock is 5,707 animals, with a minimum population estimate of 4,486 individuals (Caretta et al., 2021). In the eastern tropical Pacific, the abundance of sperm whales has been estimated as 22,700 whales; however, it is not known whether any or all of these animals routinely enter the U.S. EEZ of the Hawaiian Islands.

Several estimates from selected regions of sperm whale habitat exist for select time periods, however, at present there is no reliable estimate of total sperm whale abundance for the entire North Atlantic (Hayes et al., 2020). Sightings have been almost exclusively in the continental shelf edge and continental slope areas; however, there has been little or no survey effort beyond the slope. The current population estimate for the North Atlantic stock is 4,349 animals, with a minimum population estimate of 3,451 individuals (Hayes et al., 2020).

Sperm whales hunt for food during deep dives that routinely reach depths of 600 m (2,000 ft) and can last for 45 minutes. They are capable of diving to depths of over 3,000 m (10,000 ft) for over 60 minutes. After long, deep dives, individuals come to the surface to breathe and recover for approximately nine minutes. Because sperm whales spend most of their time in deep waters, their diet consists of many larger species that also occupy deep ocean waters. This includes squid, sharks, skates, and fish (NMFS, No Date-a).

Sperm whales inhabit all of the world's oceans. Their distribution is dependent on their food source and suitable conditions for breeding, and varies with the sex and age composition of the group. Sperm whale migrations are not as predictable or well understood as migrations of most baleen whales. In some mid-latitudes, sperm whales seem to generally migrate north and south depending on the seasons, moving toward the poles in the summer. However, in tropical and temperate areas, there appears to be no obvious seasonal migration.

Sperm whales are distributed across the entire North Pacific and into the southern Bering Sea in summer, but the majority are thought to be south of 40° north in winter. Historically they concentrated seasonally along oceanic frontal zones, for example, in the subtropical frontal zone (ca. 28-34° north) and the subarctic frontal zones (ca. 40-43° north) (Muto et al., 2020). In Alaska, their northernmost boundary extends from Cape Navarin (62° north) to the Pribilof Islands, with whales most commonly found in the Gulf of Alaska and along the Aleutian Islands (Muto et al., 2020). The shallow continental shelf may prevent their movement into the northeastern Bering Sea and the Arctic Ocean. They are found year-round in the Gulf of Alaska, although they appear to be approximately twice as common in summer than in winter. This seasonality of detections is consistent with the hypothesis that sperm whales generally move to higher latitudes in summer and to lower latitudes in winter. Sperm whales are found year-round in California waters, but they reach peak abundance from April through mid-June and from the end of August through mid-November (Carretta et al., 2020). They are seen off Washington and Oregon in every season except winter. Sperm whales are widely distributed in the tropics and have been sighted throughout the Hawaiian EEZ, including nearshore waters of the main and Northwestern Hawaiian Islands (Carretta et al., 2020). Sperm whales summer in the Mid-Atlantic Bight off the eastern U.S. coast from Virginia to Massachusetts (Hayes et al., 2018). In winter, sperm whales concentrate east and northeast of Cape Hatteras, North Carolina. Female/juvenile groups inhabit temperate and tropical waters and rarely move as far north as the Canadian EEZ. Males have a wider range, including the Hudson Strait in Canada. Sperm whales occur year-round in the northern Gulf of Mexico along the continental slope and in oceanic waters; information is limited for the southern Gulf of Mexico (Hayes et al., 2020). Satellite-tagging studies showed no discernible seasonal migrations except for Gulf-wide movements particularly along the northern Gulf slope.

3.5.1.1.3.13 False Killer Whale (Main Hawaiian Islands Insular DPS)

False killer whales are social animals found globally in all tropical and subtropical oceans and generally in deep offshore waters. They are often found in relatively small subgroups of a single to a few individuals that are associated with a larger aggregation that may spread over tens of kilometers (NMFS, No Date-a). These strong social bonds between groups and dispersion into small subgroups likely help them find prey. False killer whales are top predators that primarily hunt fish and squid. Fishery interaction is one of the main threats facing this species. False killer whales are known to take fish and bait off of fishing lines, which can lead to hooking and/or entanglement. This is especially a concern for false killer whales that interact with the Hawai'i longline fishery (NMFS, No Date-a).

Three populations or stocks of false killer whales occur in Hawai'i: the Northwestern Hawaiian Islands population, the pelagic population, and the endangered main Hawaiian Islands Insular population. The main Hawaiian Islands insular false killer whale population is estimated at 167 animals, with a minimum population estimate of 149 individuals (Carretta et al., 2022). Due to the very small population size and population decline in recent decades of the main Hawaiian Islands Insular false killer whale DPS, it was listed as endangered under the ESA in 2012. It is the only false killer whale population protected under the ESA. This stock is also listed as depleted under the MMPA.

Although the range of the main Hawaiian Islands Insular false killer whale DPS partially overlaps with the ranges of the Hawai'i pelagic and Northwestern Hawaiian Islands populations, genetic analyses, photo-identification, and social network analyses indicate that the main Hawaiian Islands Insular DPS consists of a tight social network that is socially unconnected with the other two Hawai'i-based populations (NMFS, No Date-a; Carretta et al., 2020).

False killer whales generally prefer offshore tropical to subtropical waters that are deeper than 1,000 m (3,300 ft). Both main Hawaiian Islands Insular false killer whales and Northwestern Hawaiian Islands false killer whales maintain a more island-associated habitat, preferring to remain close to the Hawaiian Islands. This is likely due to the islands' unique oceanographic setting, which concentrates and aggregates prey. The range of the main Hawaiian Islands Insular false killer whale is a modified 70-km (44-mi) radius (approximately 39 nm) around the main Hawaiian Islands. The waters farther than 70 km (44 mi) from shore, from the Island of Oahu to Hawai'i Island out to the main Hawaiian Islands Insular stock boundary, are an overlap zone between the insular and pelagic stocks. The greatest offshore movements occur on the leeward (western) sides of the islands, where individuals tend to spread out over much larger areas, both near and far from shore. When on the windward (eastern) sides, individuals concentrate closer to shore. Movements between islands may occur over the course of a few days, moving from the windward to leeward side and back within a day (NMFS, No Date-a).

Critical habitat for the main Hawaiian Islands Insular false killer whale DPS was designated in 2018 for waters from the 45-m (150-ft) depth contour to the 3,200-m (10,500-ft) depth contour around the main Hawaiian Islands from Ni'ihau east to Hawai'i (83 FR 35062, July 24, 2018). The physical or biological features essential to the conservation of this DPS are: (1) island-associated marine habitat; (2) prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth; (3) waters free of pollutants of a type and amount harmful to the species, and (4) habitat free of anthropogenic sound that would significantly impair the value of the habitat for false killer whale use or occupancy.

3.5.1.2 Pinnipeds (Seals, Sea Lions, and Walrus)

Pinnipeds are the marine mammals that include the true seals, eared seals, and walruses. Phocids are the earless seals or true seals and can be identified by their lack of external ear flaps. They have ear holes and small front flippers used to move on land by flopping along on their bellies, as well as rear flippers; their front flippers are functionally different to those of otariids. At sea, true seals move their rear flippers left and right to propel themselves through the water. Otariids are the eared seals. This family includes sea lions and fur seals. Unlike true seals, otariids have external ear flaps. Their front flippers are large, and on land they are able to bring all four flippers underneath their bodies and walk on them. In the water, they swim using their front flippers like oars. The odobenids are the walruses. Both males and females have tusks and vacuum-like mouths for sucking up shellfish from the sea floor.

Pinnipeds are amphibious animals, i.e., they venture onto land for extended periods of time, called "hauling-out". They forage at sea but most come ashore or onto ice at some point during the year to mate, give birth, suckle their young, or to molt (Sea Grant, 2015). Many of their anatomical features reflect compromises needed to succeed in both marine and terrestrial environments. Pinnipeds have four webbed flippers in the front and rear used to propel their spindle-shaped bodies. Their sensory organs are adapted to function in both air and water; large eyes and well-developed whiskers allow feeding in dimly lit water; tail and external ears are small, limiting drag. Pinnipeds have retained canine teeth, but molars are modified for consuming prey whole. All pinnipeds have fur, which is shed or molted annually, but they are insulated primarily by blubber.

Pinnipeds are present in habitats ranging from ice to tropics, coastal to pelagic waters, and may live a migratory or sedentary existence. They are opportunistic feeders and consume their varied prey whole or in chunks. Many pinnipeds are capable of long, deep, repetitive dives (up to 1,370-m [4,500-ft] depths and two hours). This diving ability is possible because of several physiological traits similar to cetaceans, such as high blood volume and reduced heart rate (Schytte Blix, 2018).

All pinnipeds are protected by the MMPA throughout their ranges. Some species are also federally listed under the ESA either throughout their ranges or for certain DPSs. Additionally, some species have designated critical habitat. **Table 3.5-2** lists the 15 species of pinnipeds (16 distinct species, subspecies, or DPS total) occurring throughout the action area, consisting of one odobenid; five otariids, one of which is ESA-listed as endangered with designated critical habitat, and one listed as threatened; and 10 phocids, one of which is ESA-listed as endangered with designated critical habitat, and two listed as threatened, both with designated critical habitat.

Table 3.5-2. Pinnipeds Occurring in the Action Area

Common Name	Scientific Name	MMPA Depleted?	ESA Status	Lead Agency	Region*	Critical Habitat	General Ecology
Walruses-Odobenids							
Pacific walrus	*Odobenus rosmarus*	No	--	USFWS	AR	--	Coastal, loose pack ice
Eared Seals-Otariids							
Guadalupe fur seal	*Arctocephalus townsendi*	Yes: throughout its range	Threatened	NMFS	WCR	No	Coastal, shelf, pelagic during foraging
Northern fur seal	*Callorhinus ursinus*	Yes: Pribilof Island/ Eastern Pacific stock	--	NMFS	AR, WCR	--	Pelagic, coastal
Steller sea lion (Western DPS)	*Eumetopias jubatus*	Yes: Western DPS	Endangered	NMFS	AR	Yes	Coastal, shelf, sea ice
Steller sea lion (Eastern DPS)	*Eumetopias jubatus*	No	--	NMFS	WCR, AR	Yes	Coastal, shelf, sea ice
California sea lion	*Zalophus californianus*	No	--	NMFS	WCR	--	Coastal, shelf
Earless Seals-Phocids							
Hooded seal	*Cystophora cristata*	No	--	NMFS	GAR	--	Pack ice and pelagic
Bearded seal (Beringia DPS)	*Erignathus barbatus nauticus*	Yes: Beringia DPS	Threatened	NMFS	AR	Yes	Sea ice, shelf areas
Gray seal	*Halichoerus grypus*	No	--	NMFS	GAR	--	Coastal, coastal waters
Ribbon seal	*Histriophoca fasciata*	No	--	NMFS	AR	--	Pack ice and pelagic
Northern elephant seal	*Mirounga angustirostris*	No	--	NMFS	WCR, AR	--	Coastal to pelagic during foraging and migrating
Hawaiian monk seal	*Neomonachus schauinslandi*	Yes: throughout its range	Endangered	NMFS	PIR	Yes	Coastal, reefs, submerged banks, deepwater coral beds, pelagic

Common Name	Scientific Name	MMPA Depleted?	ESA Status	Lead Agency	Region*	Critical Habitat	General Ecology
Harp seal	*Pagophilus groenlandicus*	No	--	NMFS	GAR	--	Pack ice and pelagic
Ringed seal (Arctic subspecies)	*Phoca hispida*	Yes: Arctic subspecies	Threatened	NMFS	AR	Yes	Pack ice
Spotted seal (Bering Sea DPS)	*Phoca largha*	No	--	NMFS	AR	--	Seasonal sea ice, coastal, pelagic
Harbor seal	*Phoca vitulina*	No	--	NMFS	GAR, WCR, AR	--	Coastal waters

Source: ECOS, No Date-a; NMFS, No Date-a

*GAR = Greater Atlantic Region (includes the U.S. portions of the Great Lakes, New England, and the mid-Atlantic); SER = Southeast Region (includes the southern portion of the U.S. Eastern Seaboard, the U.S. Caribbean Islands [Puerto Rico and the U.S. Virgin Islands], and the Gulf of Mexico); AR = Alaska Region (includes Alaskan waters and the Arctic); WCR = West Coast Region (includes coastal California, Oregon, and Washington); PIR = Pacific Islands Region (includes Hawai'i and territories of the U.S.)

3.5.1.2.1 Pinniped Sound Production and Hearing

Pinnipeds produce a wide range of vocalizations, most occurring at relatively low frequencies (Southall et al., 2007). They communicate acoustically in air and water and have different hearing capabilities in the two media. The main function of pinniped vocalizations appears to be to elicit the attention of recipients (Schusterman et al., 2001). In-air vocalizations are used to defend territories, attract females, and maintain the mother-pup bond, while underwater calls are mainly used to establish dominance.

Southall et al. (2007) considered pinnipeds as a single functional hearing group; more recently, however, pinnipeds were placed in two separate hearing groups, with phocids in one group and otariids and odobenids in another (NMFS, 2018a; Southall et al., 2019). Phocid species have consistently demonstrated an extended frequency range of hearing compared to otariids, especially in the higher frequency range. Phocid ears are anatomically distinct from otariid ears so that phocids are hypothetically more adapted for underwater hearing (NMFS, 2018a). Walrus have ears that are somewhat intermediate to a freely mobile ear and the ear type characteristic of phocids. Few data are available regarding acoustic sensitivity in walruses, so more research on walrus auditory anatomy would support further evaluation of their characterization within the marine carnivores group both in air and water (Southall et al., 2019; NMFS, 2018a) either within phocid or non-phocid hearing groups or, potentially, as a distinct hearing group.

As pinnipeds are amphibious mammals, their hearing differs in air and in water; thus, separate sound exposure criteria are required for each medium. Pinnipeds are sensitive to a broader range of sound frequencies in water than in air, and there are differences in the functional hearing range among otariids, phocids, and odobenids, especially under water, as well as differences in hearing sensitivity: phocids are more sensitive in air and underwater with especially good sensitivity at low frequencies. Southall et al. (2007, 2019) categorized pinnipeds as having functional underwater hearing between 75 Hz and 75 kHz and functional aerial hearing between 75 Hz and 30 kHz. NMFS (2018d) classified phocids as having functional underwater hearing between 50 Hz to 86 kHz and otariids as 60 Hz to 39 kHz. The audible range of hearing for walrus extends from 60 Hz to 23 kHz in air; the hearing range in water is expected to be similar or broader at high frequencies (Reichmuth et al., 2020). Although the upper hearing range for walrus in water is not precisely known, using the ratio of the in-water to in-air corner frequency from Southall et al. (2019) to scale up the walrus hearing range measured in air provides a good estimate for their high frequency cutoff in water: 34 kHz (JASCO, 2022)[6].

3.5.1.2.2 Regional Distribution of Pinnipeds

Pinnipeds are widely distributed throughout all major oceans. Many pinnipeds undertake seasonal migrations between breeding/pupping grounds and feeding areas, which are often at higher latitudes. Walruses and some phocids migrate with the seasonally-changing location of pack ice. However, some pinniped species remain year-round in a general region. Ice-breeding phocids tend to be solitary or form dispersed breeding aggregations. In contrast, other phocids, many otariids, and walruses aggregate in large groups to breed, pup, or molt (e.g., the elephant seals and sea lions). Most pinnipeds have a coastal distribution, but some occur further offshore, including foraging northern fur seals and Steller sea lions. Elephant seals are one of the pinnipeds that are pelagic much of the year.

[6] For walrus, this calculation is 23 kHz * 12.8 kHz/8.66kHz = 34 kHz. The two latter numbers come from Table 3 of Southall et al. (2019).

3.5.1.2.2.1 Greater Atlantic Region

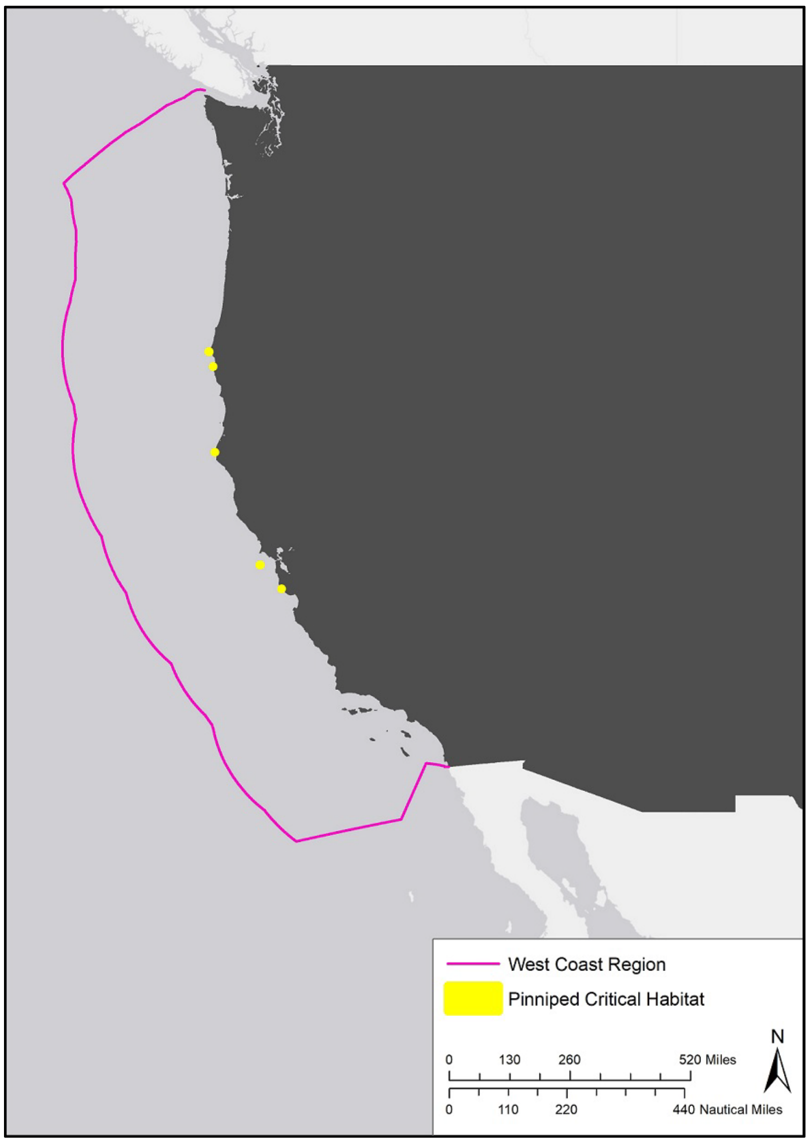
Four pinnipeds (hooded seal, gray seal, harp seal, and harbor seal) occur in the Greater Atlantic Region, as indicated in **Table 3.5-2**. None are ESA-listed. There is no designated critical habitat in the region.

3.5.1.2.2.2 Southeast Region

While harbor seals and gray seals can occur in the Southeast Region as vagrants, there are no known reliable occurrences. No other pinnipeds occur in this region.

3.5.1.2.2.3 West Coast Region

Six pinnipeds (Guadalupe fur seal, northern fur seal, Steller sea lion, California sea lion, northern elephant seal, and harbor seal) occur in the West Coast Region, as indicated in **Table 3.5-2**. The Guadalupe fur seal is ESA-listed. The Steller sea lion has designated critical habitat in the region as shown in **Figure 3.5-14**.

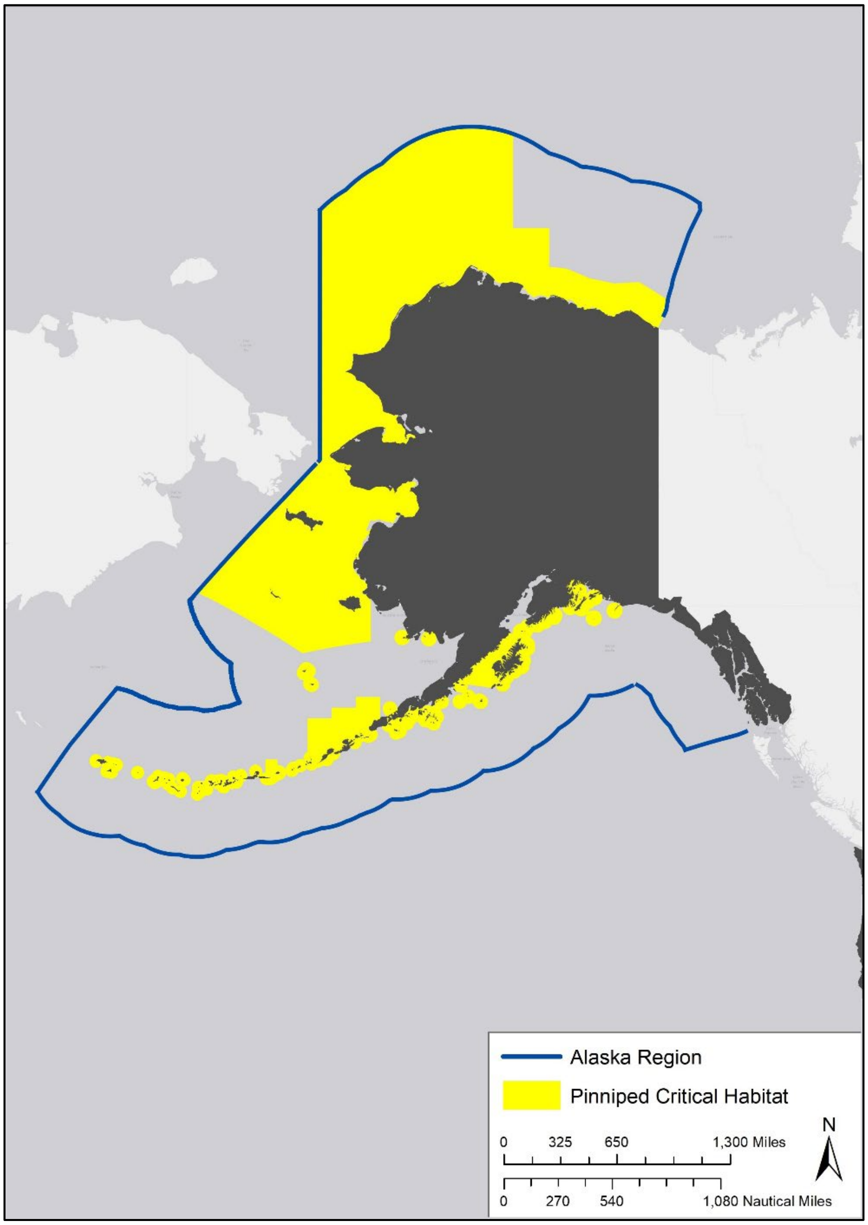


Sources: NMFS, No Date-b; ECOS, No Date-b

Figure 3.5-14. Pinniped Designated Critical Habitat in the West Coast Region

3.5.1.2.2.4 Alaska Region

Ten pinnipeds (one odobenid, three otariids, and six phocids) occur in the Alaska Region, as indicated in **Table 3.5-2**. One of the otariids is ESA-listed: the Steller sea lion (Western DPS), and two of the phocids are ESA-listed: the bearded seal (Beringia DPS) and ringed seal (Arctic subspecies). All of these species also have designated critical habitat in the region as shown in **Figure 3.5-15**.

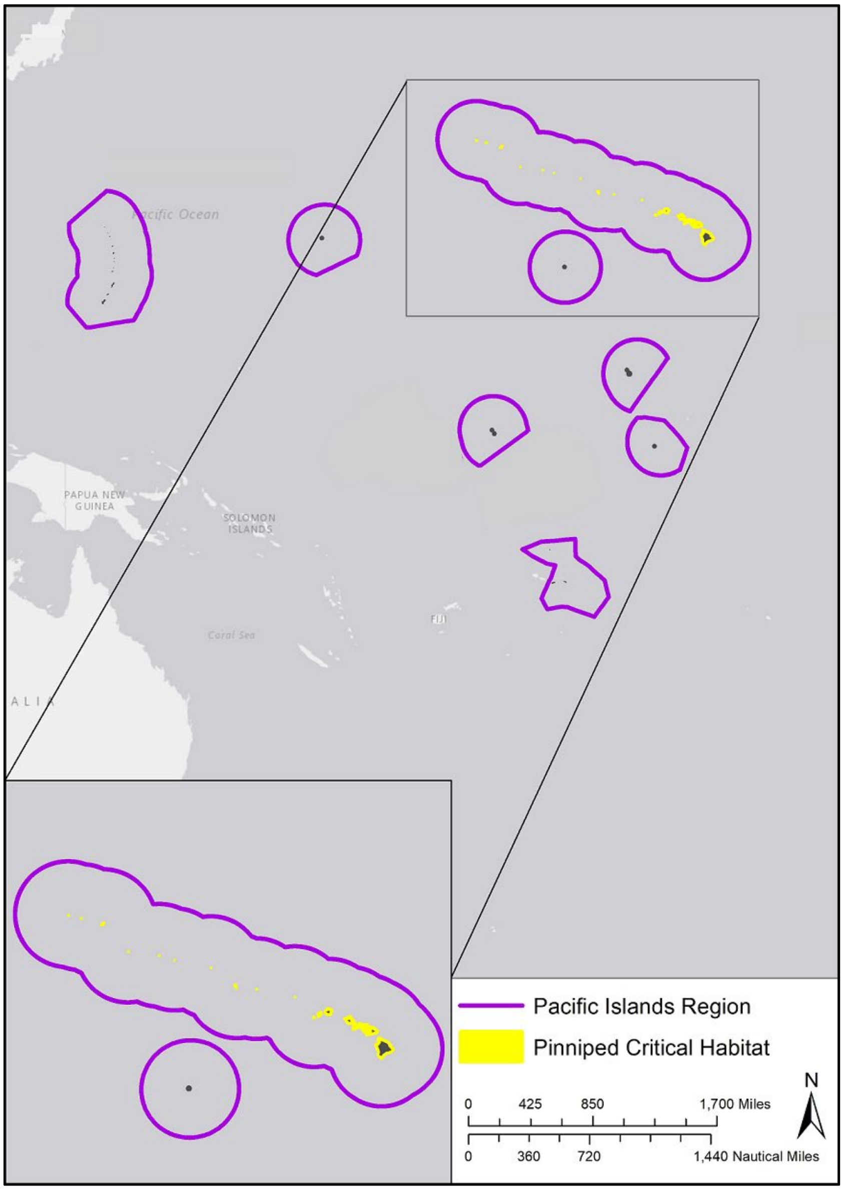


Sources: NMFS, No Date-b; ECOS, No Date-b

Figure 3.5-15. Pinniped Designated Critical Habitat in the Alaska Region

3.5.1.2.2.5 Pacific Islands Region

One pinniped (Hawaiian monk seal) occurs in the Pacific Islands Region, as indicated in **Table 3.5-2**. The Hawaiian monk seal is ESA-listed, and it also has designated critical habitat in the region as shown in **Figure 3.5-16**.



Sources: NMFS, No Date-b; ECOS, No Date-b

Figure 3.5-16. Pinniped Designated Critical Habitat in the Pacific Islands Region

3.5.1.2.3 Threatened and Endangered Pinnipeds

Five distinct populations of pinnipeds are ESA-listed in the action area; two are otariids and three are phocids. One listed otariid and one listed phocid also have designated critical habitat. These pinnipeds are shown in **Table 3.5-2** and described in more detail below.

3.5.1.2.3.1 Guadalupe Fur Seal

Guadalupe fur seals are generally solitary and thought to be non-social animals when at sea. They primarily feed at night on coastal and pelagic squid, and small pelagic fish (e.g., mackerel, sardine, and lanternfish) by diving to average depths of 20 m (65 ft) with maximum depths of about 75 m (250 ft). Commercial sealers heavily hunted Guadalupe fur seals in the 1700s to the 1800s until they were thought to be extinct in the early 1900s (NMFS, No Date-a). They were rediscovered breeding in a cave on Guadalupe Island in 1954. The Guadalupe fur seal population has continued to increase from the small remnant group on Guadalupe Island due to protection by the Mexican Government. Current threats include entanglement in and incidental hooking on commercial and recreational fishing gear, oil spills, coastal development, and military activities (NMFS, No Date-a).

Guadalupe fur seals live in the waters off southern California and the Pacific coast of Mexico. Guadalupe fur seals generally do not migrate, although they have been documented traveling great distances from their breeding grounds. During the breeding season, they are found in coastal rocky habitats and caves. Their breeding grounds are almost entirely on Guadalupe Island, off the Pacific coast of Mexico, with recent re-colonization off Baja California on the San Benito Archipelago (NMFS, No Date-a). A small number of Guadalupe fur seals have also been reported on San Miguel Island in the Channel Islands off southern California. Little is known about their whereabouts during the non-breeding season. Guadalupe fur seals are not common along the West Coast of the U.S., although strandings occur almost annually in California waters, and animals are increasingly observed in Oregon and Washington waters (Carretta et al., 2017).

Guadalupe fur seals were listed as threatened under the ESA in 1985, and they are listed as depleted under the MMPA. Guadalupe fur seals within the U.S. Pacific EEZ are aggregated into a single management unit under the MMPA: the Mexico stock (Caretta et al., 2020). The most recent estimate of population size is based on pup count data collected in 2013 and a range of correction factors applied to pup counts to account for uncounted age classes and pre-census pup mortality (Carretta et al., 2020). Resulting estimates were 34,187 individuals but do not include animals at San Benito Island, where surveys counted a maximum of 3,710 animals and 1,494 animals in July of 2014 and 2015, respectively (Carretta et al., 2020). The San Benito Island rookery is represented almost exclusively by immature animals migrating from Guadalupe Island, and negligible numbers of pups are produced at San Benito. The minimum population estimate for Guadalupe fur seals is 31,019 animals.

3.5.1.2.3.2 Steller Sea Lion (Western DPS)

Steller sea lions (**Figure 3.5-17**) were first listed as threatened under the ESA in 1990. Due to genetic, morphological, ecological, and population trend data supporting the overall distinctiveness, two DPSs for the Steller sea lion were recognized in 1997 (NMFS, No Date-a):

- The Western DPS includes all Steller sea lions originating from rookeries west of Cape Suckling (144° west longitude). The Western DPS ESA listing status was changed to endangered when it was established, due to continued declines; it remains listed as endangered today.
- The Eastern DPS includes Steller sea lions originating from rookeries east of Cape Suckling. The Eastern DPS kept a status of threatened when it was established; by 2013, it had recovered enough to be delisted off the endangered species list.

All Steller sea lions are protected under the MMPA, and the Western DPS is also designated as strategic and depleted.

Figure 3.5-17. Steller Sea Lions

Photo Credit: Capt. Budd Christman, NOAA

Historically, Steller sea lions were highly abundant throughout many parts of the North Pacific. Indigenous peoples and other settlers hunted them for their meat, hides, oil, and other products. In addition, they were killed for predator control and commercial harvests, causing their numbers to decrease. Threats that continue today include the effects of fisheries on prey, climate change, predation, exposure to toxic substances, incidental take due to interactions with active fishing gear, illegal shooting, disturbance, disease and parasites, vessel strikes, entanglement, and illegal feeding (NMFS, No Date-a).

The western stock of Steller sea lions decreased from an estimated 220,000 to 265,000 animals in the late 1970s to less than 50,000 in 2000. While the western population has been increasing slowly overall since 2003, it is still declining quickly in large areas of its range. The current and minimum population estimates for the Western U.S. stock is approximately 52,932 animals (Muto et al., 2022).

Steller sea lions prefer the colder temperate to subarctic waters of the North Pacific Ocean. They need both terrestrial and aquatic habitats. Steller sea lions are opportunistic predators, foraging and feeding primarily at night on over a hundred species of fish. They forage near shore and in open waters. In the non-breeding season, some adult females may spend long periods of time foraging well off the continental shelf while others forage much nearer to terrestrial sites. During the breeding season, a female must forage close enough to her rookery to return often and nurse her young. Steller sea lions, especially males, can travel long distances in a season. Steller sea lions need undisturbed land habitat to rest, molt, socialize, mate, give birth, and nurse small pups during the breeding season (NMFS, No Date-a). They are highly social and may rest in large groups, overlapping their bodies. At sea, they are seen alone or in small groups, but may gather in large "rafts" at the surface, including areas near important seasonal prey resources. Haul-outs and rookeries usually consist of beaches, ledges, and rocky reefs. Rookeries are normally occupied from late May to early July. In the Bering Sea, sea lions may also haul out on sea ice. The locations of rookeries and haul outs change little from year to year.

Steller sea lions are distributed mainly around the coasts along the North Pacific Ocean rim from northern Hokkaido, Japan through the Kuril Islands and Okhotsk Sea, the Aleutian Islands and Bering Sea, the southern coast of Alaska, and south to central California (NMFS, No Date-a; Muto et al., 2018). The Western DPS includes Steller sea lions that originate from rookeries west of 144° west longitude (Cape Suckling): those in the Gulf of Alaska, the Aleutian Islands, the Bering Sea, and Asia. The Eastern DPS includes sea lions originating from rookeries in southeast Alaska, British Columbia, Washington, Oregon, and California. The foraging ranges of the two DPSs overlap, especially in the non-breeding season. In recent years, a “mixing zone” has also become established in northern southeast Alaska on at least two new rookeries partially established by Western DPS females.

Critical habitat for Steller sea lions was first designated in 1993 and includes 66 specific sites (26 rookeries and 40 haul outs) in Alaska. It also includes a 32-km (20-nm) buffer around all major haul outs and rookeries, as well as associated terrestrial, air, and aquatic zones. Special foraging areas in Alaska have also been designated critical habitat for Steller sea lions, including the Shelikof Strait area of the Gulf of Alaska, the Bogoslof area in the Bering Sea shelf, and the Seguam Pass area in the central Aleutian Islands (58 FR 45269, August 27, 1993).

3.5.1.2.3.3 Bearded Seal (Beringia DPS)

Bearded seals are the largest of the northern phocids. There are two currently recognized subspecies of the bearded seal: *E. b. barbatus*, often described as inhabiting the Atlantic sector, and *E. b. nauticus*, inhabiting the Pacific sector (NMFS, No Date-a; Muto et al., 2018). Although subsistence harvest of bearded seals occurs in some parts of the species’ range, there is little or no evidence that these harvests currently pose or are likely to pose a significant threat. While the U.S. does not allow commercial harvest of marine mammals, such harvests are permitted in some other portions of the species’ range; however, there is currently no significant commercial harvest of bearded seals and significant harvests seem unlikely in the foreseeable future. Current threats include climate change, increased shipping activity, sound and activity from oil and gas exploration, and development (NMFS, No Date-a).

The Okhotsk (foreign) and Beringia (U.S.) DPSs of the Pacific sector subspecies were listed as threatened under the ESA in 2013, and they are also designated as depleted under the MMPA. Critical habitat was designed in 2022 and comprises an area of marine habitat in the Bering, Chukchi, and Beaufort seas (87 FR 19180, April 1, 2022). Accurately assessing bearded seal abundance and trends is hindered by their broad distribution, sea-ice habitat, logistical challenges in data collection, and cross-political boundaries; thus, a reliable population estimate for the entire stock is not currently available. It is estimated that there are approximately 500,000 bearded seals worldwide (NMFS, No Date). The current population estimate for the Beringia stock is 301,836 animals, with a minimum population estimate of 273,676 individuals (Muto et al., 2020).

Bearded seals primarily feed on or near the sea bottom on a variety of invertebrates (e.g., shrimps, crabs, clams, and whelks) and some fish (e.g., cod and sculpin). While foraging, they typically dive to depths of less than 100 m (328 ft). They are not known to spend much time in deep water and seem prefer to forage in waters less than 200 m (650 ft) deep where they can reach the sea floor (NMFS, No Date-a).

Bearded seals inhabit Arctic and sub-Arctic waters that are relatively shallow (primarily less than about 490 m [1,600 ft] deep) and seasonally ice-covered. Typically, they occupy sea ice habitat that is broken and drifting with natural areas of open water. Sea ice provides some protection from predators, such as polar bears, during birthing and nursing. Sea ice also provides bearded seals a haul-out platform for molting and resting. Bearded seals are solitary and can be seen resting on ice floes with their heads facing downward into the water. This allows them to quickly escape into the sea if pursued by a predator. Bearded seals also have been seen sleeping vertically in open water with their heads on the water surface (NMFS, No Date-a).

Bearded seals are circumpolar in their distribution, extending from the Arctic Ocean (85° north) south to Hokkaido (45° north) in the western Pacific (NMFS, No Date-a). In U.S. waters, they are found off the coast of Alaska over the continental shelf in the Bering, Chukchi, and Beaufort Seas. Because bearded seals are closely associated with sea ice, particularly pack ice, their seasonal distribution and movements are linked to seasonal changes in ice conditions. The shallow shelf of the Bering and Chukchi Seas provides the largest continuous area of habitat for bearded seals. In late winter and early spring, bearded seals are widely but not uniformly distributed in the broken, drifting pack ice, where they tend to avoid the coasts and areas of fast ice. To remain associated with their preferred ice habitat, most adult seals in the Bering Sea are thought to move north through the Bering Strait in late spring and summer as the ice melts and retreats. They then spend the summer and early fall at the edge of the Chukchi and Beaufort Sea pack ice and at the fragmented edge of multi-year ice. Some bearded seals—mostly juveniles—remain near the coasts of the Bering and Chukchi Seas during summer and early fall, where they are often found in bays, estuaries, and river mouths. As the ice forms again in the fall and winter, most bearded seals are thought to move south with the advancing ice edge (NMFS, No Date-a).

3.5.1.2.3.4 Hawaiian Monk Seal

The Hawaiian monk seal (**Figure 3.5-18**) is one of the most endangered seal species in the world. The Hawaiian monk seal is the last surviving species in its genus, and is endemic to the 2,400-km (1,500-mi)-long Hawaiian Islands archipelago, from Hawai'i Island to Kure Atoll, occurring nowhere else in the world. The population overall has been declining for over six decades, and current numbers are only about one-third of historic population levels. Importantly, however, the prolonged decline has slowed over the last 10 years due to recovery efforts. The current threats that Hawaiian monk seals face include food limitations in the Northwestern Hawaiian Islands, especially for juveniles and sub-adults, entanglement in marine debris, and human interactions, especially in the main Hawaiian Islands. These human interactions include bycatch in fishing gear, mother-pup disturbance on beaches, and exposure to disease. Other threats to Hawaiian monk seals include loss of haul-out and pupping beaches due to erosion in the Northwestern Hawaiian Islands, disease outbreaks, shark predation, male aggression towards females, and low genetic diversity (NMFS, No Date-a).

Figure 3.5-18. Hawaiian Monk Seal

Photo Credit: NOAA/PIFSC/HMSRP

Hawaiian monk seals were listed as endangered under the ESA in 1976, and they are listed as depleted under the MMPA; they are also protected under State of Hawai'i law. Critical habitat for the Hawaiian monk seal was initially designated in 1986, and revised critical habitat was designated in 2015. Specific designated areas include sixteen occupied locations within the range of the species: ten areas in the

Northwestern Hawaiian Islands and six in the main Hawaiian Islands. These areas contain one or a combination of habitat types: preferred pupping and nursing areas, significant haul-out areas, and/or marine foraging areas that support conservation for the species. Specific critical habitat areas are described in detail in the final rule (76 FR 50926 to 50988, August 17, 2011).

Though Hawaiian monk seal subpopulations often exhibit variation in demographic parameters (such as abundance trends and survival rates), they are connected by animal movement throughout the species' range, and genetic analysis indicates the species is a single panmictic population (i.e., random mating within a breeding population); therefore, the Hawaiian monk seal is considered a single stock (Carretta et al., 2020). The population of Hawaiian monk seals is estimated to be 1,437 seals, with a minimum population estimate of 1,376 animals (Carretta et al., 2022).

The species is well below its optimum sustainable population and has not recovered from past declines that began in the late 1950s and continued until recently. Although this decline means that a full recovery of the species is a long way off, there have been some relatively recent, encouraging developments, including (NMFS, No Date): 1) apparent recolonization and significant growth of the main Hawaiian Islands monk seal subpopulation from low numbers to approximately 300 over the past two or more decades, and 2) overall species population growth of three percent each year between 2014 and 2016.

Hawaiian monk seals can hold their breath for up to 20 minutes and dive more than 550 m (1,800 ft); however, they usually dive an average of six minutes to depths of less than 60 m (200 ft) to forage at the sea floor. They are mostly solitary and do not live in colonies, but they do sometimes lie near each other in small groups. They usually sleep on beaches, sometimes for days at a time. They also occasionally sleep in small underwater caves. Monk seals do not migrate seasonally, but some seals have traveled hundreds of kilometers in the open ocean. Individual seals often frequent the same beaches over and over, but they do not defend territories (NMFS, No Date-a).

Hawaiian monk seals are found throughout the entire Hawaiian archipelago. The majority of Hawaiian monk seals live in the Northwestern Hawaiian Islands, and a smaller population lives in the main Hawaiian Islands. There have also been rare sightings of Hawaiian monk seals, as well as a single birth, at Johnston Atoll, the closest atoll southwest of the Hawaiian Islands (NMFS, No Date-a). Monk seals live in warm, subtropical waters and spend two-thirds of their time at sea. They occur in the waters surrounding atolls and islands and areas farther offshore on reefs and submerged banks; they also use deepwater coral beds as foraging habitat. When on land, monk seals haul-out to rest, breed, give birth, and molt on sand, corals, and volcanic rock shorelines. They prefer sandy, protected beaches surrounded by shallow waters for pupping.

3.5.1.2.3.5 Ringed Seal (Arctic subspecies)

Ringed seals are the smallest and most common Arctic seal. There are five currently recognized subspecies of the ringed seal: Arctic ringed seals in the Arctic Basin and adjacent seas, including the Bering and Labrador Seas; Okhotsk ringed seals in the Sea of Okhotsk; Baltic ringed seals in the Baltic Sea; Ladoga ringed seals in Lake Ladoga, Russia; and Saimaa ringed seals in Lake Saimaa, Finland (NMFS, No Date-a; Muto et al., 2018). These subspecies were all listed as endangered or threatened under the ESA in 2013, and they are also listed as depleted under the MMPA. Critical habitat was designed in 2022 and comprises an area of marine habitat in the Bering, Chukchi, and Beaufort seas (87 FR 19232, April 1, 2022). Loss of sea ice and snow cover on the ice poses the main threat to this species. Although subsistence harvest of Arctic ringed seals occurs in some parts of this subspecies' range, harvest levels appear to be sustainable. While the U.S. does not allow commercial harvest of marine mammals, such harvests are permitted in other portions of the species' range. This has caused population declines in some regions in the past but has generally been restricted since then. Other threats to the ringed seal include climate change, entanglement in fishing gear, increasing Arctic shipping activity, sound and activity from offshore oil and gas exploration, and development (NMFS, No Date-a).

The Arctic ringed seal is the most abundant of the five ringed seal subspecies. Although no accurate estimate exists, there are probably more than 2 million Arctic ringed seals worldwide. There is one recognized stock of (Arctic) ringed seals in U.S. waters: the Arctic stock. Although a reliable population estimate for the entire stock is not available, research programs have developed survey methods that have been used to determine abundance estimates for part of the range of the stock. The estimated population size for this stock is 171,418 animals, with a minimum population estimate of 158,507 individuals (Muto et al., 2020). However, the actual number of ringed seals in the U.S. portion of the Bering Sea is likely much higher, perhaps by a factor of two or more. Researchers expect to provide a population estimate, corrected for availability bias, for the entire Arctic stock of ringed seals once the final Bering Sea results are combined with the results from spring surveys of the Chukchi Sea (conducted in 2016) and Beaufort Sea (in 2020).

Ringed seals do not live in large groups and are usually found alone, but they may occur in large groups during the molting season. Ringed seals eat a wide variety of mostly small prey. Despite regional and seasonal variations in the diet of ringed seals, fishes of the cod family tend to dominate the diet in many areas from late fall through spring. Crustaceans appear to become more important in many areas during the open-water season and often dominate the diet of young seals. While foraging, ringed seals dive to depths of up to 45 m (150 ft) or more.

Ringed seals are circumpolar and are found in all seasonally ice-covered seas of the Northern Hemisphere and in certain freshwater lakes (NMFS, No Date-a). They range throughout the Arctic Basin and southward into adjacent seas, including the Bering and Labrador Seas. They are also found in the Sea of Okhotsk and Sea of Japan in the western North Pacific and the Baltic Sea in the North Atlantic. Landlocked subspecies inhabit Lakes Ladoga (Russia) and Saimaa (Finland). During winter and spring in the U.S., ringed seals are found throughout the Beaufort and Chukchi Seas; they occur in the Bering Sea as far south as Bristol Bay in years of extensive ice coverage. Most ringed seals that winter in the Bering and Chukchi Seas are thought to migrate northward in spring with the receding ice edge and spend summer in the pack ice of the northern Chukchi and Beaufort Seas.

Throughout their range, ringed seals have an affinity for ice-covered waters and are well-adapted to occupying heavily ice-covered areas throughout the fall, winter, and spring by using the stout claws on their fore flippers to maintain breathing holes in the ice. Ringed seals remain in contact with the ice most of the year and normally pup and nurse pups on the ice in snow-covered lairs (snow caves) in late winter through early spring. The ice and snow caves provide some protection from predators, though polar bears spend much of their time on sea ice hunting ringed seals, which are their primary prey. Snow caves also protect ringed seal pups from extreme cold. As the temperatures warm and the snow covering their lairs melts during spring, ringed seals transition from lair use to basking on the surface of the ice near breathing holes, lairs, or cracks in the ice as they undergo their annual molt (NMFS, No Date-a; Muto et al., 2018).

3.5.1.2.4 Pinnipeds Hunted for Subsistence

Species of pinnipeds hunted for subsistence by Alaska native communities that are not also listed as threatened or endangered under the ESA are described below. Subsistence practices and analysis of impacts of subsistence hunting are discussed in Section 3.17 Environmental Justice.

3.5.1.2.4.1 Northern Fur Seal

Northern fur seals primarily inhabit two types of habitats: open ocean and rocky or sandy beaches on islands for resting, reproduction, and molting. They seasonally breed on six islands in the eastern North Pacific Ocean and Bering Sea in the U.S.: St. Paul, Bogoslof, St. George, Sea Lion Rock, San Miguel, and South Farallon. The Pribilof Islands, the four-island archipelago off the coast of Alaska, support the largest aggregation of northern fur seals, about half of the world's northern fur seal population. In spring, most northern fur seals migrate north to breeding colonies in the Bering Sea. Territorial adult male northern fur seals leave their breeding colonies in August and are thought to spend most of their time in the Bering Sea and North Pacific Ocean along the Aleutian Islands. Pregnant adult females begin their winter migration in November and generally travel to either the central North Pacific Ocean or to offshore areas along the west coast of North America to feed. During summer and autumn, these seals intermittently fast while on land and feed at sea (NMFS, No Date-a). The Pribilof Islands/eastern Pacific stock is listed as depleted under the MMPA (NMFS, No Date-a).

3.5.1.2.4.2 Harbor Seal

Harbor seals are one of the most common marine mammals along both the west and east coasts of the U.S. On the east coast, harbor seals are found from the Canadian Arctic to New York and occasionally as far south as the Carolinas. On the west coast, they are found from California to the Bering Sea. They are typically non-migratory and stay within 24 to 50 km (15 to 31 mi) of their home. NMFS has identified five stocks of harbor seals in the U.S.: Alaska, California, Oregon-Washington coastal, Washington inland, and western North Atlantic. The harbor seal is protected under MMPA throughout its range (NMFS, No Date-a).

3.5.1.2.4.3 Ice Seals

Bearded, ringed, spotted, and ribbon seals are collectively called ice seals because of their association with sea ice for feeding, resting, and pupping. The geographic distribution of bearded and ringed seals and details of their status under ESA and MMPA are described above under Threatened and Endangered Species. Ribbon and spotted seals, which are not ESA-listed, are described here.

Ribbon seals commonly occur in the Sea of Okhotsk and Bering Sea. More specifically, in U.S. waters they are found in the Bering Sea and in the Chukchi and western Beaufort Seas. Ribbon seals spend most of their time in the open ocean and the remainder on pack ice during spring to give birth, nurse pups, and molt. During summer, only a small number of ribbon seals are hauled out on the ice since ice melts completely in the Sea of Okhotsk, and the Bering Sea ice recedes north. Most ribbon seals are only seen again when the sea ice reforms in winter. Ribbon seals protected under the MMPA and included in NMFS' Species of Concern list (NMFS, No Date-a).

Spotted seals are widely distributed on the continental shelf of the Beaufort, Chukchi, southeastern East Siberian, Bering, and Okhotsk seas; south through the Sea of Japan; and into the Yellow Sea. In U.S. waters, spotted seals migrate south from Chukchi Sea through the Bering Strait from October to November ahead of advancing sea ice. They spend the winter in the Bering Sea in the annual pack ice over the continental shelf. During spring, they migrate to coastal habitats after the sea ice retreats. The foreign DPS of spotted seals and the southern DPS are listed as threatened under ESA and depleted under MMPA (NMFS, No Date-a).

3.5.1.3 Sirenians (Manatees)

Sirenians are an order of fully aquatic, herbivorous mammals that inhabit swamps, rivers, estuaries, marine wetlands, and coastal marine waters. Sirenians currently comprise the families Dugongidae (the dugong) and Trichechidae (manatees) with a total of four species, only one of which occurs in the U.S., the West Indian manatee (**Figure 3.5-19**) with two distinct subspecies (**Table 3.5-3**). The remaining three sirenian species do not occur in the action area.

Figure 3.5-19. West Indian Manatee

Photo Credit: David A. Straz, Jr., Manatee Critical Care Center

3.5.1.3.1 Sirenian Sound Production and Hearing

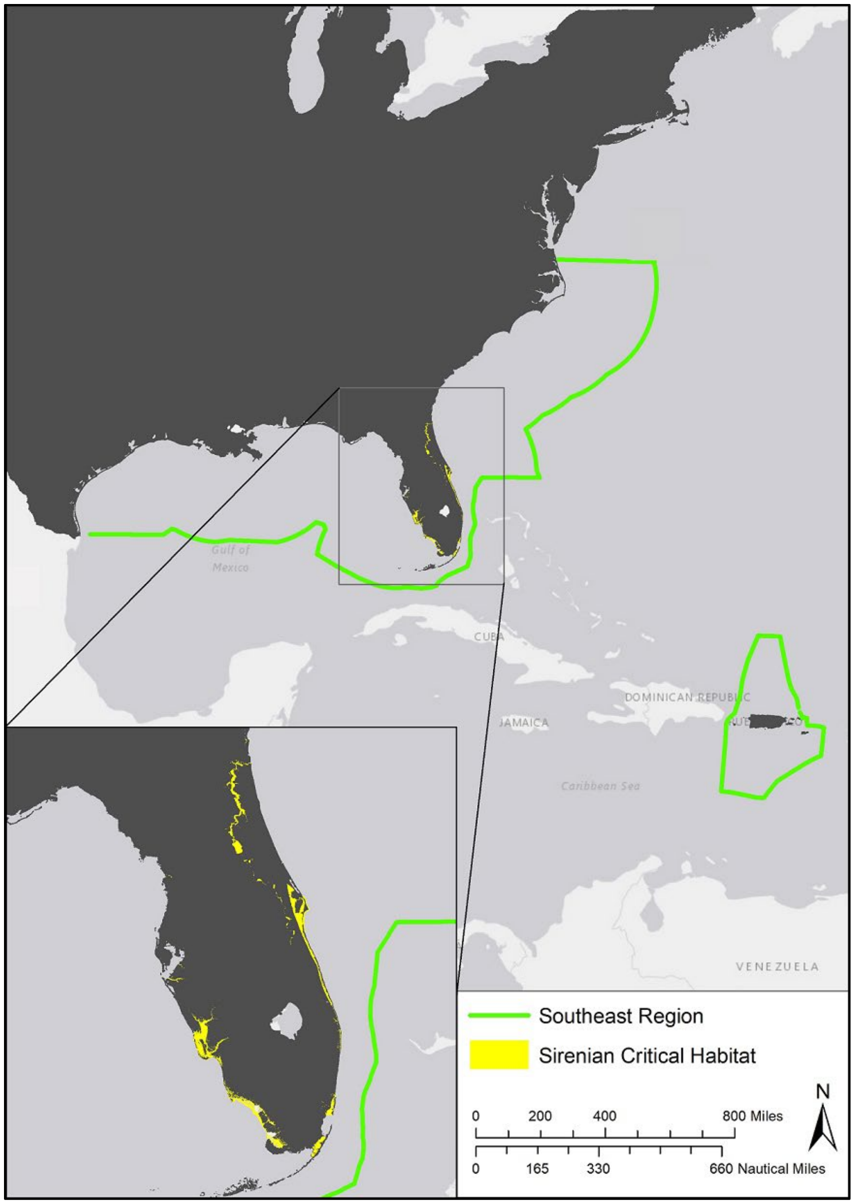
Manatees have a history of negative interaction with people. Due to their slow swimming speeds, tendency to linger near the water surface, and low profile at the surface, their main issue has been with vessel strikes, particularly by small watercraft. Vessel sound may also be a concern, but there is little other information available about manatee responses to other sound sources, including active sonar. Mysticetes, although distant relatives, are the most closely related group of marine mammals taxonomically and share important behavioral traits (e.g., grazing). Southall et al. (2019) indicates that sirenian hearing can extend from low frequencies (< 5 kHz) to above 60 kHz, and sound production for sirenians can range between 0.15 kHz and 22 kHz (Southall et al., 2019).

3.5.1.3.2 Regional Distribution of Sirenians

Manatees occur mainly in the Southeast Region of the action area, although they have been observed on occasion further north in the Greater Atlantic Region.

3.5.1.3.2.1 Southeast Region

Both subspecies of the West Indian manatee occur in the Southeast Region, as indicated in **Table 3.5-3**. Both subspecies are ESA-listed, but only the Florida subspecies has designated critical habitat as shown in **Figure 3.5-20**.



Sources: NMFS, No Date-b; ECOS, No Date-b

Figure 3.5-20. Sirenian Designated Critical Habitat in the Southeast Region

Table 3.5-3. Sirenians Occurring in the Action Area

Common Name	Scientific Name	MMPA Depleted?	ESA Status	Lead Agency	Region*	Critical Habitat	General Ecology
Manatees							
West Indian manatee (Antillean subspecies)	*Trichechus manatus manatus*	Yes: Antillean subspecies	Threatened	USFWS	SER	No	Submerged aquatic vegetation in shallow freshwater, brackish water, and marine waters
West Indian manatee (Florida subspecies)	*Trichechus manatus latirostris*	Yes: Florida subspecies	Threatened	USFWS	SER	Yes	Submerged aquatic vegetation in shallow freshwater, brackish water, and marine waters

Source: ECOS, No Date-a

*SER = Southeast Region (includes the southern portion of the U.S. Eastern Seaboard, the U.S. Caribbean Islands [Puerto Rico and the U.S. Virgin Islands], and the Gulf of Mexico)

3.5.1.3.3 Threatened and Endangered Sirenians

The West Indian manatee is ESA-listed in the action area, and one of the two manatee subspecies has designated critical habitat. These sirenians are shown in **Table 3.5-3** and described in more detail below.

3.5.1.3.3.1 West Indian Manatee (Antillean subspecies and Florida subspecies)

The West Indian manatee is found in the Southeast Region throughout the Caribbean basin and in the southeastern U.S. where it reaches the northern limit of its range. It is limited to the tropics and subtropics due to an extremely low metabolic rate and lack of a thick layer of insulating body fat, and prolonged exposure to water temperatures below 20° Celsius (C) (68° Fahrenheit [F]) can be lethal. Collisions with motorboats are the primary cause of human-related deaths; since manatees swim slowly just below or at the surface of the water, they are especially vulnerable to collisions with boats. Florida manatees are also threatened by loss of warm-water habitat, periodic die-offs due to red tides, and unusually cold weather events.

Two subspecies of West Indian manatee are recognized: the Antillean subspecies (*T. m. manatus*) and the Florida subspecies (*T. m. latirostris*). This subspeciation could reflect reproductive isolation brought on by the intemperate northern coast of the Gulf of Mexico and characteristically strong currents found in the Straits of Florida (USFWS, 2014a; USFWS, 2014b). Florida manatees are found throughout the southeastern U.S., and Antillean manatees are found in Puerto Rico in the U.S. EEZ, as well as in other parts of the Caribbean, Central America, and South America (82 FR 16668, April 5, 2017).

The West Indian manatee was listed as endangered under the ESA in 1967, and it was reclassified as threatened in 2017 (82 FR 16668, April 5, 2017). It is also a strategic stock under the MMPA. The Florida subspecies is also protected under the Florida Manatee Sanctuary Act. Florida manatees are managed jointly by both the USFWS and the Florida Fish and Wildlife Conservation Commission. The Antillean manatee population is managed jointly by the USFWS and the Puerto Rico Department of Natural and Environmental Resources. Critical habitat was designated for the Florida manatee 1976 and includes coastal areas, inland waterways, headwaters, bays, estuaries, and rivers as detailed in the final rule (41FR41914). No critical habitat has been designated outside of Florida. The most recent surveys to determine the population of the Florida manatee were conducted in 2015-16 (Hostetler et al., 2018). These surveys estimated that the number of manatees in Florida was 8,810 animals, of which 4,810 were on the west coast of Florida and 4,000 were on the east coast; the minimum population estimate is 7,520 manatees. Surveys from 2010 to 2014 estimated the average minimum island-wide population of the Antillean subspecies to be 386 manatees (Collazo et al., 2019) and found that manatees were more widespread than previously understood.

Manatees live in freshwater, brackish, and marine habitats in riverine and coastal areas. Sightings in the Atlantic Ocean and Gulf of Mexico are fairly common, especially near the coastlines. Satellite-tracked manatees have been documented moving along the coasts more than five miles offshore, and it is not uncommon for manatees to be seen near offshore oil platforms in the Gulf of Mexico more than 20 miles offshore. Preferred habitats feature submerged aquatic vegetation such as eelgrass and seagrass. The majority of the Atlantic population of the Florida manatee is located in eastern Florida, (USFWS, 2014b). As water temperatures rise in spring and summer, manatees in Florida disperse throughout the state and into neighboring states. Warm-season manatee use along the Atlantic coast north of Florida occurs frequently in Georgia, South Carolina, and North Carolina, and fairly frequently in Virginia, Delaware, and Maryland (82 FR 16668, April 5, 2017). The numbers of manatees using these areas is not known, but use in South Carolina is likely similar to use in Georgia. Use in North Carolina may be a little less, and use farther north is likely small but frequent. Because they have little tolerance for cold, manatees are generally restricted to the inland and coastal waters of peninsular Florida during the winter, where they shelter in or near sources of warm water (springs, industrial and power plant effluents, and other warm water sites).

The Antillean manatee is found in eastern Mexico and Central America, northern and eastern South America, and in the Greater Antilles (USFWS, 2014a). It inhabits riverine and coastal systems in the subtropical Western Atlantic Coastal Zone from the Caribbean islands to Brazil, including the Gulf of Mexico. Manatees found in the Bahamas are believed to be the Florida subspecies, not the Antillean. The distribution of the Antillean manatee extends eastward to Puerto Rico. In Puerto Rico, manatees favor habitats in coastal areas that are protected from severe wave action, harbor submerged aquatic vegetation, and have some source of fresh water. Manatees are consistently detected more on the eastern and southern coast than on the northern coast of the main island. Relatively higher concentrations of manatees are found in four areas: Ceiba on the east coast, Jobos Bay area between Guayama and Salinas on the southeast coast, Guayanilla and Guánica Bay area on the southwest coast, and between Cabo Rojo and Mayaguez (Guanajibo River mouth) in the west coast. Five offshore islands are significant biogeographic features in Puerto Rico: (west to east) Desecheo, Mona, Caja de Muertos, Culebra, and Vieques islands. Manatees do not use the western offshore islands of Mona and Desecheo as Mona Passage constitutes a migratory barrier to these islands since it is characterized by strong currents and high surf. There have been few sightings in Caja de Muertos and Culebra Island. In contrast, Vieques Island is within the range of the species, and manatees have been seen traveling to and from the east coast (USFWS, 2014a).

Manatees are herbivorous, feeding on a wide array of aquatic (freshwater and marine) plants such as water hyacinths and marine seagrasses. They generally prefer shallow seagrass beds, especially areas with access to deep channels. Preferred coastal and riverine habitats (e.g., near the mouths of coastal rivers) are also used for resting, mating, and calving.

3.5.1.4 Fissipeds (Sea Otters and Polar Bears)

Polar bears and sea otters are marine mammals that are neither pinniped nor cetacean. They are both fissipeds, or “split-footed” members of the taxonomic order Carnivora and are more closely related to terrestrial carnivores, like weasels (the sea otter, like its “cousin” the river otter, is in Mustelidae, the weasel family), than to seals or whales (Wynne, 2013). These species lack many of the physiologic adaptations to marine life seen in pinnipeds and cetaceans. Both species are considered marine mammals under U.S. laws because of the roles they play in the marine environment.

Polar bears, closely related to brown bears (*Ursus arctos*) in the bear family (Ursidae), spend most of their lives associated with marine ice and waters and are dependent on pack ice for much of their denning habitat and for hunting seals. Although competent swimmers, they are the marine mammal least adapted to aquatic existence. They rest, mate, give birth, and suckle their young on ice and terrestrial habitats (Wynne, 2013).

Sea otters, in the weasel family (Mustelidae), and much larger than river otters, live a primarily marine life: they rest, mate, give birth, and suckle their young in the water. Their hind limbs are webbed for swimming, but their front paws are padded with separate, clawed digits. They lack blubber but are insulated by air trapped in their thick fur, which is densest among all mammals (Wynne, 2013), and the reason for which they were heavily hunted historically, drastically reducing their populations.

All marine fissipeds are protected by the MMPA throughout their ranges. Polar bears and sea otters are also federally listed under the ESA either throughout their ranges or for certain subspecies and DPSs. Additionally, the northern sea otter (Southwest Alaska DPS) and the polar bear have designated critical habitat. **Table 3.5-4** lists the two species of fissipeds (four distinct species, subspecies, or DPS total) occurring throughout the action area.

3.5.1.4.1 Fissiped Sound Production and Hearing

Polar bears spend much of their time on land or ice and little time with their heads submerged below the surface when they are swimming or hunting. Sea otters live in shallow coastal areas and spend a great deal of time floating at the surface, or conducting short foraging dives. Finneran et al. (2017) placed fissipeds in the “Otariids and other non-phocid marine carnivores” functional hearing group (which contains all eared seals, walruses, sea otters, and polar bears) as limited data can be found specifically for polar bear or sea otter reactions to underwater sounds.

Polar bears are not known to communicate underwater. Nachtigall et al. (2007) measured the in-air hearing of polar bears and found that the best sensitivity was in the 11.2 to 22.5 kHz range. Behavioral testing of hearing indicates that polar bears can hear down to at least 14 Hz and up to 25 kHz. Testing by Owen and Bowles (2011) indicates that the greatest in-air hearing sensitivity occurs between 8-14 kHz. Polar bears generally hear in the less than 25 kHz range underwater (Owen and Bowles, 2011).

Ghoul and Reichmuth (2014) found that the aerial audiogram of the sea otter resembled that of sea lions; they can hear in the 125 Hz to 38 kHz in the air, with a best hearing sensitivity between 1.2 kHz and 27 kHz. Under water, hearing sensitivity was significantly reduced when compared to sea lions and other pinniped species, demonstrating that sea otter hearing is primarily adapted to receive airborne sounds. Underwater, sea otters hear in the less than 32 kHz range with best sensitivity between 2 kHz to 26 kHz underwater They are less efficient than other marine carnivores at extracting acoustic signals from background sound underwater, especially at frequencies below 2 kHz (Ghoul and Reichmuth, 2014).

3.5.1.4.2 Regional Distribution of Fissipeds

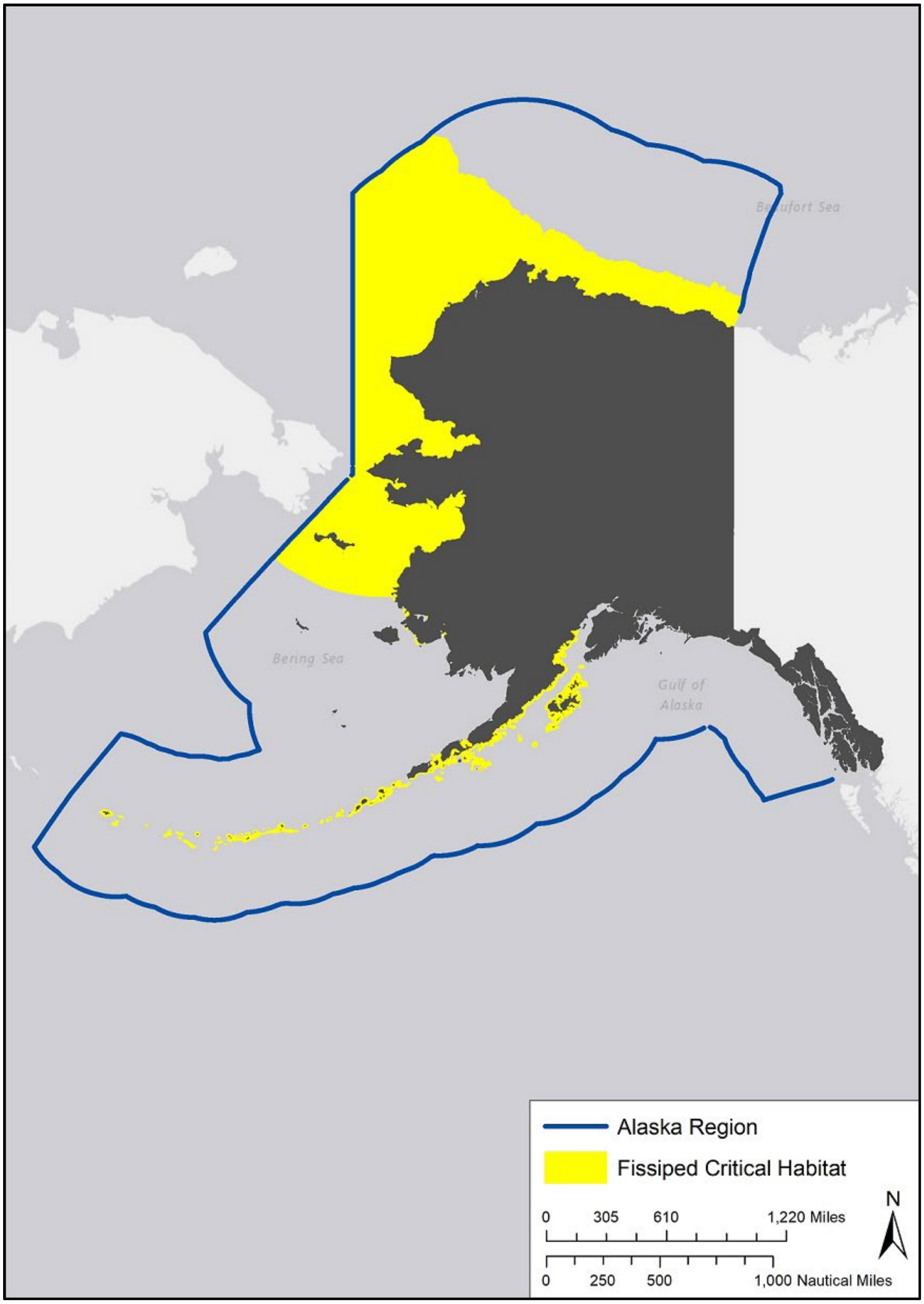
The polar bear and sea otter are distributed in two regions of the action area, described below.

3.5.1.4.2.1 West Coast Region

Two fissipeds occur in the West Coast Region, as indicated in **Table 3.5-4**: the northern sea otter and the southern sea otter, which is ESA-listed as threatened. There is no designated critical habitat in the region.

3.5.1.4.2.2 Alaska Region

Two fissipeds (northern sea otter, including the Southwest Alaska DPS, and polar bear) occur in the Alaska Region, as indicated in **Table 3.5-4.** The northern sea otter (Southwest Alaska DPS) and the polar bear are ESA-listed as threatened, and both have designated critical habitat in the region as shown in **Figure 3.5-21**.



Sources: NMFS, No Date-b; ECOS, No Date-b

Figure 3.5-21. Fissiped Designated Critical Habitat in the Alaska Region

Table 3.5-4. Fissipeds Occurring in the Action Area

Common Name	Scientific Name	MMPA Depleted?	ESA Status	Lead Agency	Region*	Critical Habitat	General Ecology
Mustelids							
Northern sea otter	*Enhydra lutris kenyoni*	No	--	USFWS	AR, WCR	--	Shallow, coastal, kelp forests
Northern sea otter (Southwest Alaska DPS)	*Enhydra lutris kenyoni*	Yes: Southwest Alaska DPS	Threatened	USFWS	AR	Yes	Shallow, coastal, kelp forests
Southern sea otter	*Enhydra lutris nereis*	Yes: throughout its range	Threatened	USFWS	WCR	No	Shallow, coastal, kelp forests
Ursids							
Polar bear	*Ursus maritimus*	Yes: throughout its range	Threatened	USFWS	AR	Yes	Sea ice

Source: ECOS, No Date-a; NMFS, No Date-a

* AR = Alaska Region (includes Alaskan waters and the Arctic); WCR = West Coast Region (includes coastal California, Oregon, and Washington)

3.5.1.4.3 Threatened and Endangered Fissipeds

Three distinct populations of fissipeds in the action area are ESA-listed under the ESA and managed by the USFWS; two species also have designated critical habitat. These fissipeds are shown on **Table 3.5-4** and described in detail below.

3.5.1.4.3.1 Southern Sea Otter and Northern Sea Otter

Historically, sea otters (**Figure 3.5-22**) occurred in nearshore marine waters around the North Pacific Rim from Hokkaido, Japan, through the Kuril Islands, the Kamchatka Peninsula, the Commander Islands, the Aleutian Islands, peninsular and south coastal Alaska, and south to Baja California, Mexico (USFWS, 2014c). In the early 1700s, the worldwide population was estimated to be between 150,000 and 300,000 individuals. Sea otters were hunted nearly to extinction during the 1700s and 1800s for the fur trade. Only small remnant groups of sea otters survived the fur hunting period. Prior to large-scale commercial exploitation, indigenous peoples of the North Pacific hunted sea otters. Although it appears that harvests may have periodically led to local reductions of sea otters, the species remained abundant throughout its range until the mid-1700s. When sea otters were afforded protection by the International Fur Seal Treaty in 1911, probably fewer than 2,000 animals remained in 13 remnant colonies. Population recovery began following legal protection. As part of efforts to re-establish sea otters in portions of their historical range, otters from Amchitka Island and Prince William Sound were translocated to other areas in the 1960s and 1970s. The primary threats to sea otters currently include entanglement in fishing gear and debris, oil spills, harvesting for pelts, conflicts with commercial fishing interests, and coastal development. Several thousand sea otters were killed in Alaska by the *Exxon Valdez* oil spill in Prince William Sound in 1989, and the detrimental effects of the spill may have persisted into the 1990s.

Figure 3.5-22. Sea Otter with Sea Urchins

Photo Credit: Neil Fisher

The USFWS recognizes five sea otter stocks in U.S. waters; these include single stocks in California and Washington and three in Alaska (Southeast, Southcentral, and Southwest). The California sea otter is the southern sea otter; all the rest comprise the northern sea otter. Sea otters are protected from hunting and harassment by the MMPA. The southern sea otter in California was listed as threatened under the ESA in 1977. The USFWS listed the Southwest Alaska DPS of northern sea otter as threatened under the ESA in 2005. The global population size is estimated at greater than 150,000 animals. The current and minimum population estimate for the southern sea otter in California is 3,272 animals (USFWS, 2021a). The minimum population estimate of the Washington sea otter population is 2,785 individuals (Jeffries et al., 2019). The estimated population size for the Southwest Alaska stock is 54,771 animals, with a minimum population estimate of 45,064 individuals (USFWS, 2014c). The estimated population size for the Southeast Alaska stock is 25,712 animals, with a minimum population estimate of 21,798 individuals (USFWS, 2014d). The estimated population size for the Southcentral Alaska stock is 18,297 animals, with a minimum population estimate of 14,661 individuals (USFWS, 2014e).

Critical habitat was designated for the northern sea otter Southwest Alaska DPS in 2009 (74 FR 51988, October 8, 2009). Five units were designated as critical habitat: the Western Aleutian Unit, the Eastern Aleutian Unit, the South Alaska Peninsula Unit, the Bristol Bay Unit, and the Kodiak, Kamishak, Alaska Peninsula Unit. The PCEs of critical habitats for the northern sea otter are:

1) Shallow, rocky areas where marine predators are less likely to forage, which are waters less than 2 m (6.6 ft) in depth;
2) Nearshore waters that may provide protection or escape from marine predators, which are those within 100 m (328.1 ft) from the mean high tide line;
3) Kelp forests that provide protection from marine predators, which occur in waters less than 20 m (65.6 ft) in depth; and
4) Prey resources within the areas identified by PCEs 1, 2, and 3 that are present in sufficient quantity and quality to support the energetic requirements of the species.

The sea otter differs from most marine mammals in that it lacks an insulating subcutaneous layer of fat. For protection against cold water, it depends on a layer of air trapped among its hair. The underfur is the densest mammalian fur. The species is most commonly observed within the 40-m (approximately 12.2-ft) depth contour because the animals require frequent access to benthic foraging habitat in subtidal and intertidal zones (USFWS, 2014c). In Washington they have also been documented in waters 58 km (36 mi) offshore in depths of 200 m (656 ft). Sea otters forage diurnally and nocturnally (Esslinger et al., 2014). During their typical midday rest period, sea otters often rest in kelp beds, where they also spend the night.

Sea otters are gregarious and may become concentrated in an area, sometimes resting in groups containing less than 10 to over 1,000 animals. Sea otters mate at all times of the year, and young may be born in any season. However, in Alaska most pups are born in late spring. The pupping period for Washington’s sea otter stock occurs primarily from March to April, with peak numbers of dependent pups expected to be present from May to September (USFWS, 2018).

Sea otter movements are likely limited by geographic barriers, their high-energy requirements, and social behavior. Sea otters are not migratory and generally do not disperse over long distances, although movements of tens of kilometers are common. Due to their benthic foraging, sea otter distribution is largely limited by their ability to dive to the sea floor. The ranges of the Alaska stocks are defined as follows (USFWS, 2014c): 1) the Southeast Alaska stock extends from Dixon Entrance to Cape Yakataga; 2) the Southcentral Alaska stock extends from Cape Yakataga to Cook Inlet including Prince William Sound, the Kenai Peninsula coast, and Kachemak Bay; and 3) the Southwest Alaska stock includes the Alaska Peninsula and Bristol Bay coasts, and the Aleutian, Barren, Kodiak, and Pribilof Islands. The distribution of the majority of the Washington sea otter stock ranges from Pillar Point in the Strait of Juan de Fuca, west to Cape Flattery and as far south as Point Grenville on the outer Olympic Peninsula coast (USFWS, 2018). Otters can be present in Puget Sound as far south as Olympia and along the outer coast as far south as Cape Arago, Oregon. Southern sea otters occupy nearshore waters along the mainland coastline of California from San Mateo County to Santa Barbara County; a subpopulation of southern sea otters also exists at San Nicolas Island, Ventura County (USFWS, 2021a).

3.5.1.4.3.2 Polar Bear

Polar bears are distributed across ice-covered waters of the circumpolar Arctic. Sea ice (**Figure 3.5-23**) is their primary habitat upon which they depend for most life functions including hunting, feeding, breeding, travel, maternity denning areas, and resting (USFWS, 2016a). Two stocks of polar bears exist in Alaska, the Southern Beaufort Sea (SBS) stock and the Chukchi/Bering Seas (CBS) stock.

Warming-induced habitat degradation and loss are negatively affecting some polar bear stocks, and unabated global warming will ultimately reduce the worldwide polar bear population (USFWS, 2016a). Loss of sea ice habitat due to climate change is identified as the primary threat to polar bears. Patterns of increased temperatures, earlier spring thaw, later fall freeze-up, increased rain-on-snow events (which can cause dens to collapse), and potential reductions in snowfall are also occurring. As a result, there is fragmentation of sea ice, reduction in the extent and area of sea ice in all seasons, retraction of sea ice away from productive continental shelf areas throughout the polar basin, reduction of the amount of heavier and more stable multi-year ice, and declining thickness and quality of shore-fast ice. These climatic phenomena may also affect the abundance of seals, the polar bear's main food source.

Figure 3.5-23. Polar Bear on Sea Ice

Photo Credit: Collection of Dr. Pablo Clemente-Colon

Subpopulations of polar bears also face different combinations of human-induced threats. The largest human-caused loss of polar bears results from subsistence hunting of the species, but for most subpopulations where subsistence hunting of polar bears occurs, it is a regulated or monitored activity. Other threats include accumulation of persistent organic pollutants in polar bear tissue, tourism, human-bear conflict, and increased development in the Arctic (USFWS, 2016a).

Due to threats to its sea ice habitat, the polar bear was listed in 2008 as threatened (73 FR 28212, May 15, 2008) throughout its range under the ESA. Polar bears are also protected under the MMPA. Low population densities, inaccessible habitat, and budget constraints have made estimating abundance of polar bear populations difficult. The estimated population of polar bears is 20,000-25,000 individuals with 19 recognized management subpopulations or stocks worldwide (USFWS, 2016a). The estimated population size for the CBS stock is 2,937 animals (Regehr et al., 2018). The estimated population size for the SBS stock is 573 bears, with 95-percent credible interval from 232 to 1,140 animals (Atwood et al., 2020).

Polar bear critical habitat was designated in 2010 (75 FR 76086, December 7, 2010). The PCEs of critical habitats for the polar bear are (USFWS, 2016a):

1) Sea-ice habitat used for feeding, breeding, denning, and movements, which is sea ice over waters 300 m (984.2 ft) or less in depth that occurs over the continental shelf with adequate prey resources (primarily ringed and bearded seals) to support polar bears.
2) Terrestrial denning habitat, which includes topographic features, such as coastal bluffs and river banks, with suitable macrohabitat characteristics:
    a. Steep, stable slopes with heights ranging from 1.3 to 34 m (4.3 to 111.6 ft), and with water or relatively level ground below the slope and relatively flat terrain above the slope;
    b. Unobstructed, undisturbed access between den sites and the coast;
    c. Sea ice in proximity to terrestrial denning habitat prior to the onset of denning during the fall to provide access to terrestrial den sites; and
    d. The absence of disturbance from humans and human activities that might attract other polar bears.
3) Barrier island habitat used for denning, refuge from human disturbance, and movements along the coast to access maternal den and optimal feeding habitat, which includes all barrier islands along the Alaska coast and their associated spits, within the range of the polar bear in the U.S., and the water, ice, and terrestrial habitat within 1.6 km (1 mi) of these islands (no-disturbance zone).

Ringed seals are the polar bear’s primary food source, and the most productive hunting grounds are areas near ice edges where ocean depth is minimal (BOEM, 2015a). While polar bears primarily hunt seals, they occasionally also consume other marine mammals. Most polar bears use terrestrial habitat partially or exclusively for maternity denning; therefore, females must adjust their movements to access land at the appropriate time. Most pregnant female polar bears excavate snow dens in the fall to early winter and give birth in the dens during midwinter. Family groups emerge from dens in March and April when cubs are approximately three months old.

The SBS population ranges from approximately Tuktoyaktuk, Canada and west to Icy Cape, Alaska. Approximately 60 percent of the SBS population spends the summer on pack ice with the remaining bears using land during late summer and fall (Atwood et al., 2020). The CBS population is widely distributed on the pack ice in the Chukchi Sea and northern Bering Sea and adjacent coastal areas in Alaska and Russia. Individuals of the CBS stock range widely on pack ice primarily from Kivalina, Alaska west to the eastern Siberian Sea, but could also occur as far east as the Colville River delta. The stock’s southern boundary in the Bering Sea is determined by the annual extent of the pack ice. These two stocks have an extensive area of overlap between Icy Cape and Point Barrow, Alaska, centered near Wainwright (Scharf et al., 2019).

Polar bear movements are extensive, individual activity areas are enormous, and bears are not dispersed evenly throughout their range. To access ringed and bearded seals, polar bears in the SBS concentrate in shallow waters less than 300 m (984 ft) deep over the continental shelf and in areas with greater than 50 percent ice cover. In response to changes in the sea ice characteristics and declines in sea ice habitat over the continental shelf during the summer and late fall, some polar bears have changed distribution to search for seals and to access the remains of subsistence harvested bowhead whales.

3.5.2 Environmental Consequences for Marine Mammals

This section discusses potential impacts of proposed activities associated with Alternatives A, B, and C on marine mammals. ESA-listed endangered and threatened species are included as part of the discussion with non-listed species because the potential impact mechanisms are the same. Effects determinations as required under Section 7 of the Endangered Species Act for ESA-listed species are presented at the end of this section after the analysis of impacts. Activities that are part of the Proposed Action and that could be expected to impact marine mammals include operation of crewed sea-going surface vessels; operation of remotely operated or autonomous vehicles; use of echo sounders, ADCPs, acoustic communication systems, and sound speed data collection equipment; anchoring; operation of drop/towed cameras and video systems; installation, maintenance, and removal of tide gauges and GPS reference stations; and SCUBA operations.

3.5.2.1 Methodology

Project activities may impact marine mammals in a variety of manners in the action area, including (1) sound from active underwater acoustic sources (i.e., from echo sounders, ADCPs, and acoustic communication systems); (2) vessel operation and equipment sound - underwater and airborne (i.e., from crewed surface vessels; remotely operated and autonomous vehicles; tide gauge installation; and GPS reference station installation); (3) vessel presence and movement, including equipment in the water (i.e., visual and physical disturbance of and risk of collisions with marine mammals); (4) human presence and activity (i.e., onboard vessels, on land during tide gauge and GPS reference station installation, and underwater during SCUBA operations); (5) accidental leakage or spillage of oil, fuel, and chemicals into surrounding waters (i.e., from vessel operations); (6) trash and debris (i.e., potential for entanglement and ingestion); and (7) air emissions (i.e., from smokestacks and outboard motors). These potential impact causing factors and their associated effects on marine mammals are discussed below after an overview of the general effects of underwater sound on marine mammals.

As discussed in Section 3.2.2, significance criteria were developed for each resource to provide a structured framework for assessing impacts from the alternatives and the significance of the impacts. The significance criteria for marine mammals are shown in **Table 3.5-5**. Potential impacts resulting from the Proposed Action are calculated or discussed on an individual animal basis (i.e., the estimate of total exposures to sound levels above specified thresholds). However, the focus of the significance analysis is to determine the consequences that those individual exposures may have on a species' population. In situations where the consequence of individual exposures has a potential for injury or behavioral disturbance (e.g., not direct mortality), it is difficult to quantitatively calculate population-level impacts from individual exposures. The significance criteria at the population level, while informed by the exposure estimates, are necessarily qualitative in considering the potential for injury or behavioral disturbance at the population level. The significance criteria also consider the status of the population, such as whether the individuals are part of an ESA-listed population. Finally, the significance criteria consider not only the number of individuals exposed, but also the spatial extent of exposures and whether the exposures are expected to occur in designated critical habitat or other biologically important areas such as preferred breeding, feeding, and nursery grounds or migratory routes.

Table 3.5-5. Significance Criteria for the Analysis of Impacts to Marine Mammals

Impact Descriptor	Context and Intensity	Significance Conclusion
Negligible	Impacts would be temporary (lasting up to several hours) and would not be outside the natural range of variability of species' populations, their habitats, or the natural processes sustaining them. Impacts could include disturbances to communication and/or echolocation and behaviors of individuals without interference to feeding, reproduction, or other biologically important functions affecting population levels. No mortality or debilitating injury to any individual marine mammal would occur. There would be no displacement of marine mammals from preferred breeding, feeding, or nursery grounds, migratory routes, or designated critical habitat.	Insignificant
Minor	Impacts would be temporary or short-term (lasting several days to several weeks) but would not be outside the natural range of variability of species' populations, their habitats, or the natural processes sustaining them. Impacts could include non-life-threatening injury to individual marine mammals and disruptions of behavioral patterns, including occasional disruption of communication and/or echolocation, behavioral disturbance of individuals or groups of marine mammals, and displacement of individuals or groups without interference to feeding, reproduction, or other biological important functions affecting population levels. Displacement of marine mammals from preferred breeding, feeding, or nursery grounds, migratory routes, or designated critical habitat would be limited to the project area or its immediate surroundings.	
Moderate	Impacts would be short-term or long-term (lasting several months or longer) and outside the natural range of variability of species' populations, their habitats, or the natural processes sustaining them. Impacts could include injury (up to and including mortal injury) and repeated disruptions of communication and/or echolocation and time-sensitive behaviors such as feeding and breeding, but in low enough numbers such that the continued viability of the population is not threatened. Behavioral responses to disturbance by individuals or groups could be expected in the project area, its immediate surroundings, or beyond, including extended displacement of individuals from preferred breeding, feeding, or nursery grounds, migratory routes, or designated critical habitat.	
Major	Impacts would be short-term or long-term and well outside the natural range of variability of species' populations, their habitats, or the natural processes sustaining them. Impacts could include extensive (i.e., affecting a large proportion of the local population), life-threatening, or debilitating injury and mortality and substantial	Significant

Impact Descriptor	Context and Intensity	Significance Conclusion
	disruption of communication and/or echolocation and time-sensitive behaviors such as breeding so that the continued viability of the local population is seriously threatened. Displacement from preferred breeding, feeding, or nursery grounds, migratory routes, or designated critical habitat would be short- or long-term within and well beyond the project area. Full recovery of a population would not be expected to occur in a reasonable time.	

The following terms are used in the analysis below and are defined here:

- Continuous Sound – a sound that is present at all times in a relevant time window.
- Intermittent Sound – a sound that is periodically present.
- Pulse – a single segment of a periodic signal that consists of (potentially) repeating segments with defined beginning and end points and is, typically, short in duration (pulses are not necessarily impulsive).
- Impulsive Sound – sounds that are typically transient, brief (less than 1 second), broadband, and consist of high peak sound pressure (i.e., the decibel level of the maximum instantaneous acoustic pressure in a stated frequency band) with rapid rise time and rapid decay.
- Non-impulsive Sound – sounds that can be broadband, narrowband or tonal, brief or prolonged, continuous or intermittent and typically do not have a high peak sound pressure with rapid rise/decay time that impulsive sounds do.
- Duty Cycle – the percentage of time a signal is on in a relevant time window.

3.5.2.2 Potential Effects of Sound on Marine Mammals

The sounds that marine mammals hear and generate vary in characteristics such as dominant frequency, bandwidth, energy, temporal pattern, and directivity. The environment often contains multiple co-occurring sounds and, like all animals, marine mammals must be able to discriminate signals (meaningful sounds) from background sounds.

Where there is an overlap between sound sources and the frequencies of sound heard and used by marine mammals, there is the potential for sound to interfere with important biological functions. Responses of marine mammals exposed to underwater anthropogenic sounds are variable and range from subtle response to injury. The magnitude of the effect appears to depend on a combination of various factors, such as spatial relationships between a sound source and the animal, hearing sensitivity of the animal, overlaps in sound frequency, received sound exposure, duration of exposure, duty cycle, and ambient sound level. Responses to sounds are context dependent; among other ecological factors, the animal's activity at time of exposure and its history of exposure and familiarity with the sound signal are important influences (Ellison et al., 2012). Marine mammal hearing and sensitivity is discussed in Section 3.5.1 for each type of marine mammal. More information on acoustic properties and propagation of sound sources can be found in Appendix E, Technical Acoustic Analysis of Oceanographic Surveys.

The range of potential effects from sound includes death; non-auditory physiological effects; auditory effects (temporary or permanent hearing threshold shift); masking; physiological stress; and behavioral responses. All of these effects can have potential population consequences depending on the number of affected individuals and whether the effects exclude marine mammals from a habitat critical for their survival.

Underwater sound sources from the Proposed Action include active acoustic equipment and vessel sounds. For regulatory purposes, sound sources are categorized as impulsive or non-impulsive. Continuous-type sounds such as vessels and many sonar signals are considered non-impulsive. Impulsive sounds consist of relatively short duration on/off pulses and include sources such as pile driving and airguns (although these are not a part of the NOS Proposed Action), as well as some sonar. Following guidance from NMFS, high-resolution geophysical sources can be either impulsive or non-impulsive. NMFS has performed qualitative classification of the impulsiveness of these sources. NMFS has determined that sparkers and boomers are classified as impulsive sources, while sub-bottom profilers and multi-beam echo sounders are non-impulsive. This classification is based on NMFS' qualitative assessment of the generated waveforms. The acoustic analysis is based on thresholds for non-impulsive sounds (see Section 3.5.2.3.1.1 below and Appendix E).

The following sections address this range of potential effects of underwater anthropogenic sound on marine mammals.

3.5.2.2.1 Death and Non-Auditory Physiological Effects

Direct physical injury, which may result in death, may occur from exposure to high levels of impulsive sound such as shock waves associated with in-water explosions. These pulses are typically short, with peak pressures that may damage internal organs or air-filled body cavities (i.e., lungs). Marine mammals can be susceptible to direct physical injury following intense exposure (e.g., close proximity to explosives; Ketten et al., 1993), such as the initial compression of a body exposed to a blast wave, or barotrauma, in which injuries are caused when large pressure changes occur across tissue interfaces such as the lungs. However, the operation of NOS acoustic equipment is not likely to elicit direct physical injury resulting in death because these sources do not emit high level impulsive sound or produce intense exposures.

Potential non-auditory effects from sound sources such as sonar are unlikely due to relatively lower peak pressures (i.e., the maximum instantaneous sound pressure during a measurement period or sound event) and slower rise times (i.e., the propagation of the wave between the source and the sensor) than potentially injurious impulsive sources such as explosives. Therefore, blast injury and barotrauma would not occur. The sound sources used by NOS are not expected to result in non-auditory physiological effects, other than stress as discussed below in Section 3.5.2.2.4.

Exposure to non-impulsive acoustic energy has also been considered a potential indirect cause of the death of marine mammals. In some cases, while the sound itself may not have directly caused death or injury, it is assumed to be a causal factor in behavior (i.e., in such cases as strandings) that led to deaths (Marine Mammal Commission, 2006; ICES, 2005). Sonar use during exercises involving the U.S. Navy has been identified as a contributing cause or factor in five specific mass stranding events: Greece in 1996; the Bahamas in March 2000; Madeira Island, Portugal in 2000; the Canary Islands in 2002, and Spain in 2006 (Cox et al., 2006; Fernandez, 2006; Navy, 2017a). These five mass strandings have resulted in about 40 known cetacean deaths consisting mostly of beaked whales and with close linkages to mid-frequency active sonar activity. In these circumstances, exposure to non-impulsive acoustic energy was considered a potential indirect cause of death of the marine mammals (Cox et al., 2006).

In another example, analysis of potential causes of a mass stranding of 100 melon-headed whales (*Peponocephala electra*) in Madagascar in 2008 implicated a mapping survey using a high-power 12 kHz multi-beam echo sounder (similar to that used in the Proposed Action) as a likely trigger for this event. Although the cause is equivocal and other environmental, social, or anthropogenic factors may have facilitated the strandings and contributed to the mortalities, the authors determined the echo sounder as the most plausible factor initiating the stranding response, suggesting that avoidance behavior may have led the pelagic whales into shallow, unfamiliar waters (Southall et al., 2013). This was the first time that a relatively high-frequency mapping sonar system had been associated with a stranding event (Southall et al., 2013). However, the exact same sound source had been used a few weeks prior in the same general area off Madagascar without incident. These types of systems are used extensively for ocean bottom mapping, fish finding, and other common surveys without any documented links to stranding events. Impacts can be situation-specific; in this case, the operation of the survey (north to south) parallel to shore may have trapped the animals between the ship (where the sound source was located) and the shore, and the animals continued to turn inland until they entered the lagoon and became entrapped. Although high-resolution acoustic surveys are routinely conducted by NOS, but there has only been one documented incident due to the use of high-resolution acoustic survey sources (as discussed above in Madagascar), stranding events are not expected to result from the Proposed Action.

3.5.2.2.2 Auditory Injuries – Hearing Threshold Shift

The hearing threshold is the minimum sound level (measured in decibels, or dB) an animal can hear within a specified frequency band. Sounds that are loud, well above the hearing threshold, and long-duration may result in an elevation of the hearing threshold (BOEM, 2014a) (i.e., hearing loss). Threshold shifts, or incremental hearing loss, may be temporary, returning to their baseline level, or permanent. Threshold shifts are defined as follows, as adapted from Southall et al. (2007) and Finneran et al. (2005):

- Temporary Threshold Shift (TTS) – the mildest form of hearing impairment; exposure to loud sound resulting in a non-permanent (reversible) elevation in hearing threshold, making it more difficult to hear sounds; TTS can last from minutes or hours to days; the magnitude of the TTS depends on the level and duration of the sound exposure, among other considerations.
- Permanent Threshold Shift (PTS) – permanent elevation in hearing threshold with physical damage (injury) to the sound receptors in the ear lasting indefinitely; in some cases, there can be total or partial deafness, whereas in other cases the animal has an impaired ability to hear sounds in specific frequency ranges. Repeated TTS, especially if the animal receives another loud sound exposure before recovering from the previous TTS, is thought to cause PTS. If the sound is intense enough, however, PTS may result without TTS.

The distinction between PTS and TTS is based on whether there is a complete recovery of a threshold shift or loss of sensitivity following a sound exposure. If the threshold shift eventually returns to zero (hearing returns to the pre-exposure normal), the threshold shift is a TTS.

Several factors determine the type and magnitude of hearing loss, including exposure level, frequency, duration, and temporal pattern of exposure. A range of mechanical effects (e.g., stress or damage to supporting cell structure) and metabolic processes (e.g., inner ear hair cell metabolism such as energy production, protein synthesis, and ion transport) within the auditory system underlie both TTS and PTS. See Appendix E for more information.

For TTS, full recovery of the hearing loss (to the pre-exposure threshold) is expected based on studies of marine mammals which determined that this recovery occurs within minutes to hours for the small amounts of TTS that have been experimentally induced (Finneran et al., 2005, 2010; Nachtigall et al., 2004). The recovery time is related to the exposure duration, sound exposure level, and the magnitude of the threshold shift, with larger threshold shifts and longer exposure durations requiring longer recovery times (Finneran et al., 2005, 2010; Mooney et al., 2009a, b). If the threshold shift does not return to zero but leaves some finite amount of threshold shift (loss in hearing sensitivity), then that remaining threshold shift is a PTS.

Studies have modeled the potential impacts (i.e., threshold shifts) (TTS: Kremser et al., 2005; PTS: Lurton and DeRuiter, 2011) in marine mammals exposed to echo sounders (such as those used for the NOS Proposed Action). The results from the studies suggest that TTS and PTS would be expected to occur in marine mammals generally at the distances of 100 m (328 ft) or less from the source in the cone ensonified by the modeled echo sounders, meaning only animals below the ship are exposed to these levels. On the side of the vessel, even at the same distances, animals are not exposed to these levels because of the conical nature of the sonar beam. Other studies involving echo sounders, such as experiments with captive common bottlenose dolphins, have shown that loud, short (1 second) tonal sounds can cause TTS (Schlundt et al., 2000), as can lower sound levels for periods up to 50 minutes (Finneran et al., 2005; Nachtigall et al., 2004, 2005). Sound sources used during NOS projects are likely to produce TTS or PTS in very few nearby marine mammals through exposure to the downward-directed echo sounder frequencies because the probability of a marine mammal swimming through the area of exposure (ensonified area) when an echo sounder emits a sound is small. The animal would have to pass the transducer at close range and/or be swimming at speeds similar to the vessel in order to accumulate enough sound energy to cause TTS or PTS. Detailed analysis of the impacts of active underwater acoustic sources potentially resulting in TTS or PTS is provided in Sections 3.5.2.3 through 3.5.3.5 for each type of marine mammal.

3.5.2.2.3 Masking

Auditory signal masking is the reduction in an animal's ability to perceive, recognize, or decode biologically relevant sounds because of interfering sounds. Masking can effectively limit the distance over which a marine mammal can communicate, detect biologically relevant sounds, and echolocate (for odontocetes). Masking only occurs in the presence of the masking noise and does not persist after the cessation of the noise (Navy, 2020). Masking can lead to vocal changes (e.g., Lombard effect, increasing amplitude, or changing frequency) and behavior changes (e.g., cessation of foraging, leaving an area) in both signalers and receivers, in an attempt to compensate for sound levels (Erbe et al., 2016). Masking can be caused by naturally occurring ambient sound produced from various sources, including wind, waves, precipitation, and other animals, or background sounds including human activities (e.g., impulsive sounds, sonar, and vessel sound).

Vocal changes in response to anthropogenic sound can occur across many sound production modes used by marine mammals, such as whistling, echolocation click production, calling, and singing (Navy, 2020). Vocalization changes include increasing the source level, modifying the frequency, increasing the call repetition rate of vocalizations, or ceasing to vocalize in the presence of increased sound (Hotchkin and Parks, 2013). In cetaceans, vocalization changes were reported from exposure to anthropogenic sound sources such as sonar, vessel sound, and seismic surveying (Gordon et al., 2003; Holt et al., 2009; McDonald et al., 2009; Rolland et al., 2012). Vocal changes represent possible tactics by the sound-producing animal to reduce the impact of masking. The receiving animal can also reduce the impacts of masking by using active listening strategies such as orienting to the sound source, moving to a quieter location, or reducing self- sound from hydrodynamic flow by remaining still (Navy, 2020).

Masking could have adverse consequences to marine mammals. Marine mammals use sound to recognize predators (Allen et al., 2014; Curé et al., 2015). Auditory recognition may be reduced in the presence of a masking noise, particularly if it occurs in the same frequency band. Therefore, the occurrence of masking may prevent marine mammals from responding to the acoustic cues produced by their predators. This could depend on the duration of the masking and the likelihood of encountering a predator during the time that predator cues are impeded. For example, harbor seals that reside in the coastal waters off British Columbia are frequently targeted by mammal-eating killer whales. The seals acoustically discriminate between the calls of mammal-eating and fish-eating killer whales (Deecke et al., 2002), a capability that should increase survivorship while reducing the energy required to attend to all killer whale calls.

Masking has been documented from use of airguns in seismic surveys, which, unlike the echo sounders used by NOS, are a powerful, omnidirectional impulsive source. Sounds from seismic surveys contribute to ocean-wide masking (Hildebrand, 2009). Impulsive sounds produced during pile driving operations have been found to mask the calls of marine mammals at great distances (Madsen et al., 2006). Gordon et al. (2003) listed a range of possible effects of seismic impulses on cetacean behavior and communication, including masking of sounds used during foraging such as echolocation. Masking could occur in mysticetes due to the overlap between their low-frequency vocalizations and the dominant frequencies of impulsive sources; however, masking in odontocetes or pinnipeds is less likely unless the activity is in close range when the pulses are more broadband (Navy, 2020). For example, differential vocal responses in marine mammals were documented in the presence of seismic survey sound. An overall decrease in vocalizations during active surveying was noted in large marine mammal groups (Potter et al., 2007), while blue whale feeding and social calls increased when seismic exploration was underway (Di Iorio and Clark, 2009), indicative of a possible compensatory response to the increased sound level.

Masking by low-frequency or mid-frequency active sonar with relatively low duty cycles is unlikely for most cetaceans and pinnipeds as sonar signals occur over a relatively short duration and narrow bandwidth that does not overlap with vocalizations for most marine mammal species (Navy, 2020). While dolphin whistles and mid-frequency active sonar are similar in frequency, masking is limited due to the low-duty cycle of most sonars. Low-frequency active sonar could overlap with mysticete vocalizations (e.g., minke and humpback whales). For example, in the presence of low-frequency active sonar, humpback whales were observed to increase the length of their songs (Fristrup et al., 2003; Miller et al., 2000), possibly due to the overlap in frequencies between the whale song and the low-frequency active sonar. Although findings by the Navy (2020), Fristrup et al. (2003), and Miller et al. (2000) all refer to Navy tactical sonars, and most NOS acoustic sources produce sounds at higher frequencies which are out of the hearing range of most marine mammals, the effects of masking discussed in these findings could potentially also apply to some acoustic sources used by NOS, such as echo sounders and ADCPs, with potential similar effects on marine mammals.

Newer high-duty cycle or continuous active tactical sonars used by the Navy have more potential to mask vocalizations, particularly for delphinids and other mid-frequency cetaceans (Navy, 2020). These sonars transmit more frequently (greater than 80 percent duty cycle) than traditional sonars, but at a substantially lower source level. Similarly, high-frequency acoustic sources such as pingers (i.e., devices that transmit short high-pitched signals at brief intervals) that operate at higher repetition rates also operate at lower source levels (Culik et al., 2001). While the lower source levels limit the range of impact compared to traditional systems, animals close to the sonar source are likely to experience masking on a much longer time scale than those exposed to traditional tactical sonars. Because the frequency range at which high-duty cycle systems operate overlaps the vocalization frequency of many mid-frequency cetaceans, their use may cause disruptions to communication, social interactions, and behaviors such as foraging or reproductive activities. Similarly, because the systems are mid frequency, there is the potential for the acoustic signals to mask important environmental cues like predator vocalizations (e.g., killer whales), possibly affecting survivorship for targeted animals. Although the acoustic sources used in these studies differed from the NOS acoustic sources included in the Proposed Action, their effects on marine mammals could be similar. Masking due to these systems is likely analogous to masking produced by other continuous sources (e.g., vessel sound). Long-term consequences could include changes to vocal behavior and vocalization structure (Foote et al., 2004; Parks et al., 2007), abandonment of habitat if masking occurs frequently enough to significantly impair communication (Brumm and Slabbekoorn, 2005), a potential decrease in survivorship if predator vocalizations are masked (Brumm and Slabbekoorn, 2005), and a potential decrease in recruitment if masking interferes with reproductive activities or mother-calf communication (Gordon et al., 2003).

Masking is more likely to occur in the presence of broadband (i.e., data transmission using a wide range of frequencies) and relatively continuous sound sources such as from vessels. Over the past 50 years, commercial shipping, the largest contributor of masking noise (McDonald et al., 2008), has increased the ambient low-frequency sound levels (e.g., 100-400 Hz) in the deep ocean by 10-15 dB (Hatch and Wright, 2007). Hatch et al. (2012) estimate that calling North Atlantic right whales might have lost, on average, 63-67 percent of their active acoustic space due to shipping sounds. Right whales were also observed to shift the frequency content of their calls upward while reducing the rate of calling in areas of increased anthropogenic sound (Parks et al., 2007) as well as increasing the amplitude (intensity) of their calls (Payne and Webb, 1971). Multiple delphinid species have been shown to increase the minimum or maximum frequencies of their whistles in the presence of anthropogenic sound (Papale et al., 2015). Holt et al. (2009; 2011) showed that Southern Resident killer whales in the waters surrounding the San Juan Islands increased their call source level as vessel sound increased. Hermannsen et al. (2014) estimated that broadband vessel sound could extend up to 160 kHz at ranges from 60 m (196 ft) to 1,200 m (3,937 ft), and that the higher frequency portion of that noise might mask harbor porpoise clicks. However, this may not be an issue as harbor porpoises may avoid vessels and may not be close enough to have their clicks masked (Polacheck and Thorpe, 1990). Liu et al. (2017) found that broadband shipping noise could cause masking of humpback dolphin whistles within 1.5 km (0.9 mi) to 3 km (1.8 mi), and masking of echolocation clicks within 0.5 km (0.3 mi) to 1.5 km (0.9 mi). Aerial and underwater vocalizations are also an important component of pinniped social behaviors, including delineation of territory, dominance posturing, and courtship (Supin et al., 2001). The low-frequency sounds generated by vessel operations are perceptible to pinnipeds and could mask ecologically important underwater vocalizations (Southall et al., 2003). Harbor seals have been found to increase the frequency and amplitude of their vocalizations while in the presence of vessel sound, while decreasing the duration of vocalizations (Matthews, 2017).

Underwater sound from sound sources used during NOS projects has the potential to mask marine mammal communication and monitoring of the environment around them. Masking of marine mammal calls and other natural sounds by pulsed sounds is expected to be limited during surveys because the narrow beam of most NOS active acoustic sources dictates that animals would not spend much time in ensonified zones (see Appendix E for calculations of the time animals spend in the beams of active acoustic sources). Vessel activity from NOS represents a very small proportion of all vessel traffic, so vessel sound from the Proposed Action is expected to contribute minimally to overall masking in the action area. Additionally, the intensity of the sound received by marine mammals is dependent on the size and speed of the vessel in question and the distance of the animal from the vessel. The sound level of the vessels used by NOS would be low relative to the sound level from shipping traffic as NOS uses smaller vessels with smaller engines traveling at lower speeds during surveys; thus, vessels used by NOS would contribute smaller masking impacts than shipping traffic.

3.5.2.2.4 Physiological Stress

Marine mammals naturally experience stressors within their environment and as part of their life histories, such as changing weather and ocean conditions, exposure to diseases and naturally occurring toxins, lack of prey availability, social interactions with members of the same species, and interactions with predators (Atkinson et al., 2015). Anthropogenic activities, such as fishery interactions, pollution, tourism, and ocean noise, have the potential to provide additional stressors to those that occur naturally (Meissner et al., 2015; Rolland et al., 2012). At this time, the sound characteristics that correlate with specific stress responses in marine mammals are poorly understood, as are the consequences due to these changes. With respect to acoustically induced stress, this includes not only determining how and to what degree various types of anthropogenic sounds cause stress in marine mammals, but what factors can mitigate those responses (Navy, 2020). Factors potentially affecting an animal's response to a stressor include the mammal's life history stage, sex, age, reproductive status, overall physiological and behavioral plasticity, and whether they are experienced with the sound (e.g., prior experience with a stressor may result in a reduced response due to habituation) (Finneran and Branstetter, 2013; St. Aubin and Dierauf, 2001).

The stress response is a suite of physiological changes that are meant to help an organism mitigate the impact of a stressor (Moberg and Mench, 2000). 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). The generalized stress response is classically characterized by the release of cortisol, a hormone that has many functions including elevation of blood sugar, suppression of the immune system, and alteration of the biochemical pathways that affect fat, protein, and carbohydrate metabolism. The endocrine response (glandular secretions of hormones into the blood) to a stressor can also extend to other hormones. These types of responses typically occur on the order of minutes to days, such as the "fight or flight" response, an acute stress response that is characterized by the very rapid release of hormones which stimulate glucose release, increase heart rate, and increase oxygen consumption (Navy, 2020). What is known about the function of the various stress hormones is based largely upon observations of the stress response in terrestrial mammals. The endocrine response of marine mammals to stress may not be the same as that of terrestrial mammals because of the selective pressures marine mammals faced during their evolution in an ocean environment (Atkinson et al., 2015).

Relatively little information exists on the linkage between anthropogenic sound exposure and stress in marine mammals, and even less information exists on the consequences of sound-induced stress responses. Most studies have focused on acute responses to sound either by measuring hormones or by measuring heart rate as an assumed proxy for an acute stress response. Whereas a limited amount of work has addressed the potential for acute sound exposures to produce a stress response, almost nothing is known about how chronic exposure to acoustic stressors affects stress hormones in marine mammals, particularly as it relates to survival or reproduction. A literature review by the Navy (2020) of recent studies which assessed sound exposure effects on marine mammal stress hormones and heart rates is incorporated here by reference.

Although there are only a small number of studies, different types of sounds have been shown to produce variable stress responses in marine mammals, and sound characteristics that correlate with specific stress responses are poorly understood. Therefore, a stress response to NOS activities is assumed if a physiological response such as a hearing loss is predicted, or if a substantial behavioral response occurs (i.e., constituting a moderate or major level of impact, see **Table 3.5-5**). Of the behavioral responses modeled, it is unlikely that any of these responses would be substantial, and all exposures are anticipated to be minor and of short duration. No repeat exposures, and thus no chronic exposures, are anticipated.

3.5.2.2.5 Behavioral Responses

Disturbance of marine mammals can range from short, subtle changes in behavior to more conspicuous dramatic changes in biologically important behaviors such as feeding or mating, and short- or long-term displacement from important habitats. Behavioral response is one of the main concerns of the potential impacts of anthropogenic sound on marine mammals. The extent by which an animal's behavior changes in response to underwater sounds varies greatly, even within the same species (Nowacek et al., 2004). The extent of an individual's response to a stimulus is determined by the number and combinations of possible sound sources acting together, which in turn is influenced by the context in which the stimulus is received and the relevance an animal attributes to the acoustic stimulus. The perceived relevance depends on a number of biological and environmental factors, such as age, sex, and behavioral state at the time of exposure (e.g., resting, foraging, or socializing), where the sounds originated from, and proximity and nature of the sound source. One common immediate response to anthropogenic sounds is that animals may temporarily avoid or move away from an ensonified area or source; however, they might also respond more conspicuously based on how close the sounds are to them. For instance, their vigilance, defined as scanning for the source of the stimulus, could increase. The more time animals invest in addressing noise means less time they can spend foraging (Purser and Radford, 2011), but this is not always easy to detect.

There is a wide range of possible behavioral responses to sound exposure, if the sound is audible to the particular animal, including (in approximate order of increasing severity but decreasing likelihood) (BOEM, 2014a):

- no observable response;
- looking at the sound source or increased alertness;
- small behavioral responses such as vocal modifications associated with masking;
- cessation of feeding or social interactions;
- temporary avoidance behavior;
- modification of group structure or activity state; and
- habitat abandonment.

Severity of responses can also vary depending on characteristics of the sound source (e.g., moving or stationary, number and spatial distribution of sound sources, similarity to predator sounds, etc.) (Southall et al., 2007; Barber et al., 2009; Ellison et al., 2012). There is species variability of marine mammals to sound exposure and a broad spectrum of behavioral responses. Variability can also occur within a species at the individual level where hearing sensitivity or prior experience with a certain sound type can influence whether or not an individual reacts (BOEM, 2014a).

Southall et al. (2007) synthesized data from many past behavioral studies and observations to determine the likelihood of behavioral reactions of marine mammals at specific sound levels. While the louder the sound source, the more intense the behavioral response; the proximity of a sound source and the animal's experience, motivation, and conditioning were also critical factors influencing the response (Southall et al., 2007). After examining the available data, Southall et al. (2007) determined that the derivation of thresholds for behavioral response based solely on exposure level was not supported because context of the animal at the time of sound exposure was an important factor in estimating response. However, in some conditions, consistent avoidance reactions were noted at higher sound levels dependent on the marine mammal species or group. Most low-frequency cetaceans (mysticetes) observed in studies usually avoided sound sources at levels of less than or equal to 160 dB re 1 µPa. Studies of mid-frequency cetaceans analyzed included sperm whales, belugas, bottlenose dolphins, and river dolphins. These groups showed no clear tendency, but for continuous sounds captive animals tolerated levels in excess of 170 dB re 1 µPa before showing behavioral reactions, such as avoidance, erratic swimming, and attacking the sound source. High-frequency cetaceans (observed from studies with harbor porpoises) exhibited changes in respiration and avoidance behavior at levels between 90 and 140 dB re 1 µPa, with marked avoidance behavior noted for levels exceeding this. Phocid seals showed avoidance reactions at or below 190 dB re 1 µPa, thus seals may actually receive levels adequate to produce TTS before avoiding the source.

Numerous studies on marine mammal behavioral responses to sound exposure have not resulted in consensus in the scientific community regarding the appropriate metric for assessing behavioral reactions. It is recognized that the context in which the sound is received affects the nature and extent of responses to a stimulus (Southall et al., 2007; Ellison and Frankel, 2012), and because of the complexity and variability of marine mammal behavioral responses to acoustic exposure, NMFS has not yet released technical guidance on behavioral thresholds for use in calculating animal exposures (NMFS, 2018a). NMFS currently uses a step function to assess behavioral impact and a threshold of 160 dB for behavioral responses (70 FR 1871, January 11, 2005; NMFS, 2018a).

An extensive literature review by the Navy (2020) on behavioral responses of marine mammals to sound is incorporated here by reference. This review discusses studies of behavioral responses to mid-frequency active sonar (MFAS), multibeam sonar, and continuous (e.g., vessels) sounds and their effects on cetaceans (mysticetes and odontocetes), pinnipeds, and fissipeds (sea otters). The impact of multibeam echo sounder (MBES) operations, similar to sound sources included in the NOS Proposed Action, on marine mammals has been less studied compared to military sonars (although at least two studies using MBES are discussed below). Despite similar source levels (216–245 dB re 1 µPa m) of MBES and MFAS, and an overlap in frequency range (10–400 kHz), there are inherent differences between the two sound sources, aside from operational frequency differences (Varghese et al., 2020). MFAS are used to detect targets, like submarines, at distant ranges (10s of km). These systems generally have a wide vertical ensonification beam with 360^{o} horizontal coverage, producing pings (1–2 s in length) for several minutes at intervals ranging from 6 to 15 minutes apart and source levels in excess of 235 dB re 1 µPa m. MBES are primarily used for seafloor mapping, requiring precise beam positioning. These requirements equate to narrow downward directed beams, 120^{o}-150^{o} horizontal coverage, and short operational pulse lengths (10–100 milliseconds [ms]) that vary based on the ocean depth. The resulting MBES geometry leads to a much smaller area of direct ensonification and orders of magnitude shorter pulses in comparison to MFAS.

Reports of observed behavioral responses by marine mammals to sound from underwater acoustic equipment include:

- Surface feeding blue whales did not show a change in behavior in response to mid-frequency sonar sources with received levels between 90 and 179 dB re 1 µPa, but deep feeding and non-feeding whales showed temporary reactions including cessation of feeding, reduced initiation of deep foraging dives, generalized avoidance responses, and changes to dive behavior (DeRuiter et al., 2017; Goldbogen et al., 2013; Sivle et al., 2015).

- A minke whale responded to mid-frequency sonar at 146 dB re 1 µPa by strongly avoiding the sound source (Kvadsheim et al., 2017; Sivle et al., 2015). Although the minke whale increased its swim speed, directional movement, and respiration rate, none of these were greater than rates observed in baseline behavior, and its dive behavior remained similar to baseline dives.
- Observed reactions by Blainville's, Cuvier's, and Baird's beaked whales to mid-frequency sonar sounds included cessation of clicking, termination of foraging dives, changes in direction to avoid the sound source, slower ascent rates to the surface, longer deep and shallow dive durations, and other unusual dive behavior (DeRuiter et al., 2013; Miller et al., 2015; Stimpert et al., 2014; Tyack et al., 2011).
- Beaked whales' response to shipboard echo sounders with frequencies ranging from 12 to 400 kHz, source levels up to 230 dB re 1 µPa, and a very narrow beam indicated that the beaked whales may be avoiding the area and may cease foraging near the echo sounder (Cholewiak et al., 2017).
- A study of 12 kHz MBES surveys found that there was no consistent change in foraging behavior during the surveys that would suggest a clear response (Varghese et al., 2020). The animals did not leave the range nor stop foraging during MBES activity. These results are in stark contrast to those of analogous studies assessing the effect of Naval mid-frequency active sonar on beaked whale foraging, where beaked whales stopped echolocating and left the area.
- Quick et al. (2017) found no evidence for a change in foraging behavior in short-finned pilot whales when exposed to an EK60 scientific echo sounder, but they did observe that the whales changed their heading more frequently when the echo sounder was active. This response could represent increased vigilance in which whales maintained awareness of echo sounder location by increasing their heading variance and provides the first quantitative analysis on reactions of cetaceans to a scientific echo sounder.
- A study found that captive hooded seals reacted to 1–7 kHz sonar signals, in part with displacement (i.e., avoidance) to the areas of least sound pressure level (SPL), at levels between 160 and 170 dB re 1 µPa (Kvadsheim et al., 2010); however, the animals adapted to the sound and did not show the same avoidance behavior upon subsequent exposures. Captive harbor seals responded differently to three signals at 25 kHz with different waveform characteristics and duty cycles at received levels over 137 dB re 1 µPa by hauling out more, swimming faster, and raising their heads or jumping out of the water (Kastelein et al., 2015).
- Behavioral responses of captive California sea lions exposed to mid-frequency sonar at various received levels (125–185 dB re 1 µPa) included a refusal to participate, hauling out, an increase in respiration rate, and an increase in the time spent submerged (Houser et al., 2013).
- Davis et al. (1988) conducted a behavioral response study that included underwater acoustic harassment devices (10–20 kHz at 190 dB; designed to keep dolphins and pinnipeds from being caught in fishing nets) and found that the sea otters often remained undisturbed and quickly became tolerant of the various sounds; even when chased from a location by presentation of a purposefully harassing sound, they generally moved only a short distance 100–200 m (110-220 yards [yds]) before resuming normal activity.

Reports of observed behavioral responses by marine mammals to underwater sound from vessels include:

- North Atlantic right whales may change behaviors, specifically calling behavior (shifting call frequency), to compensate for increased low-frequency sound, such as vessel-related sound (Parks et al., 2007).

- Most beaked whales tend to avoid approaching vessels (Würsig et al., 1998) and may dive for an extended period when approached by a vessel. Northern bottlenose whales, on the other hand, are sometimes quite tolerant of slow-moving vessels (Hooker et al., 2001).
- Dolphins may tolerate boats of all sizes, often approaching and riding the bow and stern waves (Shane et al., 1986). At other times, dolphin species that are known to be attracted to boats will avoid them. Such avoidance is often linked to previous boat-based harassment of the animals (Richardson et al., 1995).
- Coastal bottlenose dolphins that are the object of whale watching activities have been observed to swim erratically (Acevedo, 1991), remain submerged for longer periods of time (Janik and Thompson, 1996; Nowacek et al., 2001), display less cohesiveness among group members (Cope et al., 2005), whistle more frequently (Scarpaci et al., 2000), and be restless often when boats were nearby (Constantine et al., 2004).
- Pantropical spotted dolphins and spinner dolphins in the eastern tropical Pacific, where they have been targeted by the tuna fishing industry because of their association with tuna, show avoidance of survey vessels up to 11 km (6.8 mi) away (Au and Perryman, 1982; Hewitt, 1985), whereas spinner dolphins in the Gulf of Mexico were observed bow riding the survey vessel in all 14 sightings of this species during one survey (Würsig et al., 1998).
- A recent study found that harbor seals and gray seals dive lower in the water column when in the presence of vessel sound (Mikkelsen et al., 2019). This observation is consistent with previous observations of changing diving behavior in elephant seals elicited by vessel sound (Burgess et al., 1998), which suggests a wider pattern of noise avoidance among pinnipeds.
- Manatees typically occupy habitats with low sound levels and avoid areas with high levels of vessel traffic and noise (Miksis-Olds et al., 2007). Generally, sounds from oncoming vessels are detectable to manatees within 93 m (305 ft) of the vessel and evoke flight responses in manatees within 50 m (164 ft) of the vessel, such as increased swimming speed or depth within the water column (Rycyk et al., 2018).
- Sea otters off the coast of California tended to avoid areas of high vessel traffic and exhibited disturbance behaviors in direct response to the transit vessels through the study area (Curland, 1997).

Active underwater sound sources and vessel operations proposed for use during NOS projects have the potential to produce behavioral responses in marine mammals. It is possible that if a marine mammal reacts briefly to an underwater sound by changing its behavior or moving a small distance, the impacts of the change are unlikely to be significant to the individual, stock, or population. However, if a sound source displaces marine mammals from an important feeding or breeding area for a prolonged period, impacts on both individuals and the population could be of greater intensity. Detailed analysis of the impacts of vessel sounds and active underwater acoustic sources is provided below for each type of marine mammal in Sections 3.5.2.3 through 3.5.2.5.

3.5.2.3 Alternative A: No Action - Conduct Surveys and Mapping for Coastal and Marine Data Collection with Current Technology and Methods, at Current Funding Levels

The discussion of impacts of Alternative A is organized by impact causing factors for each type of marine mammal (cetaceans, pinnipeds, sirenians, and fissipeds). Under Alternative A, NOS survey effort would cover a total of 2,633,374 nm (4,877,009 km) across all five regions over a five-year period (note that survey effort in the Great Lakes is not included as no marine mammals occur there). Although the survey effort under Alternative A would vary by year (see **Table 3.5-6**), over the five-year period of the Proposed Action, the greatest number of nautical miles surveyed every year would be in the Southeast Region (approximately 47 percent). The survey efforts in the other four regions are of a similar order of magnitude (approximately 10 percent in each region for each of the five years), although slightly greater in the Alaska Region where the percentage of survey effort would be approximately 18 percent. In general, it is expected that level of effort and overall impacts trend together (i.e., greater impacts where the survey effort is higher), but there are other factors, such as location and depth of surveys, sound production and hearing frequency of the animals, and population density of marine mammals, that add nuance to this trend. Overall, NOS projects would comprise a very small part of all ocean activities as vessels used by NOS would represent a very small proportion of all vessel traffic in the action area (as discussed in Section 2.4.1). Additionally, whenever possible, the location and timing of a given project would be purposefully coordinated to ensure that areas are not repeatedly surveyed. This ensures that the potential environmental impacts directly resulting from proposed NOS activities would not be exacerbated by repeated surveys within a given area.

Table 3.5-6. Survey Effort under Alternative A, by Geographic Region by Year

Region	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Survey Effort (in nautical miles)						
Greater Atlantic Region (without Great Lakes)	60,822	105,757	50,971	46,912	46,912	311,375
Southeast Region	220,336	210,185	262,450	281,733	281,733	1,256,437
West Coast Region	59,558	57,909	55,973	58,204	58,204	289,848
Alaska Region	93,871	119,974	174,445	41,350	41,327	470,967
Pacific Islands Region	70,210	54,900	69,742	54,948	54,948	304,748

3.5.2.3.1 Cetaceans

The analysis of impacts on cetaceans, which live primarily underwater, does not consider air emissions. All the other impact causing factors are discussed below. Potential impacts could occur in all of the geographic regions as approximately 20 to 30 species, subspecies, or DPSs of cetaceans, including several ESA-listed species, occur in each region (see Section 3.5.1.1 above); all regions also include designated critical habitat for one or more listed cetacean species (see Section 3.5.1.1).

3.5.2.3.1.1 Active Underwater Acoustic Sources

Active underwater acoustic sources in Alternative A include echo sounders, ADCPs, and acoustic communication systems as discussed in Section 2.4. The sound sources of potential concern during active acoustic surveys are the moving Sound Navigation and Ranging (SONAR) sources. The equipment used during any individual survey depends on the final survey design, vessel availability, site conditions, and data needs. A list of all active sources, and their parameters, considered in this study can be found in Appendix D of the Technical Acoustic Analysis of Oceanographic Surveys report (Appendix E of this Final PEIS). Table 1 in Appendix E identifies the proposed survey equipment expected to operate at, or below, 200 kHz and lists the relevant acoustic parameters of each of these sources. A subset of the operational sources used by NOS was modeled for the technical acoustic analysis. These sources were selected to represent the largest ranges to PTS/injury exposures of similar source types (e.g., beam pattern, frequency range). Sources that would be operated at frequencies higher than 200 kHz (e.g., some multibeam echo sounders and side scan sonars) were not included in the analysis as they operate at frequencies above the hearing range of marine mammals. **Table 3.5-7** identifies the proposed survey equipment expected to operate at or below 200 kHz that was used in the modeling and lists the relevant acoustic parameters of each of these sources; these are the sources considered in the impact analysis below for active underwater acoustic sources**.**

Table 3.5-7. Active Underwater Sources and Acoustic Parameters Considered in Exposure Modeling

Manufacturer	Model	SL (dB re 1 µPa)	Frequency (kHz)	Signal duration (ms)	Ping rate (Hz)
Knudsen	320 B/R	222	3.5	10	5
Simrad	ES60	225	12	1	20
Kongsberg	EM124	242	12.5	15	0.17
Teledyne Odom	CV200	229	24	2	20
Simrad	EM302	214	30	5	10
Kongsberg	EM710	231	40	2	20
Teledyne Odom	CV200	229	50	2	20
Kongsberg	EM710	231	70	2	20
Klein	3000	234	100	0.4	10

Acoustic signals from echo sounders (which range from 0.5 kHz to 900 kHz) can fall within the frequency hearing ranges for all the cetacean hearing groups: mid-frequency and high-frequency odontocetes (which can hear up to ~160 kHz) and low-frequency mysticetes (which can hear up to 35 kHz) if the lower end of the sound frequency spectrum is used. Adverse impacts of echo sounder signals could include behavioral responses, loss of hearing, stress, and physical harm (as discussed above in Section 3.5.2.2). Given the directionality and small beam widths, there is low potential for TTS and PTS, and cetacean communications are not expected to be masked appreciably as the animals would not be in the direct sound field for more than a few pulses.

Acoustic signals from ADCPs (ranging from 35 kHz to 1200 kHz) are likely detectable by mid-frequency and high-frequency odontocetes (which can hear up to ~160 kHz), but not by low-frequency mysticetes (which can hear up to 35 kHz). The effects of underwater sound from ADCPs on cetaceans are similar to those discussed above for echo sounders as ADCPs have a narrow and directional beam width similar to single-beam echo sounders.

Acoustic communication systems emit sound in mid-frequency ranges (10s of kHz) and thus could be detected by low-frequency mysticetes as well as mid-frequency and high-frequency odontocetes. The impact of underwater sound on cetaceans from acoustic communication systems would be similar but less than that described above for the use of echo sounders because, although acoustic communication systems are omnidirectional, they have lower power, a lower duty cycle, and would be used less frequently than echo sounders.

Quantitative acoustic exposure to marine mammals, including cetaceans, from operation of sound sources was modeled for nine sources (see **Table 3.5-7**). Acoustic modeling was conducted by determining the size of the sound field expected from each source (referred to and depicted as an isopleth) and estimating the number of marine mammals that may be exposed above sound thresholds for PTS/injury and behavioral disruption during surveys (see Appendix E for more information). To gauge the potential for impacts, received sound levels that may result in injury or behavioral disruption to the animal were needed. For this study, the current NMFS criteria for both PTS/injury (NMFS, 2018a) and behavioral disruption (84 FR 72308, December 31, 2019) were used (see Appendix E). Species density estimates (animals/km^2) were derived from the best available data sources for each species and region. For the Pacific and Alaska regions, species abundance and distribution were obtained from the U.S. Pacific and Alaska Marine Mammal Stock Assessment Reports (SARs) (Carretta et al., 2022; Muto et al., 2022). For the east coast of the U.S. and the Gulf of Mexico, densities were obtained using the Duke University Marine Geospatial Ecology Laboratory model results (Roberts et al., 2016a, 2016b, 2017, 2018, 2021a, and 2021b). At the request/direction of NMFS, this is a change from the estimates reported in the Draft PEIS which used the SARs for all species (see below for additional discussion). Although for some species abundance data were either unknown, uncertain, or outdated, NOS used the best available scientific information on presence, density, and population status to determine exposure estimates in the acoustic modeling.

The estimated exposures have decreased overall for both PTS/injury and behavioral disruption between the Draft PEIS and the Final PEIS, although exposures for some species have increased. This can be attributed to three factors:

- A change in the timeframe for the Proposed Action from six years in the Draft PEIS to five years in the Final PEIS;
- Updated inputs to the acoustic model:
  - the use of Roberts et al. (2016a, 2016b, 2017, 2018, 2021a, and 2021b) density data for the Greater Atlantic and Southeast regions in the Final PEIS (versus [vs.] use of the SARs abundance data for those regions in the Draft PEIS);
  - the use of more current abundance data from the 2021 SARs for the Alaska, West Coast, and Pacific Islands regions (Carretta et al., 2022; Hayes et al., 2022; and Muto et al., 2022); and
- Identification of an incorrect averaging function[7] during the quality assurance/quality control (QA/QC) process for the acoustic modeling.

Due to the number of sources to be evaluated, the distance at which exposure above PTS threshold could occur was first estimated using the source level and a simple geometric spreading model. A criterion of 10 m, roughly approximated from the survey platform vessel sizes, was chosen as encounters at shorter ranges are precluded by the physical presence of the vessel hull. If the distance for potential injury was <10 m (33 ft), then the source was categorized as having a low potential for impact and not carried through for further exposure modeling. If the predicted range to injury was >10 m (33 ft), then a more accurate (ray-tracing) propagation model was used to refine the injury range estimate. If the refined range was <10 m (33 ft) then the source was again categorized as low impact and not considered in additional modeling. If the refined range was still >10 m (33 ft), then the sound field of a conservatively-chosen representative sound source in each frequency band (<30 kHz, 30-70 kHz, and 70-200 kHz) was used in scenario simulations that considered species-specific movement (i.e., agent-based modeling). These simulations

[7] During the first stage of post processing that occurs after running the animal movement and exposure model, the number of exposed animats is calculated to get an average for a 24-hour duration. To do this, all exposures are summed and then divided by the total number of 24-hour simulation steps. In this case, there were a total of 18 overlapping 24-hour simulation windows over a duration of 3 days. The divisor for the average should have been 18 (the number of windows) but was incorrectly set to 3 (the total number of days). After correcting this, the average number of 24-hour exposures for every species and every zone was lower by a factor of 6.

estimated the number of animals that could exceed injury threshold during representative surveys. More detailed descriptions of acoustic and exposure modeling methods can be found in Appendix E.

Caveats when interpreting acoustic impacts on marine mammals include:

- The modeled projections are annual estimates spanning five years by region; source locations and movement, animal locations and movement, oceanographic/acoustic conditions, equipment descriptions and specifications, and the time of the year and exact location for each project are not precisely known; and
- Marine mammal abundances, distributions, and behavior patterns are not precisely known and may change as animal populations vary from year to year and location to location.

Despite uncertainty, the use of models can provide estimates of potential impacts for likely actions. Modeled results, however, are only as good as the data on which they are based. Many parameters are required, and there are many unknowns. Representative sound sources were modeled at maximum power, which produces the highest level sounds that have the greatest impact. Likewise, marine mammal densities values used likely exceed actual densities (see Appendix E for further explanation), and models do not include the effect of mitigations in reducing exposure estimates.

3.5.2.3.1.1.1 Permanent Threshold Shift Exposure Estimates

Estimated PTS/injury exposures were calculated as shown in Appendix E and as noted above, the estimates should be considered conservative predictions of potential exposure based on modeling assumptions and qualifications. These estimates consider that all proposed activities would occur, that marine mammals do not avoid sounds, and that conservative population density estimates were used. Sources with a signal frequency 200 kHz or higher were expected to have no impact because the sounds are above the hearing frequency range of cetaceans (see Section 3.5.1.1.1). It was also expected that any source with a range to threshold for potential injury <10 m (33 ft) based on the geometric spreading model or ray-trace propagation model would result in minimal impacts because the range is similar to or smaller than the vessel used by NOS and that the acoustic impact very close to the vessel would not be as relevant a concern as a vessel strike (i.e., it is very unlikely that a cetacean would approach that close to a moving vessel). For sources with ranges to potential injury >10 m (33 ft), representative simulations were conducted to estimate the exposure of species for those sources in the various regions (Appendix E). Summarized total potential PTS/injury exposure over five years for all acoustic sources for cetaceans in each region are shown in **Table 3.5-8** (note that no PTS/injury exposure was predicted for any species in the Pacific Islands Region). For annual numbers, see **Table 13** and **Table E-2** in Appendix E. The range to the closest point of approach (CPA) for each of the species-specific animats (i.e., simulated animals) was recorded. The 95 Percent Exposure Range is the horizontal range that includes 95 percent of animat CPAs that exceed a given impact threshold (see Appendix E). Species that may be in the area but for which no impacts were predicted are not included in the table.

Table 3.5-8. Total Predicted Exposures for Cetacean Species and Range Accounting for 95 Percent of Exposure Above PTS Threshold Under Alternative A

Species	Total Exposures*	Exposure Range (m)
Southeast Region**		
Dwarf sperm whale	2.53	35
Pygmy sperm whale	1.85	35
Greater Atlantic Region		
Harbor porpoise	15.15	34
Dwarf sperm whale	0.94	32
Pygmy sperm whale	0.13	32
West Coast Region		
Harbor porpoise	5.59	28
Dall's porpoise	5.48	24
Alaska Region		
Harbor porpoise	4.18	27
Dall's porpoise	3.48	20

*Exposures are based on a probabilistic model that is scaled by animal density and may therefore include fractional counts.

**Exposure modeling for the Southeast Region was conducted for the Gulf of Mexico.

Exposure predictions are based on classifying the sources as non-impulsive sounds, which have higher thresholds than impulsive sounds (NMFS, 2018a), but are conservative because the exposures consider that neither the simulated animals nor the operators changed behaviors due to the presence of the other. Avoidance of sound sources, including the vessel, by the animal or mitigation measures by the vessel operator could reduce the exposure estimates. Including aversive behavior of harbor porpoise to loud sound levels would have reduced their expected injury exposures by >60 percent (Appendix E). Also, the model overestimates near-field sound levels because modeled predictions do not account for the reduced sound levels present in the near-field of the source.

As shown in **Table 3.5-8**, PTS/injury exposure of high-frequency cetaceans could occur in four of the five regions with ranges to exposures in the simulations ~30 m (~100 ft). High-frequency cetaceans (Dall’s and harbor porpoises, and dwarf and pygmy sperm whales) have been shown to be more sensitive to sounds than other cetacean species, and therefore have comparatively low thresholds for PTS/injury exposures (NMFS, 2018a). Over the five-year timeframe, a total of 39 individuals could be exposed above the PTS/injury threshold across four regions. The numbers of animals exposed above threshold over the extensive project area and over five years would not be expected to result in population level adverse impacts, especially when comparing exposures to Potential Biological Removal (PBR) levels.

The PBR approach was developed to identify marine mammal populations experiencing human-caused mortality at levels that could result in population depletion. PBR can be used to consider the level of impact (i.e., removal of individuals) that a population can sustain before population-level impacts (e.g., breeding) are incurred. PBR is defined by the MMPA as the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population. PBR is calculated using the product of minimum population size, one-half the maximum net productivity rate, and a recovery factor for ESA-listed species and depleted stocks. NOS emphasizes that PBR is used here to estimate population level impacts of mortalities, but PTS/injury exposures modelled as a response to NOS activities are not anticipated to arise in serious physical injuries or death. However, PBR can be a useful tool to contextualize the health or vulnerability of a population. When comparing the annual PTS/injury exposures for species listed in **Table 3.5-8** to the PBRs listed for each species in recent stock assessment reports (Carretta et al., 2022; Hayes et al., 2022; and Muto et al., 2022), the PTS/injury exposures are below, and often well below the PBR for all species (**Table 3.5-9**). For example, in the West Coast Region, the total exposure estimate for Dall's porpoise is 5.48 over five years, or on average 1.10 per year, and the PBR for that species in that region is 99; thus, population-level impacts are not predicted because the exposures do not exceed the PBR.

Table 3.5-9. Comparison of Exposure Above PTS Threshold for Cetacean Species Under Alternative A with Current Potential Biological Removal (PBR) Levels

Species	Total Exposures	Average Annual Exposures	PBR Levels *
Southeast Region			
Dwarf sperm whale	2.53	0.51	2.5**
Pygmy sperm whale	1.85	0.37	2.5**
Greater Atlantic Region			
Harbor porpoise	15.15	3.03	851
Dwarf sperm whale	0.94	0.19	46
Pygmy sperm whale	0.13	0.03	46
West Coast Region			
Harbor porpoise	5.59	1.12	35 to 349***
Dall's porpoise	5.48	1.10	99****
Alaska Region			
Harbor porpoise	4.18	0.84	2.2 to 11*****
Dall's porpoise	3.48	0.70	131

*Sources for PBR Levels: Carretta et al., 2022; Hayes et al., 2022; and Muto et al., 2022

**Differs from PBR levels reported in the Draft PEIS due to numbers presented in the Draft PEIS for incorrect stock.

***PBR levels for harbor porpoise in the West Coast Region is shown as the range across six stocks.

****Differs from PBR levels reported in the Draft PEIS due to changes between the 2019 and the 2021 SARs.

***** PBR levels for the Southeast Alaska stock; PBR levels are undetermined for the Gulf of Alaska and Bering Sea stocks.

In the Southeast and Greater Atlantic regions, where Roberts et al. (2016a, 2016b, 2017, 2018, 2021a, and 2021b) density data were used to predict exposure, a discrepancy may arise in abundance (and PBR) estimates between those derived from the Roberts et al. densities and those reported in the SARs. For example, the Roberts density model for *Kogia* spp. (dwarf and pygmy sperm whales) predicts an abundance of 2,234 individuals over the entire Gulf of Mexico, while the SAR predicts only 336 individuals in the same area. The reason that the abundance predicted from the Roberts et al. model is higher than the SARs abundance is due to underlying assumptions made when estimating abundance. To be conservative (i.e., obtain the lowest abundance), NOAA assumed that any animals at the surface along the vessel trackline would be detected during a survey, whereas Roberts et al. assumes that only a fraction of those animals would be detected (Roberts et al., 2015b). Had NOAA used the same probability of detecting an animal that occurs along a trackline that Roberts et al. used, the *Kogia* abundance estimates would have been three times higher and much closer to the Roberts abundance estimate. PBR is based on the lower SAR abundance estimate, while the acoustic exposure estimates are based on the higher Roberts density data. Although the use of the Roberts et al. density results in higher estimates than would come from use of the SAR abundance data, the average annual PTS/injury exposure estimate in the Southeast and Greater Atlantic regions is less than one individual dwarf or pygmy sperm whale, and two individual harbor porpoises; thus, population-level impacts are not predicted.

3.5.2.3.1.1.2 Behavioral Disruption Estimates

Behavioral disruption exposure estimates over the five-year period were calculated for sources with operational frequencies within the cetacean hearing frequency range (less than or equal to 200 kHz, see Section 3.5.1.1.1). As was the case for PTS/injury exposure estimates, the behavioral disruption exposure estimates consider that all proposed activities would occur; the estimates use the highest levels of anticipated cetacean densities and do not factor in effects of potential mitigation procedures or animals avoiding the sounds. Summarized total potential behavioral disruption exposures of cetaceans over five years for all sources in each region are shown in **Table 3.5-10**. For annual numbers, see **Table 16** and **Table E-5** in Appendix E. Species that may be in the area but for which no impacts were predicted are not included in the table.

Table 3.5-10. Total Predicted Exposures for Cetacean Species and Time in Seconds Above the Behavioral Disruption Threshold Under Alternative A

Species	Total Exposures*	Average time above 160 dB (s)**
Alaska Region		
Pacific white-sided dolphin	784.14	63
Beluga whale	256.05	85
Harbor porpoise	80.29	88
Dall's porpoise	72.03	69
Bowhead whale	58.89	53
Common minke whale	56.48	47
Humpback whale, Central North Pacific	40.84	95
Resident killer whale	31.25	58
Fin whale	27.14	50
Transient killer whale	20.60	58
Beluga, Cooke Inlet	11.84	85
Humpback whale, Western North Pacific	4.46	95
Gray whale	1.55	51
Sperm whale	0.15	56
North Pacific right whale	0.03	53
Southeast Region* **		
Atlantic spotted dolphin	882.77	56
Common bottlenose dolphin	555.30	89

Species	Total Exposures*	Average time above 160 dB (s)**
Pantropical spotted dolphin	330.04	52
Clymene dolphin	113.80	52
Rough-toothed dolphin	62.02	75
Spinner dolphin	57.83	58
Risso’s dolphin	23.20	69
Striped dolphin	31.72	50
False killer whale	32.82	55
Pilot whale, short finned	17.02	60
Pilot whale, long finned	16.72	60
Pygmy sperm whale	16.39	52
Pygmy killer whale	4.70	52
Sperm whale	12.46	64
Melon-headed whale	12.48	50
Dwarf sperm whale	9.89	52
Fraser’s dolphin	7.67	50
Blainville beaked whale	7.18	67
Gervais’ beaked whale	7.18	67
Mesoplodont beaked whales (all)	7.18	67
Cuvier's beaked whale	2.22	64
Transient killer whale	2.02	58
Rice’s whale	0.65	82
Greater Atlantic Region		
Short-beaked common dolphin	2,587.99	102
Atlantic white-sided dolphin	2,322.53	101
Atlantic spotted dolphin	1,020.42	89
Common bottlenose dolphin	970.74	184
Harbor porpoise	780.49	120
Risso’s dolphin	418.21	112
Pilot whale, long finned	291.13	63
Fin whale	188.48	98
Pilot whale, short finned	185.73	63
Common minke whale	107.46	83
Humpback whale	96.84	97
Cuvier’s beaked whale	47.07	55
Dwarf sperm whale	46.57	57
Rough-toothed dolphin	45.04	110
Gervais beaked whale	35.62	55
Sowerby’s beaked whale	35.62	55
Blainville beaked whale	35.62	55
True’s beaked whale	35.62	55

Species	Total Exposures*	Average time above 160 dB (s)**
Mesoplodont beaked whales (all)	35.62	55
Striped dolphin	18.17	50
Pantropical spotted dolphin	13.94	62
Sperm whale	13.76	50
Sei whale	14.99	98
North Atlantic right whale	14.43	100
Melon-headed whale	7.34	50
Pygmy sperm whale	6.68	57
Clymene dolphin	4.57	62
Fraser's dolphin	3.09	38
False killer whale	2.84	64
White-beaked dolphin	2.69	101
Spinner dolphin	1.29	41
Northern bottlenose whale	0.49	42
Bryde's whale	0.35	112
Blue whale	0.06	43
West Coast Region		
Short-beaked common dolphin	23,788.53	55
Long-beaked common dolphin	15,896.35	82
Pacific white-sided dolphin	6,251.14	67
Striped dolphin	3,731.43	25
Northern right whale dolphin	2,550.46	25
Gray whale	2,212.68	51
Risso's dolphin	260.00	66
Common bottlenose dolphin	257.45	110
Humpback whale, Central America	206.39	128
Common minke whale	180.10	51
Fin whale	129.13	62
Harbor porpoise	118.37	96
Dall's porpoise	115.10	75
Mesoplodont beaked whales (all)	66.83	26
Blue whale	62.78	27
Humpback whale, Central North Pacific	40.84	95
Sperm whale	32.97	29
Cuvier's beaked whale	29.03	33
Baird's beaked whale	29.91	55
Sei whale	23.95	62
Offshore killer whale	20.75	64
Transient killer whale	19.66	64
Resident killer whale	18.15	64

Species	Total Exposures*	Average time above 160 dB (s)**
Pilot whale, short finned	16.22	82
Humpback whale, Western North Pacific	4.46	95
Pacific Islands Region		
Pygmy sperm whale	9,948.66	63
Rough-toothed dolphin	9,930.13	71
Striped dolphin	6,975.36	55
Pantropical spotted dolphin	3,261.02	62
Fraser's dolphin	2,774.83	50
Pygmy killer whale	942.31	64
False killer whale	345.82	56
Risso's dolphin	89.41	69
Common bottlenose dolphin	57.09	112
Spinner dolphin	41.38	84
Humpback whale, Central North Pacific	40.84	95
Melon-headed whale	30.24	59
Pilot whale, short finned	22.41	62
Humpback whale, Western North Pacific	4.46	95
Bryde’s whale	3.95	70
Sperm whale	3.48	67
Longman’s beaked whale	2.34	54
Cuvier’s beaked whale	2.32	54
Sei whale	2.17	75
Fin whale	1.48	75
Blainville beaked whale	1.16	55
Resident killer whale	0.58	56
Transient killer whale	0.58	56
Blue whale	0.21	54

*Exposures are based on a probabilistic model that is scaled by animal density and may therefore include fractional counts.

**Exposure above threshold over 24 hours.

***Exposure modeling for the Southeast Region was conducted for the Gulf of Mexico.

Under Alternative A, behavioral disruption exposures to cetaceans could occur in all five regions. Depending on the species, behavioral disruption exposure of cetaceans could affect from a few to thousands of individuals in each region over the five-year timeframe. However, for the simulated animals exposed above the 160 dB threshold, the average time above threshold is under two minutes, and often under one minute (**Table 3.5-10**). The disturbances, therefore, are expected to be transient, and surveys, once completed in an area, would not generally be repeated, thus limiting an individual’s behavioral disruption. Behavioral exposures need to occur over the timespan of weeks to have a population level effect on marine mammals (Southall et al., 2016), as in the case of seismic surveys that have months’ worth of activity. Any disruption that occurs for a matter of hours or for less than a day would not likely have a population-level impact. Thus, although many individuals of some species could experience behavioral disturbance from NOS acoustic sources, the small increments of time that the animals could be exposed above threshold over five years and over the extensive project area would not be expected to result in population level adverse impacts.

In coordination with NMFS and USFWS, NOS has developed mitigation measures (see Appendix D) to reduce potential impacts of active acoustic sources on marine mammals. NOS would continue to use the lowest power appropriate to perform surveys. NOS would also continue to use Protected Species Observers (PSOs) and would employ a robust suite of animal approach restrictions and reduced vessel speeds, described in more detail in Sections 3.5.2.3.1.2 and 3.5.2.3.1.3. For instance, NOS must maintain a 457-m (500-yd) minimum separation distance of the vessel from ESA-listed whales, and vessel operators would also take steps to avoid approaching any cetaceans (see mitigation measures in Appendix D). Since the radius for PTS/injury exposure is small (35 m [115 ft] or less; see **Table 3.5-8**), and the radius for behavioral disruption exposure is generally less than 457-m (500-yd) (with some exceptions for several species, such as beaked whales, Mesoplodont whales, northern right whale dolphin, striped dolphin, sperm whale, and blue whale, in the West Coast Region; see **Tables 7** through **11** in Appendix E), these approach restrictions would effectively reduce the number of marine mammals exposed to sound from active acoustic sources. The small radii for PTS/injury also reduce the need for and effectiveness of additional mitigation measures, such as equipment ramp-up (i.e., slowly increasing the sound of acoustic equipment to allow animals to exit the area). It is not practicable for NOS to power-down active acoustic sources upon sighting a marine mammal within a certain radius of the vessel because data continuity would be lost. For the Alaska Region, NOS would employ the additional mitigation measure:

- For use of High-Resolution Geophysical (HRG)[8] sound sources in all areas north of the Forelands in Cook Inlet, Alaska[9], contact the Alaska Region (akr.prd.section7@noaa.gov) for advice on how to proceed.

NOS also considered whether additional mitigation measures should be employed in BIAs. BIAs, as discussed in Section 3.5.1.1.2 of this PEIS, comprise locations where particular species engage in biologically important behaviors either year-round or seasonally. BIAs occur in every region throughout the NOS action area, but they do not present the totality of important habitat throughout a marine mammal's entire range. NOS considered the geographic extent of marine mammal exposures and the potential for exposures to occur in designated critical habitat or BIAs, such as preferred breeding, feeding, and nursery grounds or migratory routes. In general, marine mammal responses to acoustic stressors from the Proposed Action are anticipated to be minor and temporary, regardless of where the exposure occurs. NOS specifically considered the potential effectiveness and practicability of mitigation measures in BIAs for those species for which PTS/injury exposure was predicted by the acoustic modeling. Only the harbor porpoise has designated BIAs in regions where PTS/injury exposure was predicted: two separate small resident year-round populations in Morro Bay and Monterey Bay in the West Coast Region, and another small resident population in the Greater Atlantic Region, concentrated in waters less than 150 m (492 ft) deep in the Gulf of Maine between July and September. These BIA designations reflect a concentration of

[8] HRG surveys are defined as surveys using an electromechanical source that operates at frequencies less than 180 kHz, other than those defined at § 217.184(c)(1) (i.e., side-scan sonar, multibeam echo sounder, or CHIRP sub-bottom profiler) per the 2020 BOEM BiOp on the Federally Regulated Oil and Gas Program Activities in the Gulf of Mexico.

[9] The Forelands in Cook Inlet are described as 60°43'10.9" north, 151°24'35.8" west (east side of the Inlet, Nikiski, Alaska) and West Foreland (60°42'48.1" north, 151°42'38.3" west).

marine mammals rather than areas where marine mammals engage in biologically important behaviors that could be impacted by active acoustic sources. NOS determined that avoiding harbor porpoise BIAs entirely would be impractical, in particular, year-round Morro Bay and Monterey Bay BIAs. If these areas are avoided and not surveyed, important information that supports habitat research and vessel safety would not be collected.

3.5.2.3.1.1.3 Conclusion

The effects of underwater sound from active acoustic sources on cetaceans under Alternative A would continue to be **adverse** and **minor.** Potential impacts include injury exposures in the form of hearing loss (PTS), but such injury would be rare and confined to a few individual high-frequency cetaceans in four regions (from four animals in the Southeast Region up to 17 animals in the Greater Atlantic Region over the five-year timeframe, see **Table 3.5-8**). While more individual animals are expected to experience behavioral disruptions than injury (on the order of hundreds or thousands of animals in each of the five regions over the five-year timeframe), the amount of time individuals may exceed the behavioral exposure threshold would be on average less than two minutes (**Table 3.5-10**). Similarly, the potential for masking would continue to be minimal during surveys because the narrow beams of most active acoustic sources mean that animals would not spend much time in ensonified zones. Overall, the potential impacts would likely continue to be limited to short-term disruption of acoustic habitat and behavioral patterns. Impacts would be temporary or short-term and would not be considered outside the natural range of variability of species' populations, their habitats, or the natural processes sustaining them. Impacts could include disruptions of behavioral patterns such as temporary disruption of communication and/or echolocation, disturbance of individuals or groups of cetaceans, and possible displacement of individuals or groups, but without substantial interference to feeding, reproduction, or other biologically important functions affecting population levels. Displacement of cetaceans from preferred breeding, feeding, or nursery grounds, migratory routes, or designated critical habitat would be limited to the project area or its immediate surroundings. Thus, impacts of Alternative A on cetaceans, including ESA-listed species, would continue to be **insignificant**.

3.5.2.3.1.2 Vessel and Equipment Sound

All vessels produce underwater sound (10 Hz to 10 kHz) and are major contributors to overall background sound in the sea (see Appendix E). Under Alternative A, project activities would continue to generate low levels of vessel and equipment sound that could disturb marine mammals. The types of sound produced by these sources are non-pulsed, or continuous, transitory, and of relatively low frequency. Impacts of underwater sound depend on the duration of the sound source and the intensity of the sound output. The frequency range over which mysticetes are believed to hear sounds is approximately 7 Hz to 35 kHz (see Section 3.5.1.1.1), thus they are considered most sensitive to low-frequency sounds. The mid-frequency odontocetes have functional hearing from about 150 Hz to 160 kHz; the high-frequency hearing group has functional hearing from about 275 Hz to 160 kHz. Thus, all cetaceans could be impacted by vessel-generated sound. Behavioral responses of cetaceans to vessel and equipment sound are expected to be variable depending on the vessel speed, size, location, frequency, and pattern of travel, as discussed below.

The dominant source of sound from vessels is from the operation of propellers, including cavitation (which is the formation of water vapor cavities as water passes over propeller blades), singing (i.e., propeller singing is a phenomenon involving resonance between the natural frequency of the propeller blade tip and the vortex shedding frequency at the trailing edge of the blade, thus producing radiated sound), and propulsion (BOEM, 2014a). Vessel size, load, and speed affect intensity of sound. Traveling at low speed can reduce and avoid propeller cavitation noise. The vessels used by NOS typically produce source levels of 130 to 160 dB while transiting; in comparison, large and powerful watercraft such as ferries, container ships, and icebreakers have source levels of 200 dB or greater (Erbe et al., 2019). However, source levels may vary by 20 to 40 dB within a ship class due to variability in design, maintenance, and operational parameters (Simard et al., 2016). Operating speeds would vary by the marine conditions, the capabilities of the vessel, and the survey equipment being used. Vessels used by NOS could move at speeds of up to 25 knots when transiting and up to13 knots while surveying, but 5 to 8 knots would be more common.

Vessels used by NOS would be variable in size, producing variable sound levels, and could travel anywhere in navigable U.S waters including areas as shallow as 1.8 m (6 ft). The exact locations that would be surveyed in a given year would be based on a variety of factors, including the age of the existing data, the changeability of the local sea floor, user needs, the availability of vessels and crews, the opportunity for cooperative projects with other offices or agencies, and the availability of funds. Projects could occur any time of the year in mid-latitudes and in the spring and summer months in Alaska. However, vessels used by NOS would represent a very small proportion of total vessel traffic in the action area (see Section 2.4.1), and thus would not constitute a substantial portion of the existing volume of vessels already found within the EEZ.

Specific projects may comprise a single surveying pass while others may involve multiple adjacent passes in a designated area (i.e., to ensure 100 percent bottom coverage). The line spacing in these full coverage surveys would be narrow enough that a cetacean could perceive the vessel and/or its instruments more than once, depending on its mobility and reaction. However, whenever possible, the location and timing of a given project would be purposefully coordinated to ensure that areas are not repeatedly surveyed. This would ensure that the potential environmental impacts directly resulting from NOS activities would not be exacerbated by repeated surveys within a given area.

Vessel sound can cause behavioral disturbance in at least some individuals and stocks of cetaceans. However, the occurrence and nature of responses are variable, depending on species, location, novelty of the sound, vessel behavior, and habitat, among many other factors. Behavioral responses could include evasive maneuvers such as diving or changes in swimming direction and/or speed and dive duration, decreased time searching for food, and avoidance behaviors, as well as disruptions in breeding, nursing, and migration (BOEM, 2014a). Some cetaceans may be displaced a short distance, potentially from preferred or critical habitat, but they would not be anticipated to leave a project area entirely. Introduced underwater sound may also reduce (i.e., mask) the effective communication distance of cetaceans if the frequency of the source is close to that used as a signal by the species, and if the anthropogenic sound is present for a significant fraction of the time. Most cetaceans use sound for almost all aspects of their life, including mating, reproduction, feeding, predator and hazard avoidance, communication, and navigation. Among cetaceans, baleen whales are considered particularly vulnerable to masking by vessel sounds as they use low-frequency sound and communicate over great distances. Odontocetes are considered less sensitive to masking by low-frequency sounds than are mysticetes (Ketten, 2000). Sounds from vessels used by NOS would be at levels not expected to cause anything more than possible localized and temporary or short-term behavioral changes as vessel sound is already so prevalent that it is commonly considered a usual source of ambient underwater sound.

Animal approach restrictions and decreasing vessel speeds could contribute to decreased sound levels from vessels, as well as fewer ship-strikes (see Section 3.5.2.3.1.3); rerouting vessels to avoid animals and designated critical habitats would also help alleviate some detrimental impacts of underwater noise. Although federal agencies such as NOAA are exempt, given the sensitivity of the resource, NOS operators shall adhere to 50 CFR 224.105 which states no vessel of 20 m (65 ft) or greater in overall length may exceed a speed of 10 knots in designated seasonal management areas for the North Atlantic right whale.

Additionally, 50 CFR 224.103 lists special prohibitions for endangered marine mammals to which NOS operators shall adhere, specifically Part B of the regulation, which states that vessels must maintain a 91-m (100-yd) distance from endangered humpback whales in Alaska and cannot disrupt normal behavior; Part C of the regulation, which states that vessels must maintain a 457-m (500-yd) distance from North Atlantic and North Pacific right whales; and Part E of the regulation, which states that vessels must maintain a 365-m (400-yd) distance from killer whales in Washington.

Transits through North Pacific right whale critical habitat would be avoided. For unavoidable transits, vessels would maintain a speed of 10 knots or less. Nighttime operations would be prohibited in specific parts of the Gulf of Mexico that have been identified as important to the Rice's whale. Additionally, if an ESA-listed whale is identified within 457 m (500 yds) of the forward path of a vessel used by NOS, the vessel would steer a course that increases the distance from the whale at a speed of 10 knots or less until the 457 m (500 yds) minimum distance has been established. If an ESA-listed whale is identified within 91 m (100 yds) of the forward path of a vessel used by NOS, the vessel must reduce speed and shift the engine into neutral; the engines would not be engaged until the whale has moved outside of the vessel's path and beyond 457 m (500 yds).

Impacts from low-frequency underwater sound generated by remotely operated and autonomous vehicles and other equipment would be similar to those of surface vessels but at a much-reduced magnitude due to the far fewer nautical miles of proposed travel (i.e., approximately 518,000 nm [959,000 km] for surface vessels vs. 28,600 nm [53,000 km] for remotely operated and autonomous vehicles over the five-year period across all geographic regions).

Low-flying aircraft, such as seaplanes or helicopters, may be used to reach remote areas, especially in Alaska for such projects as tide gauge installation, and can disturb cetaceans. Aircraft generate sound from their engines, airframe, and propellers, and the physical presence of low-flying aircraft can disturb cetaceans because of both the sound and the visual disturbance. Levels of sound received underwater from passing aircraft depend on the aircraft's altitude, the aspect (direction and angle) of the aircraft relative to the receiver, receiver depth and water depth, and seafloor type (Richardson et al., 1995). Because of these physical variables, exposure of individual cetaceans to aircraft-related sound (including both airborne and underwater sound) would be expected to be brief in duration. Considering the relatively low level of aircraft activity that may occur (once or twice a year), along with the short duration of exposure to sound and visual disturbance, potential impacts from this activity on cetaceans are expected to be minimal.

Underwater sound from vessels and equipment may adversely affect the foraging or prey characteristics of critical habitat that support some ESA-listed cetaceans by impacting different life stages of fish and aquatic macroinvertebrate prey species. See Section 3.7 Fish and Section 3.8 Aquatic Macroinvertebrates for full discussions of the potential impacts on fish and aquatic macroinvertebrates from vessel sound and underwater acoustic sources.

Considering that the proposed number of vessels associated with NOS project activities within the EEZ is very low as compared with all other shipping and vessel traffic (see Section 2.4.1), and the assumption that individuals or groups of cetaceans may be familiar with various and common vessel-related sounds, particularly within frequented shipping lanes, the effects of vessel sound on cetaceans under Alternative

A would continue to be **adverse** and **minor**. Small disruptions of behavioral patterns or displacement of individuals or groups would continue to be temporary or short-term with no life-threatening injury to individual marine mammals. Displacement of cetaceans from preferred breeding, feeding, or nursery grounds, migratory routes, or designated critical habitat would continue to be limited to the project area or its immediate surroundings. However, vessel sound is expected to result in **insignificant adverse** effects on individuals or populations of cetaceans, including ESA-listed species and critical habitat.

3.5.2.3.1.3 Vessel Presence and Movement of Equipment in the Water

Behavioral responses of cetaceans to vessel presence are expected to be variable, often depending on the vessel speed, size, location, frequency, and pattern of travel (as discussed above under Vessel and Equipment Sound). Reactions of cetaceans to vessel presence often include changes in general activity (e.g., from resting or feeding to active avoidance), changes in surfacing-respiration-dive cycles, and changes in speed or direction of movement. Past experience of the animals with vessels is also important in determining the degree and type of response elicited from an animal-vessel encounter. Whale reactions to slow moving vessels are less dramatic than to fast or erratic vessel movement. Some species, especially delphinids, commonly approach vessels (Shane et al., 1986) while others, including most beaked whales, avoid approaching vessels (Würsig et al., 1998). Others appear to show no reaction to a passing vessel (Hooker et al., 2001). Some cetaceans may be displaced a short distance, potentially away from preferred or critical habitat, but they would not be anticipated to leave a project area entirely. In all oceans of the world, vessel presence is currently so prevalent that it is commonly considered a usual source of disturbance. The presence of vessels used by NOS would not be at levels expected to cause anything more than possible localized and temporary or short-term behavioral changes in cetaceans.

Water disturbance by remotely operated and autonomous vehicles can temporarily disturb and displace nearby cetaceans. The impact should be minimal, and exposure of individual cetaceans would likely be brief in duration as the equipment would quickly pass by; however, impacts could increase if the frequency of disturbance becomes greater. In either case, if displaced, cetaceans are expected to return to the area and resume normal activities once the water disturbance ends. Surveying equipment such as echo sounders is typically attached to a crewed vessel, remotely operated or autonomous system, thus effects on cetaceans due to its movement in the water would occur from the presence and operation of the equipment carrier, rather than from the presence of the equipment itself. ADCPs and acoustic communication systems are often operated from tethered systems, buoys, fixed moorings, or they are hull mounted or on remotely operated or autonomous underwater vehicles. As with echo sounders, any effects on cetaceans would occur from the presence and operation of the vessel, rather than from presence of the equipment itself. Deployment of all autonomous systems, as well as other equipment and divers, would be suspended if any protected species is sighted within 91 m (100 yds) of the vessel. Work already in progress may continue if the activity is not expected to adversely affect the animal.

Sound speed data collection equipment, grab samplers, and drop/towed cameras are lowered and raised through the water column. This movement through the water could temporarily disturb and displace nearby cetaceans. These impacts would be temporary as cetaceans are expected to return once water column turbulence ceases. The ropes and wires used to lower a sound speed profiler or to connect a probe to the equipment on a ship can cause entanglements with cetaceans. This is not expected to interfere with cetacean movements, as whales, dolphins, and porpoises could swim below and avoid such equipment. Also, prior to using equipment NOS would ensure there is at least one PSO observing the area for protected species at all times.

Water disturbance by anchors and chains moving through the water can also temporarily disturb and displace nearby cetaceans. The impact on cetaceans should be minimal and cease when the anchoring system comes to rest or is taken out of the water. Cetaceans are expected to return to the area and resume normal activities once water column turbulence ceases. Anchoring would be a relatively infrequent activity; thus, impacts are expected to be minimal as they would rarely occur. Additionally, vessels would anchor in waters that are relatively shallow; the larger cetaceans would not generally be expected to occur in those areas and thus would not be impacted.

An important consideration to all crewed vessel operations is the possibility of a vessel striking a marine mammal, with whales being the most vulnerable and commonly impacted cetacean, although collisions with smaller species could also occur. Determining the exact numbers of whales killed through vessel strikes is considered difficult or impossible because strikes often go unnoticed or unreported. In the project area, a minimum of 217 whales were confirmed to be killed through vessel strikes from 2006 to 2020, including a minimum of 52 ESA-listed whales (Henry et al., 2020; Henry, 2022; NMFS, 2021a; NMFS, No Date-c; Shaban et al., 2021). One of the most affected species is the North Atlantic right whale, which is particularly vulnerable to ship-strikes and is often found in high traffic areas. Marine mammal species of concern for possible ship strike with vessels operating at speed primarily include slow-moving species (e.g., North Atlantic right whales) and deep-diving species while on the surface (e.g., sperm whales, pygmy/dwarf sperm whales, and beaked whales). It is expected, however, that the probability of such an encounter, and thus impact, is very low. However, vessel operations within areas such as the North Atlantic right whale critical habitat and migration corridor during calving and nursing or migration periods may increase the probability of vessel strikes due to a higher concentration of animals in the area. Also, certain cetacean species, including bottlenose dolphin and other dolphin species (e.g., *Stenella* spp.), may actively approach vessels moving at speed to swim within the pressure wave produced by the vessel's bow, thus increasing the potential for vessel strikes (BOEM, 2014a).

Vessel strikes can lead to death by massive trauma, hemorrhaging, broken bones, or propeller wounds. Massive propeller wounds can be fatal; if more superficial, whales may be able to survive the collision. Most severe and lethal whale injuries involve larger ships (>80 m [260 ft]) moving at higher speeds (>15 knots). Animal approach restrictions and decreasing vessel speeds as discussed in Section 3.5.2.3.1.2 would help reduce the potential for ship strikes of some protected species. Additionally, if an ESA-listed whale is identified within 457 m (500 yds) of the forward path of a vessel used by NOS, the vessel would steer a course that increases the distance from the whale at a speed of 10 knots or less until the 457 m (500 yd) minimum distance has been established. If an ESA-listed whale is identified within 91 m (100 yds) of the forward path of a vessel used by NOS, the vessel must reduce speed and shift the engine into neutral; the engines would not be engaged until the whale has moved outside of the vessel's path and beyond 457 m (500 yds). If one or more cetaceans are sighted while a vessel is underway, attempts would be made to remain parallel to the animals' course and avoid excessive speed or changes in direction until the cetaceans have left the area. Vessels would not enter into Rice's whale CDA and the 100 - 400 m (328 – 1,312 ft) isobath in the Gulf of Mexico at night; if vessels are present in the CDA/isobath at night, the vessel must be anchored, moored, or otherwise immobile. In addition to complying with all seasonal management areas, NOS would check with various communication media for general ship strike information and specific details regarding North Atlantic right whale sighting locations. These sources include NOAA weather radio, U.S. Coast Guard NAVTEX broadcasts, and Notices to Mariners.

During NOS projects, waters surrounding the vessel would be visually monitored for any marine mammals by at least one PSO observing the area for protected species at all times. PSOs would use all means necessary to enhance visibility (e.g., spotlights, night vision) and would be trained as appropriate. In order to maintain safe navigation and avoid interactions with marine mammals and other sensitive species during transit, the vessel crew would be instructed to remain vigilant to the presence of marine mammals.

While vessel strikes would pose a direct threat to marine mammals, the likelihood of a collision between a vessel used by NOS and a marine mammal would be extremely unlikely because relatively low vessel speeds (particularly within seasonal restricted areas and inshore waterways and during data collection) and visual observation during all vessel operations (regardless of size) would avoid vessel strikes with all marine mammal species. Marine mammal strikes by ROVs and autonomous vehicles are of low concern because of their slow speeds, small size, and built-in proximity avoidance systems.

Vessel presence and movement of equipment in the water would not have any direct effects on the designated critical habitat of any species of cetacean. Indirectly, prey species such as fish and seals may be disturbed by vessels and equipment (see discussion in Section 3.7.2 Fish and Section 3.5.2.3.2 below). This could affect the North Atlantic right whale, North Pacific right whale, Beluga whale, and killer whale, all of which have critical habitat characteristics based on feeding and finding prey. However, it is not expected that impacts on prey species would be substantial, and thus impacts on critical habitat from vessel presence and movement of equipment are likely to be negligible to minor.

Since the likelihood of a vessel strike would continue to be very low, overall effects on cetaceans, including ESA-listed species and designated critical habitat, from vessel presence and movement of equipment in the water under Alternative A would continue to be **adverse** and **minor**. Small disruptions of behavioral patterns or displacement of individuals or groups would continue to be temporary or short-term with no life-threatening injury to individual marine mammals. Displacement of cetaceans from preferred breeding, feeding, or nursery grounds, migratory routes, or designated critical habitat would continue to be limited to the project area or its immediate surroundings. Multiple activities in one area or in several areas across migratory corridors could lead to larger magnitudes and more widespread impacts due to vessel operations; however, impacts would still continue to be considered **insignificant**. In the unlikely event that a vessel strike occurs, its impact would depend on the population status of the species affected. Although extremely unlikely, debilitating injury or mortality of one or a few individuals could occur; if population-level impacts are not expected, then impacts would be **moderate**, although the magnitude of impact could be greater if an ESA-listed species is affected.

3.5.2.3.1.4 Human Activity

Human activity on vessels above the surface of the water would not be expected to have any effects on cetaceans underwater. During SCUBA operations, divers would move through the water column, possibly temporarily disturbing cetaceans that may be in the area. Cetaceans would continue with the activities they were engaged in once divers depart and water column turbulence ceases.

When using a boat or platform to conduct SCUBA operations, at least one PSO would maintain visual watch for protected species to ensure none are sighted within the working area. If a listed species moves into the work area, cessation of operation of any moving equipment within 15 m (50 ft) of the animal would occur and only resume when the species has left the project area. SCUBA divers involved in in-water activities would have proper training and be capable of responsible dive practices such that they minimize injury to organisms and avoid unnecessary habitat impacts. During all buoy deployment and retrieval operations, buoys would be lowered and raised slowly to minimize risk to listed species. In addition, observers would monitor for listed species in the area prior to and during deployment and retrieval. Work would be stopped if listed species are observed in the area to minimize entanglement risk.

The impacts of human activity on cetaceans, including ESA-listed species, under Alternative A would continue to be **adverse** and **negligible** as there would continue to be only be minimal disruptions of behavioral patterns and no displacement from preferred breeding, feeding, or nursery grounds, migratory routes, or designated critical habitat; thus, the impacts would continue to be **insignificant**. It is not expected that human activity would have any impacts on designated critical habitat.

3.5.2.3.1.5 Accidental Leakage or Spillage of Oil, Fuel, and Chemicals

An accidental event could result in release of oil, fuel, or chemicals by a vessel used by NOS. Spills occurring at the ocean surface would be expected to disperse to a very light sheen and weather rapidly (BOEM, 2014a). Volatile components of the contaminant would evaporate. Fuel such as diesel used for operation of vessels is light and would float on the ocean surface. There is the potential for a small proportion of heavier fuel components to adhere to particulate matter in the upper portion of the water column and sink.

Severity of oil and fuel spills on cetaceans depends on the type of contaminant, exposure pathway, and degree of weathering of the substance. Oil and fuel harm cetaceans via acute toxicity, sublethal health effects that reduce fitness, and disruption of marine communities (Walker et al., 2018). In the highly unlikely event of an accidental oil or fuel spill into the marine environment from a vessel used by NOS, cetaceans may be affected through various pathways: direct contact on skin, inhalation of volatile components, ingestion (directly or indirectly through the consumption of fouled prey species), and (for mysticetes) impairment of feeding by fouling of baleen (BOEM, 2014a). Mysticetes, such as humpback and right whales that feed in confined areas (e.g., bays), may be at greater risk of ingesting oil and fuel. The most likely effects of inhalation of volatile vapors would be irritation of respiratory membranes and absorption of hydrocarbons into the bloodstream. Cetacean skin is highly impermeable and is not seriously irritated by brief exposure to petroleum products. Ingestion (via contaminated prey) or inhalation may have negative effects for digestive, respiratory, and circulation systems; however, cetaceans exposed to an accidental spill from a vessel used by NOS are unlikely to ingest enough contaminants to cause serious internal damage because the volume of contaminants spilled would be fairly small given the size of vessel used in NOS projects. Death or life-threatening injury of individual cetaceans would not be expected from a small spill, nor would extended displacement of animals from preferred feeding or breeding habitats or migratory routes.

Cetaceans can be affected indirectly by oil, fuel, and chemical spills through changes in the ecosystem that adversely affect prey species and habitats, including degradation of water quality. Mortality of phytoplankton and zooplankton from oil and fuel spills could indirectly affect mysticetes which feed on them. However, even if a large number of plankton were affected, they can recover rapidly due to high reproductive rates, rapid replacement by cells from adjacent waters, widespread distribution, and exchange with tidal currents. Thus, the impact of an accidental spill on a pelagic phytoplankton community, and consequently on mysticetes, would not be substantial.

An accidental spill adjacent to or within critical habitat areas for the North Atlantic right whale and Beluga whale (both of which have critical habitat characteristics associated with nursery areas and calving) during calving periods may result in the direct contact of the spilled contaminants with both adult and newly born whales. Additionally, critical habitat areas designated for feeding and foraging characteristics for the North Atlantic right whale, North Pacific right whale, Beluga whale, and killer whale could be affected by adverse impacts on prey species from spilled fuel, oil, and other contaminants. Small spills could also make localized areas of critical habitat temporarily unavailable because of disturbance while clean up occurs, or temporarily decrease the value of critical habitat through contamination. However, impacts from such events are not likely to seriously injure individual whales, as discussed above, and the likelihood of occurrence of an accidental spill is expected to be very low.

Such accidents may be caused by equipment malfunction, human error, or natural phenomena and are not expected during the course of NOS operations. In the unlikely event of an accidental spill, there would be very low likelihood for contaminants to make contact with the water because vessel operations personnel are required to respond immediately using established spill response procedures. For example, on NOAA fleet vessels, in the event of an oil, hazardous substance, or marine pollutant spill, the Commanding Officer takes appropriate action to minimize the effects of the spill. The Office of Marine and Aviation Operations (OMAO) Procedure 0701-06 'Shipboard Oil Pollution Emergency Plan & Non-Tank Vessel Response Plan (VRP/SOPEP)' provides policy and guidance to all NOAA vessels regarding oil pollution emergency planning and response, in accordance with MARPOL 73/78, Annex I. The plan contains all the information and instruction required for responding to shipboard oil spills, such as general spill mitigation and response, shipboard spill mitigation and response, reporting requirements, completing Corrective Action Assessments, trainings, drills, and exercises. This plan has been approved by the United States Coast Guard (USCG), and complies with the Oil Pollution Act of 1990 and Federal Water Pollution Act of 1973.

Since the likelihood of occurrence of an accidental spill from a vessel used by NOS would continue to be very low, impacts on cetaceans under Alternative A are expected to be **adverse** and **negligible**. In the event that an accidental spill does occur, the volume of oil, fuel, and/or chemicals would be fairly small given the size of vessels used by NOS and the amounts of fuel and other chemicals they typically carry. Additionally, all hazardous or regulated materials would continue to be handled in accordance with applicable laws, and crew members would continue to be appropriately trained in materials storage and usage. Thus, the impact on cetaceans would continue to be **adverse** and **minor** as impacts would continue to be temporary or short-term without any impacts on population levels. Displacement of cetaceans that move away to avoid spilled substances would continue to be short-term and limited to the project area or its immediate surroundings. Impacts on cetaceans, including ESA-listed species and designated critical habitat, would continue to be **insignificant**.

3.5.2.3.1.6 Trash and Debris

Marine debris, particularly items made of synthetic materials, is a major form of marine pollution. Ship-generated waste generally includes glass, metal, and plastic containers, organic and food waste, cardboard and paper packaging waste, and hazardous waste (e.g., batteries, noxious liquids, paint waste, pharmaceuticals) (Walker et al., 2018).

Marine debris poses two types of negative impacts on cetaceans: entanglement and ingestion. Entanglement is a far more likely cause of mortality to cetaceans than ingestion (BOEM, 2014a). Entanglements occur when cables, lines, nets, or other objects suspended in the water column become wrapped around marine mammals, potentially causing injury, interference with essential behaviors and functions, and possibly mortality. Entanglement is most common in pinnipeds (see Section 3.5.3.2 below), less common in mysticetes, and rare among odontocetes (Laist et al., 1999). Entanglement data for mysticetes reflects a high interaction rate with active fishing gear rather than marine debris (BOEM, 2014a). During proposed activities, numerous cables, lines, and other objects could be towed behind the vessel near the water's surface. Although it is possible that such lines and cables could detach from a vessel and become debris in which cetaceans could get entangled, it is not very likely.

Impacts from discarded trash and debris are expected to be avoided through vessel operators' required compliance with USCG and U.S. Environmental Protection Agency (EPA) regulations. In addition, no intentional vessel discharges would occur if a protected species is sighted within 91 m (100 yds) of the vessel used by NOS, and all MARPOL discharge protocols would be followed. Thus, impacts of discarded trash and debris on cetaceans, including ESA-listed species, under Alternative A would continue to be **adverse** and **negligible** as any disturbance of animals would continue to be temporary, no mortality or debilitating injury would be expected, and there would continue to be no displacement from preferred or designated critical habitat; impacts would continue to be **insignificant**. It is also not expected that trash and debris would have any impacts on designated critical habitat.

3.5.2.3.2 Pinnipeds

The analysis of impacts on pinnipeds considers all of the impact causing factors introduced above. Potential impacts could occur in all of the geographic regions as one or more pinniped species, subspecies, or DPS occur in each region (see Section 3.5.1.2 above). Three regions – West Coast, Alaska, and Pacific Islands – include one or more ESA-listed species, and two regions, Alaska and Pacific Islands, each include designated critical habitat for one listed species.

3.5.2.3.2.1 Active Underwater Acoustic Sources

While many pinnipeds forage near the water surface, others make deep and prolonged foraging dives of hundreds of meters (elephant seals are the deepest-diving pinnipeds); thus, they could be affected by underwater sound from acoustic sources used in NOS projects. Active underwater acoustic sources included in Alternative A comprise echo sounders, ADCPs, and acoustic communication systems as discussed in Section 2.4 and under cetaceans in Section 3.5.2.3.1.1. **Table 3.5-7** lists the representative equipment and frequency ranges used in acoustic modeling.

Sound frequencies produced by the echo sounders overlap the range of pinniped hearing (50 Hz to 86 kHz), and they can presumably hear these sounds if sufficiently close. Acoustic signals from echo sounders (ranging from 0.5 kHz to 900 kHz) are likely to be detectable by pinnipeds if the lower end of the sound frequency spectrum is used. The adverse impacts of such sound can include behavioral responses and short-term or permanent loss of hearing (TTS and PTS). Masking effects are expected to be minimal or non-existent given the beam directionality, the brief period when an individual pinniped would potentially be within the downward-directed beam from a transiting vessel, and the relatively low source level of an echo sounder. TTS and PTS through exposure to the downward-directed echo sounder sounds is unlikely to occur because the probability of a pinniped swimming through the area of exposure when an echo sounder emits a sound is small. The animal would have to pass the transducer at close range and be swimming at speeds similar to the vessel in order to be subjected to sound levels that could cause TTS or PTS.

Acoustic signals from ADCPs (ranging from 35 kHz to 1200 kHz) are likely to be detectable by pinnipeds underwater if the lower end of the sound frequency spectrum is used. The effects of underwater sound from ADCPs on pinnipeds would be similar to those from echo sounders, although there would potentially be no impacts at all as ADCPs, although capable of producing lower frequency sound, are usually operated at high to extremely high frequency.

Acoustic communication systems would emit sound in mid-frequency ranges (10s of kHz) and thus could be detectable by pinnipeds (which can hear from 50 Hz to 86 kHz) underwater. The impacts of underwater sound on pinnipeds from acoustic communication systems would be similar to but less than that described above for the use of echo sounders because, although acoustic communication systems are omnidirectional, they have lower power, a lower duty cycle, and would be used less frequently than echo sounders.

Quantitative acoustic exposure to marine mammals, including pinnipeds, from operation of sound sources was modeled for nine sources (see Appendix E). Acoustic modeling was conducted by determining the size of the sound field expected from each source (referred to and depicted as an isopleth) and estimating the number of pinnipeds that may be exposed above sound thresholds for PTS/injury and behavioral disruption (see Appendix E). To gauge the potential for impacts, received sound levels that could result in PTS/injury or behavioral disruption to the animal were needed. For this study, the current NMFS criteria for both PTS/injury (NMFS, 2018a) and behavioral disruption (84 FR 72308, December 31, 2019) were used (see Appendix E). The methodology for modeling the impacts of active underwater acoustic sources is presented in Appendix E. Additionally, Section 3.5.2.3.1.1 under Cetaceans discusses the assumptions made and the data sources used in the modeling scenarios to predict exposures of marine mammals, including pinnipeds.

Based on the modeling, and taking into account animal behavior, source characteristics, and animal hearing capability, no PTS/injury exposures of pinnipeds are expected to occur; thus, only behavioral disruption exposure is discussed below. Note that the estimated exposures have overall decreased between the Draft PEIS and the Final PEIS for the reasons discussed in Section 3.5.2.3.1.1 under Cetaceans.

3.5.2.3.2.1.1 Behavioral Disruption Exposure Estimates

Behavioral disruption exposure estimates over the five-year period were calculated for sources with operational frequencies within the pinniped hearing frequency range (<200 kHz, see Section 3.5.1.2.1). Behavioral disruption exposure estimates considered that all proposed activities would occur, used the highest levels of anticipated animal densities, and did not factor in effects of potential mitigation procedures or animals avoiding the sounds. Summarized total potential behavioral disruption exposures of pinnipeds over five years for all sources in the four regions where they could occur are shown in **Table 3.5-11**. For annual numbers, see Appendix E. Species that may be in the area but for which no impacts were predicted are not included in the table.

Table 3.5-11. Total Predicted Exposures for Pinniped Species and Time in Seconds Above the Behavioral Disruption Threshold Under Alternative A

Species	Total Exposures*	Average time above 160 dB (s)**
Alaska Region		
Northern fur seal***	20,494.45	138
Spotted seal	10,026.01	104
Harbor seal	6,471.74	104
Northern elephant seal***	5,662.73	118
Bearded seal	1,451.04	104
Ribbon seal	1,372.51	104
Ringed seal	1,103.05	104
Walrus	593.19	95
Steller sea lion***	443.17	104

Species	Total Exposures*	Average time above 160 dB (s)**
Greater Atlantic Region		
Harp seal	691.06	174
Gray seal	559.35	168
Harbor seal	341.84	193
Hooded seal	321.20	174
West Coast Region		
California sea lion	29,566.71	96
Northern fur seal	20,976.33	138
Northern elephant seal	5,662.73	118
Harbor seal	5,425.79	138
Stellar sea lion	2,472.05	138
Guadalupe fur seal	227.24	138
Pacific Islands Region		
Hawaiian monk seal	548.17	86

*Exposures are based on a probabilistic model that is scaled by animal density and may therefore include fractional counts.

**Exposure above threshold over 24 hours.

***Populations span Alaska and West Coast regions.

Under Alternative A, behavioral disruption exposures to pinnipeds could occur in four regions. Depending on the species, behavioral disruption exposure of pinnipeds could affect hundreds to tens of thousands of animals in each region over the five-year timeframe. However, for the simulated animals exposed above the 160 dB threshold, the average time above threshold is under four minutes, and often less than two minutes (**Table 3.5-11**). The disturbances, therefore, are expected to be transient, and surveys, once completed in an area, would not generally be repeated, thus limiting an individual's behavioral disruption. Behavioral exposures need to occur over the timespan of weeks to have a population level effect on marine mammals, as in the case of seismic surveys that have months' worth of activity (Southall et al., 2016). Any disruption that occurs for a matter of hours or for less than a day would not likely have a population-level impact. Thus, although many individuals of some species could experience behavioral disturbance from NOS acoustic sources, the small increments of time that the animals could be exposed above threshold over the five years and the extensive project area would not be expected to result in population level adverse impacts.

In coordination with NMFS and USFWS, NOS has developed mitigation measures (see Appendix D) to reduce potential impacts of active acoustic sources on marine mammals. NOS would continue to use the lowest power appropriate to perform surveys. NOS would also continue to use PSOs and would employ a robust suite of animal approach restrictions and reduced vessel speeds, described in more detail in Sections 3.5.2.3.2.2 and 3.5.2.3.2.3, as well as the walrus-specific measures outlined in Section 3.5.2.3.2.2.

3.5.2.3.2.1.2 Conclusion

The effects of underwater sound from active acoustic sources on pinnipeds under Alternative A would continue to be **adverse** and **minor.** No injury exposures in the form of hearing loss (PTS) are expected to occur. While individual animals would be expected to experience behavioral disruptions (from thousands to tens of thousands of animals across four regions over the five-year timeframe), the amount of time individuals may exceed behavioral exposure thresholds would be on average less than four minutes (**Table 3.5-11**). Similarly, the potential for masking would continue to be minimal during surveys because the narrow beams of most active acoustic sources mean animals would not spend much time in ensonified zones. Overall, the potential impacts are likely limited to short-term disruption of acoustic habitat and behavioral patterns. Impacts would be temporary or short-term and would not be considered outside the natural range of variability of species' populations, their habitats, or the natural processes sustaining them. Impacts could include disruptions of behavioral patterns such as temporary disruption of communication, disturbance of individuals or groups of pinnipeds, and possible displacement of individuals or groups, but without substantial interference to feeding, reproduction, or other biologically important functions affecting population levels. Displacement of pinnipeds from preferred breeding, feeding, or nursery grounds or designated critical habitat would be limited to the project area or its immediate surroundings. Impacts of Alternative A on pinnipeds, including ESA-listed species, would continue to be **insignificant**.

3.5.2.3.2.2 Vessel and Equipment Sound

Pinnipeds can be classified within two separate functional hearing groups ("pinnipeds in water" [75 Hz-75 kHz] and "pinnipeds in air" [75 Hz-30 kHz]) since these species communicate acoustically in both air and water and have different hearing capabilities in the two media. Vessels and equipment used by NOS would generate transitory sound (10 to 10,000 Hz) into the air and underwater while in a project area that would allow them to be heard by pinnipeds.

Vessel sound in the air and underwater can cause behavioral disturbance in pinnipeds. However, the occurrence and nature of pinniped responses would be variable, depending on species, location, novelty of the sound, vessel behavior, and habitat, among many other factors (see Section 3.5.2.3.1.2 above for discussion of vessel variables). Behavioral responses could include evasive maneuvers such as diving, changes in swimming direction and/or speed, dive duration, decreased time searching for food, and avoidance behaviors, as well as disruptions in breeding and nursing. Introduced underwater sound may also reduce (i.e., mask) the effective communication distance of a pinniped if the frequency of the source is close to that used as a signal by the animal, and if the anthropogenic sound is present for a substantial fraction of the time. Vessel sounds, however, would be at levels not expected to cause anything more than possible reactions limited to startle or otherwise brief responses and temporary or short-term behavioral changes of no lasting consequence to the animals. Additionally, vessels would avoid approaching within 100 yards of in-water seals and sea lions.

Animal approach restrictions in part D of 50 CFR 224.103 list special prohibitions for Steller sea lions to which NOS operators would adhere:

- Per part D of the regulation, vessels must maintain a distance of 3 nm (5.6 km) from Steller sea lion rookery sites listed in the regulation (Table 1 to 50 CFR 224.103 - Listed Steller Sea Lion Rookery Sites).

Impacts from low-frequency underwater sound generated by remotely operated or autonomous vehicles and other equipment would be similar to those of surface vessels but at a much reduced magnitude due to the far fewer nautical miles of proposed travel (i.e., approximately 518,000 nm [959,000 km] for surface vessels vs. 28,600 nm [53,000 km] for remotely operated and autonomous vehicles over the five-year period across all geographic regions).

Low-flying aircraft used to reach remote areas, especially in Alaska for such projects as tide gauge installation, can disturb pinnipeds because of both airborne and underwater sound and visual disturbance, particularly to individuals resting on the sea surface or at haul out locations. Behavioral responses of pinnipeds to aircraft are highly variable and range from no observable reaction to diving or rapid changes in swimming speed or direction. Exposure of individual pinnipeds to aircraft-related sound would be expected to be brief in duration, and considering the relatively infrequent level of aircraft activity that may occur (only once or twice a year), potential impacts from this activity on pinnipeds are expected to be minimal. Walruses, however, are easily frightened when on haul outs and are more sensitive to disturbance than swimming individuals; walruses tend to pack closely together when hauled out so that a flight response by one animal can quickly travel through the herd, triggering a mass exodus to the water (BOEM, 2016; USFWS, 2016a). Stampedes are the greatest impact of aircraft and vessel disturbance and may result in cow-calf separations or injuries and mortalities. In recent years, upwards of 60,000 walrus have consistently hauled out on land near Point Lay, Alaska (USFWS, 2020). Disturbance at these types of haulouts would have a greater impact on walrus than on ice or on other land haulouts such as in Bristol Bay, Alaska since haulouts at Point Lay are primarily populated by females with pups, subadults and some males. A stampede at a haulout of this size with this demographic would likely incur more deaths, injuries, and separations than at other locations.

NOS may encounter walruses while conducting activities within the Bering Sea or Chukchi Sea, or along the associated coastline. Walrus are sensitive to disturbance from noise, sights, and smells associated with human activities and could result in significant behavioral response, injury, or death. Appendix D details the mitigation measures that have been suggested by USFWS and adopted by NOS to prevent such adverse effects and include:

- Maintain an appropriate minimum distance from walruses hauled out on ice or land: Marine vessels less than 15 m (50 ft) in length – 0.5 nm (1 km); Marine vessels 15 m (50 ft) or more but less than 30 m (100 ft) in length – 1 nm (1.8 km); and Marine vessels 30 m (100 ft) or more in length – 3 nm (5.5 km);
- Reduce noise levels near haulouts. Avoid abrupt maneuvers, sudden changes in engine noise, using loud speakers, loud deck equipment or other operations that produce noise when in the vicinity of walrus haulouts. Note that sound carries a long way across the water and often reverberates off of cliffs and bluffs adjacent to coastal walrus haulouts, amplifying noise. Do not operate the vessel in such a way as to separate members of a group of walruses from other members of the group;
- Reduce speed and maintain a minimum distance of 0.8 km (0.5 mi) from groups of walruses in the water;
- If walruses approach the vessel or are found to be in close proximity, place boat engines in neutral and allow the animals to pass. If vessel safety considerations prevent this, carefully steer around animals;
- When weather conditions require, such as when visibility drops, adjust speed accordingly to avoid the likelihood of injury to walruses;
- Do not fly autonomous system devices or single engine fixed wing aircraft over or within 0.8 km (0.5 mi) of walruses hauled out on land or ice;
- If weather or aircraft safety require flight operations within 0.8 km (0.5 mi) of a haulout site, maintain a 610 m (2,000 ft) minimum altitude;

- Do not fly helicopters over or within 1.6 km (1 mi) of walruses hauled out on land or ice;
- If weather or aircraft safety require crewed flight operations within 1.6 km (1 mi) of a haulout site, maintain a 915 m (3000 ft) minimum altitude;
- Landings, take-offs, and taxiing of autonomous system devices or single engine fixed wing aircraft should not occur within 0.8 km (0.5 mi) of hauled out walruses, or within 1.6 km (1 mi) for helicopters;
- Avoid circling or turning near walruses hauled out on land or ice; and
- If aircraft safety requires flight operations below recommended altitudes near a haulout, pass inland or seaward of the haulout site at the greatest lateral distance manageable for safe operation of the aircraft.

Underwater sound from vessels and equipment may adversely affect the foraging or prey characteristics of critical habitat that support some ESA-listed pinnipeds by impacting different life stages of fish and aquatic macroinvertebrate prey species. See Section 3.7 Fish and Section 3.8 Aquatic Macroinvertebrates for full discussions of the potential impacts on fish and aquatic macroinvertebrates from vessel sound and underwater acoustic sources.

Considering that the proposed volume of vessels associated with NOS project activities within the EEZ is very low as compared with all other shipping and vessel traffic (see Section 2.4.1), and the assumption that individuals or groups of pinnipeds may be familiar with various and common vessel-related sounds, particularly within frequented shipping lanes, the effects of vessel sound on pinnipeds under Alternative A would continue to be **adverse** and **minor**. If a walrus stampede occurs due to vessel or aircraft disturbance, the impact could be **moderate** or greater as debilitating injury or mortality could occur, but the continued viability of the population would not be threatened, especially when BMPs and guidelines are implemented. Small disruptions of behavioral patterns or displacement of individuals or groups would continue to be temporary or short-term with no life-threatening injury to individual pinnipeds. Displacement of pinnipeds from preferred breeding, feeding, or nursery grounds, or designated critical habitat would continue to be limited to the project area or its immediate surroundings. Multiple activities in one area could lead to larger magnitudes and more widespread impacts. However, vessel sound is expected to result in **insignificant adverse** effects on individuals or populations of pinnipeds, including ESA-listed species and designated critical habitat.

3.5.2.3.2.3 Vessel Presence and Movement of Equipment in the Water

As with vessel sound, behavioral responses of pinnipeds to vessel presence and movement are also expected to be variable. Some species may tolerate slow moving vessels within several hundred meters, especially when the vessel is not directed towards the animal or making sudden changes in direction or engine speed. Reactions of pinnipeds to vessel presence and movement include attraction to the vessel, increased alertness, modification of vocalization, cessation of feeding or interacting, alteration of swimming or diving behavior (change in direction or speed), habitat abandonment, and possibly panic reactions such as stampeding (particularly in walruses). Disturbance from vessels can include localized displacement of pinnipeds in close proximity from haul out locations. The presence of vessels used by NOS, however, would not be at levels expected to cause anything more than possible localized and temporary or short-term behavioral changes in pinnipeds.

An important consideration for all crewed vessel operations is the possibility of marine mammal vessel strikes. Vessel strikes can lead to death by massive trauma, hemorrhaging, broken bones, or propeller wounds. However, vessel strikes are unlikely as pinnipeds in general are very agile, are able to swim much faster than the vessels used by NOS, and can easily swim away from or under vessels traveling at full speed. When feeding, pinnipeds may be distracted and thus inattentive to vessels; however, they can probably move away quickly enough to avoid collisions. As NOS would ensure visual observation during all vessel operations (regardless of size), along with animal approach restrictions discussed above in Section 3.5.2.3.2.2, vessels used by NOS would be unlikely to strike pinnipeds. Marine mammal strikes by ROVs and autonomous vehicles are of low concern because of their slow speeds, small size, and built-in proximity avoidance systems.

Water disturbance by remotely operated and autonomous vehicles can temporarily disturb and displace nearby pinnipeds both in the water and those who are hauled out. The impact should be minimal and likely brief in duration as the ROV or equipment would quickly pass by; however, impacts could increase if the frequency of disturbance becomes greater or if an ROV gets too close to haul out locations. In either case, if displaced, pinnipeds are expected to return to the area and resume normal activities once the water disturbance is no longer present. Equipment such as echo sounders is typically attached to a crewed vessel or remotely operated or autonomous vehicle; thus, effects on pinnipeds would occur from the presence and operation of their carriers as discussed above, rather than from the presence of the equipment itself. ADCPs and acoustic communication systems are often operated from tethered systems, buoys, fixed moorings, or they are hull mounted or on remotely operated or autonomous underwater vehicles. As with echo sounders, any effects on pinnipeds would occur from the presence and operation of the vessel, rather than from presence of the equipment itself. Deployment of all autonomous systems, as well as other equipment and divers, would be suspended if any protected species is sighted within 91 m (100 yds) of the vessel. Work already in progress may continue if the activity is not expected to adversely affect the animal. Additionally, the mitigation measures discussed in Section 3.5.2.3.2.2 for protecting walruses also apply for vessel presence and movement of equipment in the water.

Sound speed data collection equipment, grab samplers, and drop/towed cameras are lowered and raised through the water column. This movement through the water could temporarily disturb and displace nearby pinnipeds. These impacts would be temporary as pinnipeds are expected to return once water column turbulence ceases. The ropes and wires used to lower such equipment, or to connect a probe to the equipment on a ship, can also cause entanglements with pinnipeds. However, this is not expected to interfere with pinniped movements as, prior to using equipment, NOS would ensure there is at least one PSO observing the area for protected species at all times.

Water turbulence by anchors and chains moving through the water can also temporarily disturb and displace nearby pinnipeds. The impact on pinnipeds should be minimal and cease when the anchoring system comes to rest or is taken out of the water. Pinnipeds are expected to return to the area and resume normal activities once water column turbulence ceases. It is possible that vessels anchoring near haul out locations could disturb or displace hauled out pinnipeds. Such impacts could be avoided by using designated anchorage areas or previously surveyed areas when available, and if an appropriate distance away so as not to disturb animals. Anchoring would be a relatively infrequent activity; thus, impacts on pinnipeds would be expected to be minimal as they would rarely occur.

Vessel presence and movement of equipment in the water would not have any direct effects on the critical habitat of any pinniped species. Indirectly, prey species such as fish may be disturbed by vessels and equipment (see discussion in Section 3.7.2 Fish). This could affect the Steller sea lion and Hawaiian monk seal, both of which have critical habitat characteristics that are based on feeding and finding prey. However, it is not expected that impacts on prey species would be substantial, and thus impacts on critical habitat from vessel presence are likely to be temporary and small. Additionally, vessel operations have the potential to interfere with the haul out, rookery, and nursing characteristics of designated critical habitat for the Steller sea lion and Hawaiian monk seal if these species are displaced or otherwise prevented from using the habitat when vessels are present.

The mitigation measures discussed in Section 3.5.2.3.2.2 for reducing the impacts of vessel and equipment sound on pinnipeds also apply for reducing impacts of vessel presence and movement of equipment in the water.

Since the likelihood of a vessel strike would continue to be very low, the overall effects on pinnipeds, including ESA-listed species and designated critical habitat, from vessel presence and movement of equipment in the water under Alternative A would continue to be **adverse** and **minor**. Small disruptions of behavioral patterns or displacement of individuals or groups would continue to be temporary or short-term with no life-threatening injury to individual pinnipeds. Displacement of pinnipeds from preferred breeding, feeding, or nursery grounds, or designated critical habitat would continue to be limited to the project area or its immediate surroundings. Multiple activities in one area could lead to larger magnitudes and more widespread impacts due to vessel operations; however, impacts would still continue to be considered **insignificant**. In the unlikely event that a vessel strike occurs, its impact would depend on the population status of the species affected. Although very unlikely, debilitating injury or mortality of one or a few individuals could occur; since population-level impacts are not expected, impacts would be **moderate**, although the magnitude of impact could be greater if an ESA-listed species is affected.

3.5.2.3.2.4 Human Activity

Human activity could affect pinnipeds primarily during activities on land, such as tide gauge and shore-based reference station installation, maintenance, and removal. Sound and movement from human activity onboard vessels could also affect pinnipeds that are hauled out; however, the sound and presence from the vessels themselves would likely be the greater cause of impacts, as discussed above.

Onshore human activity during tide gauge installation near pinniped haul out sites could disturb activities such as communication, feeding, or reproduction and displace animals from haul outs temporarily or over the short-term. Tide gauge operation would not generally affect pinnipeds as tide gauges operate autonomously. Occasionally, there could be some disturbance or displacement of nearby pinnipeds from sound and activity if field personnel need to do maintenance in such situations as when a buoy breaks its mooring, the gauge stops sending messages, or batteries need to be recharged. Sound and activity from tide gauge removal could also cause temporary or short-term, localized disturbance and changes in behavior of nearby hauled out pinnipeds, similar to impacts during installation. During all buoy deployment and retrieval operations, buoys would be lowered and raised slowly to minimize risk to listed species. In addition, observers would monitor for listed species in the area prior to and during deployment and retrieval. Work would be stopped if listed species are observed in the area to minimize entanglement risk.

Impacts from installation of a shore-based GPS reference station could potentially occur if the site is located near a pinniped haul out location, similar to impacts during tide gauge installation. In addition, shore and/or coastal habitat could be disturbed or altered because a small area of ground would be covered by the GPS reference station. Although this could affect habitat at haul out locations, it is not likely that the ground disturbance would be large enough to alter habitat to the point where pinnipeds could no longer use the site.

During SCUBA operations, divers would move through the water column, possibly temporarily disturbing pinnipeds that may be in the area. Pinnipeds would continue with the activities they were engaged in once divers depart and water column turbulence ceases. When using a boat or platform to conduct SCUBA operations, at least one PSO would maintain visual watch for protected species to ensure none are sighted within the working area. If a listed species moves into the work area, cessation of operation of any moving equipment within 15 m (50 ft) of the animal would occur and only resume when the species has left the project area. SCUBA divers involved in in-water activities would have proper training and be capable of responsible dive practices such that they minimize injury to organisms and avoid unnecessary habitat impacts.

Overall, the impacts of human activity on pinnipeds, including ESA-listed species, under Alternative A would continue to be **adverse** and **minor** as there would only continue to be small disruptions of behavioral patterns and any displacement would continue to be limited to the project area or immediate surroundings, and thus **insignificant**. It is not expected that human activity would have any impacts on designated critical habitat as the locations for tide gauges and GPS reference stations would not likely be located in or adjacent to critical habitat areas.

3.5.2.3.2.5 Accidental Leakage or Spillage of Oil, Fuel, and Chemicals

Severity of oil, fuel, and chemical spills on pinnipeds depends on the type of contaminant, exposure pathway, and degree of weathering of the substance. Oil and fuel can harm pinnipeds via acute toxicity, sublethal health effects that reduce fitness, and disruption of marine communities. In the highly unlikely event of an accidental spill into the marine environment from a vessel used by NOS, pinnipeds could be coated with oil or fuel, could ingest oil or fuel with water or contaminated food, or could absorb oil or fuel components through the respiratory tract. Oil can destroy the insulating qualities of hair or fur, resulting in hypothermia. Thus, pinnipeds that depend on fur rather than a thick layer of fat for insulation, such as fur seals and newborn pups, are most sensitive to oiling. If oil or fuel is ingested, some of it would be voided in vomit or feces or metabolized at rates that prevent significant bioaccumulation, but some could be absorbed and could cause toxic effects. However, pinnipeds exposed to a small oil or fuel spill from vessels used by NOS are unlikely to ingest enough to cause serious internal damage. A small spill would not be likely to result in the death or life-threatening injury of individual pinnipeds, or the long-term displacement of these animals from preferred feeding or breeding habitats. It is expected that spilled oil or fuel would rapidly disperse on the sea surface to a very light sheen and weather rapidly (BOEM, 2014a).

Pinnipeds could be affected indirectly by oil, fuel, and chemical spills through changes in the ecosystem that adversely affect prey species and habitats, including degradation of water quality. Water quality and visibility could be temporarily impacted, which could indirectly affect the ability of pinnipeds to locate prey (primarily fish or invertebrates). This could also affect critical habitat areas designated for feeding and foraging characteristics for the Steller sea lion and Hawaiian monk seal. Small spills could also make localized areas of critical habitat temporarily unavailable because of disturbance while clean up occurs, or temporarily decrease the value of critical habitat through contamination. However, since it would be highly unlikely that an accidental spill would occur, adverse impacts on prey and habitat, including critical habitat, would be very low.

Such accidents may be caused by equipment malfunction, human error, or natural phenomena and are not expected during the course of NOS operations. In the unlikely event of an accidental spill, there would be very low likelihood for contaminants to make contact with the water because vessel operations personnel are required to respond immediately using established spill response procedures. For example, on NOAA fleet vessels, in the event of an oil, hazardous substance, or marine pollutant spill, the

Commanding Officer takes appropriate action to minimize the effects of the spill. OMAO Procedure 0701-06 VRP/SOPEP provides policy and guidance to all NOAA vessels regarding oil pollution emergency planning and response, in accordance with MARPOL 73/78, Annex I. The plan contains all the information and instruction required for responding to shipboard oil spills, such as general spill mitigation and response, shipboard spill mitigation and response, reporting requirements, completing Corrective Action Assessments, trainings, drills, and exercises. This plan has been approved by the USCG, and complies with the Oil Pollution Act of 1990 and Federal Water Pollution Act of 1973.

Since the likelihood of occurrence of an accidental spill from a vessel used by NOS would continue to be very low, impacts on pinnipeds under Alternative A are expected to be **adverse** and **negligible**. In the event that an accidental spill does occur, the volume of oil, fuel, and/or chemicals would continue to be fairly small given the size of vessels used by NOS and the amounts of fuel and other chemicals they typically carry. Additionally, all hazardous or regulated materials would continue to be handled in accordance with applicable laws, and crew members would continue to be appropriately trained in materials storage and usage. Thus, the impact on pinnipeds would continue to be **adverse** and **minor** as impacts would continue to be temporary or short-term without any impacts on population levels. Displacement of pinnipeds that move away to avoid spilled substances would continue to be short-term and limited to the project area or its immediate surroundings. Impacts on pinnipeds, including ESA-listed species and designated critical habitat, would continue to be **insignificant**.

3.5.2.3.2.6 Trash and Debris

Marine debris poses two types of negative impacts on pinnipeds: entanglement and ingestion. Entanglement is a far more likely cause of mortality to marine mammals than ingestion and is most common in pinnipeds. Entanglements occur when cables, lines, nets, or other objects suspended in the water column become wrapped around animals, potentially causing injury, interference with essential behaviors and functions, and possibly mortality. Northern fur seals have been particularly susceptible to entanglement from commercial fishing debris, primarily trawl net webbing, plastic packing straps, and monofilament line (NMFS, No Date-d). However, the tendency of pinnipeds to generally avoid approaching vessels used by NOS (in contrast with their tendency to congregate around fishing vessels) presumably reduces the risk of entanglement. During proposed activities, cables, lines, and other objects could be towed behind the vessel near the water surface. Although it is possible that such lines and cables could detach from a vessel and become debris in which pinnipeds could get entangled, the likelihood of this occurring would be low.

Impacts from discarded trash and debris are expected to be avoided through vessel operators’ required compliance with USCG and EPA regulations. In addition, no intentional vessel discharges would occur if a protected species is sighted within 91 m (100 yds) of the vessel used by NOS, and all MARPOL discharge protocols would be followed. Thus, impacts of discarded trash and debris on pinnipeds, including ESA-listed species, under Alternative A would continue to be **adverse** and **negligible** as any disturbance of animals would continue to be temporary, no mortality or debilitating injury would be expected, and there would be no displacement from preferred or designated critical habitat; impacts would continue to be **insignificant**. It is expected that trash and debris would continue to not have any impacts on designated critical habitat under Alternative A.

3.5.2.3.2.7 Air Emissions

Since the pre-industrial era, increased emissions of anthropogenic greenhouse gases (GHG) [carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O)] have resulted in higher atmospheric concentrations of these gases and influenced atmospheric, terrestrial, and oceanic conditions (Limpinsel et al., 2017).

Smokestack and two-stroke outboard motor emissions from vessels used by NOS would release air pollutants. The type and amount of air emissions from vessels used by NOS would depend on the type of fuel, engine, and engine efficiency. Pinnipeds which are hauled out may be exposed to airborne smokestack or outboard motor emissions; however, such emissions would be temporary and ephemeral as they would dissipate rapidly into the air and may not reach hauled out animals.

Burning fossil fuels pollutes not just the air but also the oceans as the waters absorb carbon dioxide, which lowers the pH of surface waters and leads to acidification. Changes in seawater carbon chemistry, in particular interference with the formation of calcium carbonate ($CaCO_3$) in marine shells and skeletons, may affect marine biota through a variety of biochemical, physiological, and physical processes. However, the amount of emissions from vessels used by NOS would continue to be a very small fraction as compared to emissions from all other vessel activity in the oceans. Thus, impacts on pinnipeds, including ESA-listed species and designated critical habitat, from air emissions under Alternative A are expected to be **adverse** and **negligible** as there would continue to be no disturbance of communication or behavior, no displacement, and no debilitating injury of individuals; impacts would continue to be **insignificant**.

3.5.2.3.3 Sirenians

The analysis of impacts on sirenians, which live primarily underwater, does not consider air emissions. All the other impact causing factors for marine mammals are analyzed below for sirenians. Potential impacts could occur in one of the geographic regions, the Southeast Region, as it is the only region where sirenians (two subspecies of manatees) occur (see Section 3.5.1.3 above); this region also includes designated critical habitat for one of the manatee subspecies. Manatees occur mainly in the Southeast Region, although they have been found on occasion to travel further north into the Greater Atlantic Region; thus, the analysis of underwater acoustic impacts below also includes the Greater Atlantic Region.

Critical habitat consists of both a geographic area and PCEs within that area (i.e., the physical or biological features essential to the conservation of a species upon which its designated or proposed critical habitat is based). The Florida manatee was among the first species for which critical habitat was designated, and PCEs were not listed as they have been for other species (e.g., PCEs for other marine mammals include such characteristics of critical habitat use as feeding, breeding, escape from predators, and haul outs). Without a list of PCEs, analyzing the impacts of the Proposed Action on manatee critical habitat is difficult other than in a general way assuming that the designated critical habitat is for protection of the species.

3.5.2.3.3.1 Active Underwater Acoustic Sources

Active underwater acoustic sources included in the Proposed Action comprise echo sounders, ADCPs, and acoustic communication systems as discussed in Section 2.4 and under cetaceans in Section 3.5.2.3.1.1. **Table 3.5-7** lists the representative equipment and frequency ranges used in acoustic modeling.

Acoustic signals from echo sounders (ranging from 0.5 kHz to 900 kHz) are likely to be detectable by manatees (whose hearing ranges from approximately 5 kHz to 60 kHz). The ability to detect high frequencies may be an adaptation to shallow water, where the propagation of low-frequency sound is limited. Manatees are known or likely to use the same mid to high frequencies as produced by echo sounders. The adverse impacts of such sound can include behavioral responses (i.e., reactions are expected to be limited to startle or otherwise brief responses of no lasting consequence to the animals) and possibly loss of hearing. Given the directionality and small beam widths, and the intermittent and downward-directed nature of the echo sounder signals, manatee communications are not expected to be masked appreciably and would result in no more than one or two brief exposures to an animal that happened to swim under the vessel. TTS and PTS through exposure to the downward-directed echo sounder sounds are highly unlikely to occur because the probability of a manatee swimming through the area of exposure when an echo sounder emits a sound is small. The animal would have to pass the transducer at close range and be swimming at speeds similar to the vessel in order to be subjected to sound levels that could cause TTS or PTS.

ADCPs produce sound at frequencies between 35 kHz and 1200 kHz. While many ADCPs produce sounds outside of the hearing frequency range of manatees, others produce sounds detectable by manatees (whose hearing ranges from 5 kHz to 60 kHz). The effects of underwater sound from ADCPs on manatees would be similar to those discussed above for echo sounders, although there would potentially be no impacts at all as ADCPs, which can produce lower frequency sound, are usually operated at high to extremely high frequency.

Acoustic communication systems would emit sound in mid-frequency ranges (10s of kHz). The impact of underwater sound on manatees from acoustic communication systems would be similar to but less than that described above for the use of echo sounders because, although acoustic communication systems are omnidirectional, they have lower power, a lower duty cycle, and would be used less frequently than echo sounders.

Quantitative acoustic exposure to marine mammals, including sirenians, from operation of sound sources was modeled for nine sources (see Appendix E). Acoustic modeling was conducted by determining the sound field expected from each source and estimating the number of manatees that may be exposed above sound thresholds for PTS/injury and behavioral disruption during surveys (see Appendix E). To gauge the potential for impacts, received sound levels that may result in PTS/injury or behavioral disruption to the animal were needed. For this study, the current NMFS criteria for both PTS/injury (NMFS, 2018a) and behavioral disruption (84 FR 72308, December 31, 2019) were used (see Appendix E). Methodology for modeling the impacts of active underwater acoustic sources is presented in Appendix E. Additionally, Section 3.5.2.3.1.1 under Cetaceans discusses the assumptions made and the data sources used in the modeling scenarios to predict exposures of marine mammals, including sirenians.

Based on the modeling and taking into account animal behavior, source characteristics, and animal hearing capability, no PTS/injury exposure of manatees is expected to occur; thus, only behavioral disruption exposure is discussed below. Note that the estimated exposures have overall decreased between the Draft PEIS and the Final PEIS for the reasons discussed in Section 3.5.2.3.1.1 under Cetaceans.

3.5.2.3.3.1.1 Behavioral Disruption Exposure Estimates

Behavioral disruption exposure estimates over the five-year period were calculated for sources with operational frequencies within the sirenian hearing frequency range (5 kHz to 60 kHz, see Section 3.5.1.3.1). Behavioral disruption exposure estimates consider that all proposed activities would occur, would expect the highest levels of anticipated animal densities, and do not factor in effects of potential mitigation procedures or animals avoiding the sounds. Summarized total potential behavioral disruption exposure of manatees over five years for all sources, which could occur in two regions, are shown in **Table 3.5-12**. For annual numbers, see Appendix E.

Table 3.5-12. Total Predicted Exposures for Manatees and Time in Seconds Above the Behavioral Disruption Threshold Under Alternative A

Species	Total Exposures*	Average time above 160 dB (s)**
Greater Atlantic Region		
Manatee	226.65	196
Southeast Region***		
Manatee	84.73	196

*Exposures are based on a probabilistic model that is scaled by animal density and may therefore include fractional counts.

**Exposure above threshold over 24 hours.

***Exposure modeling for the Southeast Region was conducted for the Gulf of Mexico and Caribbean.

Under Alternative A, behavioral disruption exposures to sirenians could occur in two regions. Behavioral disruption exposure of manatees could affect up to 312 individuals over the five-year timeframe. However, for the simulated animals exposed above the 160 dB threshold, the average time above threshold is under four minutes (**Table 3.5-12**). The disturbances, therefore, are expected to be transient, and surveys, once completed in an area, would not generally be repeated, thus limiting an individual's behavioral disruption. Behavioral exposures need to occur over the timespan of weeks to have a population level effect on marine mammals, as in the case of seismic surveys that have months' worth of activity (Southall et al., 2016). Any disruption that occurs for a matter of hours or for less than a day would not likely have a population-level impact. Thus, although many individuals of some species could experience behavioral disturbance from NOS acoustic sources, the small increments of time that the animals could be exposed above threshold over five years and over the extensive project area would not be expected to result in population level adverse impacts.

In coordination with NMFS and USFWS, NOS has developed mitigation measures (see Appendix D) to reduce potential impacts of active acoustic sources on marine mammals. NOS would continue to use the lowest power appropriate to perform surveys. NOS would also continue to use PSOs and would employ a robust suite of animal approach restrictions and reduced vessel speeds, described in more detail in Sections 3.5.2.3.3.3 and 3.5.2.3.3.4, as well as the manatee-specific measures to prevent disturbance and harassment.

3.5.2.3.3.1.2 Conclusion

The effects of underwater sound from active acoustic sources on sirenians under Alternative A would continue to be **adverse** and **minor.** No PTS/injury exposure is expected to occur. Some individual animals are expected to experience behavioral disruptions (<312 animals over the five-year timeframe in two regions), but the amount of time they may exceed the behavioral exposure thresholds would be less than four minutes (**Table 3.5-12**). Similarly, the potential for masking would continue to be minimal during surveys because the narrow beams of most active acoustic sources mean animals would not spend much time in ensonified zones. Overall, the potential impacts are likely limited to short-term disruption of acoustic habitat and behavioral patterns. Impacts would be temporary or short-term and would not be considered outside the natural range of variability of manatee populations, their habitats, or the natural processes sustaining them. Impacts could include disruptions of behavioral patterns such as temporary disruption of communication, disturbance of individuals or groups of manatees, and possible displacement of individuals or groups, but without substantial interference to feeding, reproduction, or other biologically important functions affecting population levels. Displacement of manatees from preferred breeding, feeding, or nursery grounds or designated critical habitat would be limited to the project area or its immediate surroundings. Impacts of Alternative A on manatees would continue to be **insignificant**.

3.5.2.3.3.2 Vessel and Equipment Sound

Vessels and equipment used by NOS would generate transitory sound (10 to 10,000 Hz) while in a project area. Manatees hear from low frequencies (< 5 kHz) to above 60 kHz, thus they would be able to hear the low-frequency sound emitted by ship engines and vessel hulls underwater. Especially in the freshwater habitats of their range in Florida (i.e., in rivers, sloughs, marshes, and lakes) manatees are often exposed to considerable levels of background or ambient sound from numerous small and medium-sized boats with outboard and inboard motors.

Vessel sound underwater can cause behavioral disturbance in manatees. However, the occurrence and nature of manatee responses are variable, depending on location, novelty of the sound, vessel behavior, and habitat, among many other factors (see Section 3.5.2.3.1.2 above for discussion of vessel variables). Manatee vocalizations, including chirps and squeaks, range between 0.6 and 16 kHz, although most vocalizations occur between 2.5 and 5 kHz. Sounds may attenuate more quickly in seabed habitat, particularly for sounds at frequencies less than 2 kHz such as the dominant sounds from vessels. Manatees, particularly mothers with calves, may select quieter habitats that attenuate sound, such as seagrass beds that facilitate their ability to tolerate high sound levels while also providing for nutritional needs. The potential for masking by vessel sound is reduced in seagrass foraging habitats. Thus, the potential for masking of manatee sounds is considered minimal, especially when combined with the intermittent nature and short duration of vessel sound. If manatees react briefly to vessels or underwater sounds by minimally changing their behavior or moving a short distance, the impacts of the change are unlikely to be substantial. However, if a sound displaces manatees from an important breeding or feeding area for a prolonged period, impacts on the animals could be more significant.

Impacts from low-frequency underwater sound generated by remotely operated or autonomous vehicles would be similar to those of surface vessels but at a much reduced magnitude due to the far fewer nautical miles of proposed travel (i.e., approximately 518,000 nm [959,000 km] for surface vessels vs. 28,600 nm [53,000 km] for remotely operated and autonomous vehicles over the five-year period across all geographic regions).

Considering that the proposed volume of vessels associated with project activities within the Southeast Region is very small as compared with all other shipping and vessel traffic, and the assumption that individuals or groups of manatees may be familiar with various and common vessel-related sounds, particularly within frequented shipping lanes, the effects of vessel sound on sirenians under Alternative A would continue to be **adverse** and **minor**. Small disruptions of behavioral patterns or displacement of individuals or groups would continue to be temporary or short-term with no life-threatening injury to individual sirenians. Displacement of manatees from preferred breeding, feeding, or nursery grounds, or designated critical habitat would continue to be limited to the project area or its immediate surroundings. Multiple activities in one area could lead to larger magnitudes and more widespread impacts, but they would still continue to be considered **insignificant**. It is also not expected that vessel sound would have any impacts on designated critical habitat.

3.5.2.3.3.3 Vessel Presence and Movement of Equipment in the Water

As with vessel sound, behavioral responses of manatees to vessel presence and movement are also expected to be variable. Manatees have been found to reduce their use of important habitats when continually disturbed by boats in some areas. In other locations, manatee density is higher where there is the greatest boat traffic. They may even adapt to boat disturbance by concentrating their feeding between dusk and dawn when boat traffic and/or fishing activities are low. The presence of vessels used by NOS would not be at levels expected to cause anything more than possible localized and temporary or short-term behavioral changes.

Water disturbance by remotely operated and autonomous vehicles can temporarily disturb and displace nearby manatees. The impact should be minimal, and exposure of individual manatees is likely brief in duration as the ROVs or equipment would quickly pass by; however, impacts could increase if the frequency of disturbance becomes greater. In either case, if displaced, manatees are expected to return to the area and resume normal activities once the water disturbance is no longer present. Equipment such as echo sounders is typically attached to a crewed vessel or a remotely operated or autonomous vehicle, thus effects on manatees due to equipment in the water would occur from the presence and operation of the carriers, rather than from the presence of the equipment itself. ADCPs and acoustic communication systems are often operated from tethered systems, buoys, fixed moorings, or are hull mounted or on remotely operated or autonomous underwater vehicles. As with echo sounders, any effects on manatees would occur from the presence and operation of the vessel, rather than from presence of the equipment itself. Deployment of all autonomous systems, as well as other equipment and divers, would be suspended if any protected species is sighted within 91 m (100 yds) of the vessel. Work already in progress may continue if the activity is not expected to adversely affect the animal.

Sound speed data collection equipment, grab samplers, and drop/towed cameras are lowered and raised through the water column. This movement through the water could temporarily disturb and displace nearby manatees. These impacts would be temporary as manatees are expected to return once water column turbulence ceases. The ropes and wires used to lower a sound speed profiler or to connect a probe to the equipment on a ship can cause entanglements with manatees. However, this is not expected to interfere with manatee movements as, prior to using equipment, NOS would ensure there is at least one PSO observing the area for protected species at all times.

Water disturbance by anchors and chains moving through the water can temporarily disturb and displace nearby manatees. The impact on manatees should be minimal and cease when the anchoring system comes to rest or is taken out of the water. Manatees are expected to return to the area and resume normal activities once water column turbulence ceases. Additionally, anchoring is a relatively infrequent activity, thus any potential impacts are expected to be minimal as they would rarely occur.

An important consideration for all crewed marine vessel operation is the possibility of marine mammal vessel strikes, and the relatively slow-moving manatee, which is often found at or just beneath the water surface, is known to be at great risk of mortality or injury from boat strikes. For example, in Florida the largest known cause of manatee deaths is collisions with the hulls and/or propellers of boats and ships. Ship strikes can lead to death by massive trauma, hemorrhaging, broken bones, or propeller wounds. Massive propeller wounds can be fatal. However, NOS would ensure visual observation during all vessel operations (regardless of size) so as to avoid manatees. Marine mammal strikes by ROVs and autonomous vehicles are of low concern because of their slow speeds, small size, and built-in proximity avoidance systems.

Mitigation measures (see Appendix D) that would avoid or reduce impacts from vessels on manatees include:

- Instructing personnel about the presence of manatees, manatee speed zones, and the need to avoid collisions with and injury to manatees;
- All vessels associated with NOS projects shall operate at “Idle Speed/No Wake” at all times while in the immediate area and while in water where the draft of the vessel provides less than a four-foot clearance from the bottom;
- All vessels will follow routes of deep water whenever possible;
- All in-water operations, including vessels, must be shut down if a manatee(s) comes within 15 m (50 ft) of the operation. Activities will not resume until the manatee(s) has moved beyond the 15-m (50-ft) radius of the project operation, or until 30 minutes elapses if the manatee(s) has not reappeared within 15 m (50 ft) of the operation. Animals must not be herded away or harassed into leaving; and
- Any collision with or injury to a manatee shall be reported immediately.

Since the likelihood of a vessel strike would continue to be very low, the overall effects on manatees from vessel presence and movement of equipment in the water under Alternative A would continue to be **adverse** and **minor**. Small disruptions of behavioral patterns or displacement of individuals or groups would continue to be temporary or short-term with no life-threatening injury to individual manatees. Displacement of manatees from preferred breeding, feeding, or nursery grounds, or designated critical habitat would continue to be limited to the project area or its immediate surroundings. Vessel presence in designated critical habitat could affect the protection capability of the habitat if animals are disturbed, displaced, or injured. Multiple activities in one area could lead to larger magnitudes and more widespread impacts due to vessel operations; however, impacts on manatees and critical habitat would still continue to be considered **insignificant**. In the unlikely event that a vessel strike occurs, its impact would depend on the status of the local manatee population and severity of injury. Although very unlikely, debilitating injury or mortality of one or a few individuals could occur; if population-level impacts are not expected, then impacts would be **moderate**, although it is possible that the magnitude of impacts could be greater since manatees are an ESA-listed species.

3.5.2.3.3.4 Human Activity

Human activity on vessels above the surface of the water would continue to not be expected to have any effects on manatees which live underwater. During SCUBA operations, divers would move through the water column, possibly temporarily disturbing manatees that may be in the area. When using a boat or platform to conduct SCUBA operations, at least one PSO would maintain visual watch for protected species to ensure none are sighted within the working area. If a listed species moves into the work area, cessation of operation of any moving equipment within 15 m (50 ft) of the animal would occur and only resume when the species has left the project area. SCUBA divers involved in in-water activities would have proper training and be capable of responsible dive practices such that they minimize injury to organisms and avoid unnecessary habitat impacts. During all buoy deployment and retrieval operations, buoys would be lowered and raised slowly to minimize risk to listed species. In addition, observers would monitor for listed species in the area prior to and during deployment and retrieval. Work would be stopped if listed species are observed in the area to minimize entanglement risk. Manatees would continue with the activities they were engaged in once divers depart and water column turbulence ceases. Many manatees thrive in areas with heavy human presence and seem relatively undisturbed by human activity around them. The impacts of human activity on manatees under Alternative A would continue to be **adverse** and **negligible** as there would continue to only be minimal disruptions of behavioral patterns and no displacement from preferred breeding, feeding, or nursery grounds, migratory routes, or designated critical habitat. Impacts would therefore be **insignificant**. It is not expected that human activity would have any impacts on designated critical habitat.

3.5.2.3.3.5 Accidental Leakage or Spillage of Oil, Fuel, and Chemicals

Severity of oil, fuel, and chemical spills on manatees depends on the type of contaminant, exposure pathway, and degree of weathering of the substance. Oil and fuel harms manatees via acute toxicity, sublethal health effects that reduce fitness, and disruption of marine communities. In the highly unlikely event of an accidental oil or fuel spill into the marine environment from a vessel used by NOS, manatees may be affected through various pathways: direct contact, inhalation of volatile components, and ingestion (directly or indirectly through the consumption of fouled vegetation). Manatees are expected to be less vulnerable to oil and fuel spills than some other marine mammals due to their lack of insulating fur, and thus their inability to ingest oil by intense fur grooming. A small spill would not be likely to result in the death or life-threatening injury of individual manatees or the long-term displacement of these animals from preferred feeding or breeding habitats. It is expected that spilled oil or fuel would rapidly disperse on the sea surface to a very light sheen and would weather rapidly.

Manatees can be affected indirectly by oil, fuel, and chemical spills through changes in the ecosystem that adversely affect food (vegetation) and habitats, including degradation of water quality. Spills could also affect critical habitat in coastal areas, inland waterways, headwaters, bays, estuaries, and rivers in Florida. Small spills could also make localized areas of critical habitat temporarily unavailable because of disturbance while clean up occurs, or temporarily decrease the value of critical habitat through contamination. However, since it would be highly unlikely that an accidental spill would occur, adverse impacts on critical habitat would be very low.

Such accidents may be caused by equipment malfunction, human error, or natural phenomena and are not expected during the course of NOS operations. In the unlikely event of an accidental spill, there would be very low likelihood for contaminants to make contact with the water because vessel operations personnel are required to respond immediately using established spill response procedures. For example, on NOAA fleet vessels, in the event of an oil, hazardous substance, or marine pollutant spill, the Commanding Officer takes appropriate action to minimize the effects of the spill. OMAO Procedure 0701-06 VRP/SOPEP provides policy and guidance to all NOAA vessels regarding oil pollution emergency planning and response, in accordance with MARPOL 73/78, Annex I. The plan contains all the information and instruction required for responding to shipboard oil spills, such as general spill mitigation and response, shipboard spill mitigation and response, reporting requirements, completing Corrective Action Assessments, trainings, drills, and exercises. This plan has been approved by the USCG, and complies with the Oil Pollution Act of 1990 and Federal Water Pollution Act of 1973.

Since the likelihood of occurrence of an accidental spill from a vessel used by NOS would continue to be very low, impacts on sirenians under Alternative A are expected to be **adverse** and **negligible**. In the event that an accidental spill does occur, the volume of oil, fuel, and/or chemicals would continue to be fairly small given the size of vessels used by NOS and the amounts of fuel and other chemicals they typically carry. Additionally, all hazardous or regulated materials would continue to be handled in accordance with applicable laws, and crew members would continue to be appropriately trained in materials storage and usage. Thus, the impact on sirenians would continue to be **adverse** and **minor** as impacts would continue to be temporary or short-term without any impacts on population levels. Displacement of sirenians that move away to avoid spilled substances would continue to be short-term and limited to the project area or its immediate surroundings. Impacts on sirenians, which are ESA-listed species, including designated critical habitat, would continue to be **insignificant**.

3.5.2.3.3.6 Trash and Debris

Marine debris poses two types of negative impacts on marine mammals: entanglement and ingestion. Entanglement is a far more likely cause of mortality to marine mammals than ingestion. Entanglements occur when cables, lines, nets, or other objects suspended in the water column become wrapped around marine mammals, potentially causing injury, interference with essential behaviors and functions, and possibly mortality. Manatees are known to become entangled in various types of fishing gear and other marine debris. Entanglement was documented as the leading anthropogenic reason for rescue of manatees in Florida between 1993-2012 (Reinert et al., 2017). During proposed activities, numerous cables, lines, and other objects could be towed behind the vessel near the water surface. Although it is possible that such lines and cables could detach from a vessel and become debris in which manatees could get entangled, it is not very likely.

Impacts from discarded trash and debris are expected to be avoided through vessel operators' required compliance with USCG and EPA regulations. In addition, no intentional vessel discharges would occur if a protected species is sighted within 91 m (100 yds) of the vessel used by NOS, and all MARPOL discharge protocols would be followed. Thus, impacts of trash and debris on manatees under Alternative A would continue to be **adverse** and **negligible** as any disturbance of animals would continue to be temporary, no mortality or debilitating injury would be expected, and there would continue to be no displacement from preferred or designated critical habitat. For these reasons, impacts would continue to be **insignificant**. It is also not expected that trash and debris from NOS projects would have any impacts on designated critical habitat.

3.5.2.3.4 Fissipeds

The analysis of impacts on fissipeds considers all of the impact causing factors introduced above. Potential impacts could occur in two of the geographic regions: the West Coast and Alaska regions, as two to three fissiped species, subspecies, or DPS, including ESA-listed species, occur in each region (see Section 3.5.1.4 above). The Alaska Region also includes designated critical habitat for two of the listed species.

3.5.2.3.4.1 Active Underwater Acoustic Sources

Active underwater acoustic sources included in the Proposed Action comprise echo sounders, ADCPs, and acoustic communication systems as discussed in Section 2.4 and under cetaceans in Section 3.5.2.3.1.1. **Table 3.5-7** lists the representative equipment and frequency ranges used in acoustic modeling.

Sound frequencies produced by the echo sounders overlap the range of fissiped hearing and they can presumably hear these sounds if sufficiently close. Acoustic signals from echo sounders (ranging from 0.5 kHz to 900 kHz) are likely to be detectable by fissipeds if the lower end of the sound frequency spectrum is used. Polar bears generally do not dive much below the water surface and they normally swim with their heads above the surface, where sounds produced underwater are weak. Thus, it is very unlikely that polar bears would be exposed to very loud underwater sounds to the point where they might be injured or even disturbed.

Sea otters may be less responsive to underwater sound than other marine mammals, such as cetaceans, since they spend a great deal of time on the water's surface feeding and grooming. While at the surface, the potential exposure of sea otters to underwater sound would be much reduced. Reactions to echo sounders are expected to be limited to startle or otherwise brief responses. Although there could be no lasting consequence to the animals, a startle response may also lead to an abandoned foraging attempt, and possibly multiple foraging attempts. Sea otters require up to 30 percent of their body weight in food every day, even more for females caring for pups, thus the consequences of missed foraging may have lasting consequences to individuals. Although sea otters use the mid to high frequencies produced by echo sounders, masking effects are expected to be negligible due to their use of in-air calls rather than underwater calls.

Acoustic signals from ADCPs (ranging from 35 kHz to 1200 kHz) are not likely to be detectable by polar bears underwater as they generally hear in the less than 25 kHz range. Sea otters, which hear in the less than 38 kHz range, could overlap with the lower end of ADCP signals, although their best hearing sensitivity underwater is less than 26 kHz. There would not be any impacts on polar bears as ADCPs usually produce high to extremely high-frequency sound. Additionally, polar bears tend to spend more time above the water surface than underwater. Sea otters spend between 40 and 60 percent of a 24-hour period foraging underwater (Esslinger et al., 2014; Laidre et al., 2009; Yeates et al., 2007; Tinker et al., 2008), and thus could be affected if the lowest end of the ADCP frequency range is used.

Acoustic communication systems would emit sound in mid-frequency ranges (10s of kHz), and thus could be detectable by fissipeds underwater. The impacts of underwater sound on fissipeds from acoustic communication systems would be similar to but less than that described above for the use of echo sounders because, although acoustic communication systems are omnidirectional, they have lower power, a lower duty cycle, and would be used less frequently than echo sounders. However, there would potentially be no impacts at all on polar bears as they tend to spend more time above the water's surface than underwater. The hearing range of sea otters (<38 kHz) and polar bears (<25 kHz) is on the low side of the potential frequency range; thus, there may be no impacts because sound from acoustic communications systems is above the hearing frequency range of fissipeds.

Quantitative acoustic exposure to marine mammals, including fissipeds, from operation of sound sources was modeled for nine sources (see Appendix E). Acoustic modeling was conducted by determining the sound field expected from each source and estimating the number of fissipeds that may be exposed above sound thresholds for PTS/injury and behavioral disruption during surveys (see Appendix E). To gauge the potential for impacts, received sound levels that may result in PTS/injury or behavioral disruption to the animal were needed. For this study, the current NMFS criteria for both PTS/injury (NMFS, 2018a) and behavioral disruption (84 FR 72308, December 31, 2019) were used (see Appendix E). Methodology for modeling the impacts of active underwater acoustic sources is presented in Appendix E. Additionally, Section 3.5.2.3.1.1 under Cetaceans discusses the assumptions made and the data sources used in the modeling scenarios to predict exposures of marine mammals, including fissipeds.

Based on the modeling and taking into account animal behavior, source characteristics, and animal hearing capability, no PTS/injury exposures of fissipeds are expected to occur; thus, only behavioral disruption exposure is discussed below. Note that the estimated exposures have overall decreased between the Draft PEIS and the Final PEIS for the reasons discussed in Section 3.5.2.3.1.1 under Cetaceans.

3.5.2.3.4.1.1 Behavioral Disruption Exposure Estimates

Behavioral disruption exposure estimates over the five-year period were calculated for sources with operational frequencies within the fissiped hearing frequency range (<200 kHz, see Section 3.5.1.4.1). Behavioral disruption exposure estimates consider that all proposed activities would occur, would expect the highest levels of anticipated animal densities, and do not factor in effects of potential mitigation procedures or animals avoiding the sounds. Summarized total potential behavioral disruption exposure of fissipeds over five years for all sources in the two regions where they could occur are shown in **Table 3.5-13**. For annual numbers, see Appendix E.

Table 3.5-13. Total Predicted Exposures for Fissiped Species and Time in Seconds Above the Behavioral Disruption Threshold Under Alternative A

Species	Total Exposures*	Average time above 160 dB (s)**
Alaska Region		
Sea otter, SE	432.74	124
Sea otter, SC	317.41	124
Polar Bear	54.17	177
West Coast Region		
Sea otter, CA	595.70	124
Sea otter, SE	432.74	124
Sea otters, WA	192.18	124

*Exposures are based on a probabilistic model that is scaled by animal density and may therefore include fractional counts.

**Exposure above threshold over 24 hours.

Under Alternative A, behavioral disruption exposures to fissipeds could occur in two regions. Depending on the species, behavioral disruption exposure of fissipeds could affect up to 55 polar bears and a few hundred sea otters in each region over the five-year timeframe. However, for the simulated animals exposed above the 160 dB threshold, the average time above threshold is under three minutes (**Table 3.5-13**). The disturbances, therefore, are expected to be transient, and surveys, once completed in an area, would not generally be repeated, thus limiting an individual's behavioral disruption. Behavioral exposures need to occur over the timespan of weeks to have a population level effect on marine mammals, as in the case of seismic surveys that have months' worth of activity (Southall et al., 2016). Any disruption that occurs for a matter of hours or for less than a day would not likely have a population-level impact. Thus, although many individuals of some species could experience behavioral disturbance from NOS acoustic sources, the small increments of time that the animals could be exposed above threshold over five years and over the extensive project area would not be expected to result in population level adverse impacts.

In coordination with NMFS and USFWS, NOS has developed mitigation measures (see Appendix D) to reduce potential impacts of active acoustic sources on marine mammals. NOS would continue to use the lowest power appropriate to perform surveys. NOS would also continue to use PSOs and would employ a robust suite of animal approach restrictions and reduced vessel speeds, described in more detail in Sections 3.5.2.3.4.2 and 3.5.2.3.4.3, as well as the polar bear- and sea otter-specific measures to prevent adverse effects on fissipeds.

3.5.2.3.4.1.2 Conclusion

The effects of underwater sound from active acoustic sources on fissipeds under Alternative A would continue to be **adverse** and **minor**. No PTS/injury exposure is expected to occur. While individual animals are expected to experience behavioral disruptions (<55 polar bears and a few hundred sea otters across the two regions over the five-year timeframe), the amount of time they are exposed to sound that exceeds the behavioral exposure threshold would be on average less than three minutes (**Table 3.5-13**). Similarly, the potential for masking would continue to be minimal during surveys because the narrow beams of most active acoustic sources mean animals would not spend much time in ensonified zones. Overall, the potential impacts would likely be limited to short-term disruption of acoustic habitat and behavioral patterns. Impacts would be temporary or short-term and would not be considered outside the natural range of variability of species' populations, their habitats, or the natural processes sustaining them. Impacts could include disruptions of behavioral patterns such as temporary disruption of communication, disturbance of individuals or groups of fissipeds, and possible displacement of individuals or groups, but without substantial interference to feeding, reproduction, or other biologically important functions affecting population levels. Displacement of fissipeds from preferred breeding, feeding, or nursery grounds or designated critical habitat would be limited to the project area or its immediate surroundings. Impacts of Alternative A on fissipeds, including ESA-listed species, would continue to be **insignificant**.

3.5.2.3.4.2 Vessel and Equipment Sound

Vessels and equipment used by NOS would generate transitory sound (10 to 10,000 Hz) into the air and water while in a project area that would allow them to be heard by sea otters, which can hear in the 125 Hz–38 kHz range, with best hearing sensitivity less than 27 kHz in the air and less than 26 kHz underwater. Polar bears generally hear in the less than 25 kHz range underwater and in the range of 14 Hz up to 25 kHz in the air; thus, vessel sound could be heard by polar bears.

Vessel sound in the air and underwater can cause behavioral disturbance in fissipeds. However, the occurrence and nature of fissiped responses are variable depending on location, novelty of the sound, vessel behavior, and habitat, among many other factors (see Section 3.5.2.3.1.2 above for discussion of vessel variables). Short-term behavioral effects are possible during vessel operations, although effects may be reduced for sea otters as they do not appear to rely heavily on underwater communication and spend considerable time out of water. Additionally, masking effects are expected to be negligible in the case of sea otters due to their use of in-air calls rather than underwater calls. Polar bears normally keep their heads above or at the water's surface when swimming, where underwater sound is weak or undetectable, and they generally do not dive much below the water surface (Richardson et al., 1995). Underwater sound would minimally affect polar bears because they are unlikely to hear underwater sound when above the water on ice or on land. Vessel sounds would be at levels not expected to cause anything more than possible localized and temporary behavioral changes in fissipeds.

Impacts from low-frequency underwater sound generated by remotely operated or autonomous vehicles would be similar to those of surface vessels but at a much reduced magnitude due to the far fewer nautical miles of proposed travel for remotely operated and autonomous vehicles as compared to surface vessels (i.e., approximately 518,000 nm [959,000 km] for surface vessels vs. 28,600 nm [53,000 km] for remotely operated and autonomous vehicles over the five-year period across all geographic regions). Reactions to remotely operated and autonomous vehicles are expected to be limited to startle or otherwise brief responses. Although there could be no lasting consequence to the animals, a startle response may also lead to an abandoned foraging attempt, and possibly multiple foraging attempts. Sea otters require up to 30 percent of their body weight in food every day, and even more for females caring for pups, thus the consequences of missed foraging may have lasting consequences to individuals.

Low-flying aircraft used to reach remote areas, especially in Alaska during such projects as tide gauge installation, can disturb fissipeds because of both airborne and underwater sound and visual disturbance. Low altitude flights could disturb polar bears or sea otters resting on ice, on barrier islands, or at coastal haul outs. Denning bears have been known to abandon or depart their dens early in response to repeated sound produced by extensive aircraft overflights (NMFS, 2016a; BOEM, 2015a), although that would not be expected to occur from NOS projects as aircraft use would be infrequent. In response to aircraft overflights, polar bears may initially run away from the area, or dive into the water if on land or ice, but then resume their normal activities within minutes. The effects of fleeing are likely to be minimal if the event is temporary, the animal is otherwise unstressed, and it is a cool day. However, on a warm spring or summer day, a short run may be enough to overheat a polar bear; and a bear already experiencing stress that swims a long distance could require rest for a long period prior to reinitiating essential life functions such as feeding. Additionally, small cubs could become separated from their mothers (USFWS, 2016a).

The visual presence of aircraft alone is unlikely to cause disturbance of sea otters. If sea otters are disturbed, it would more likely be due to the airborne sound. Some otters would likely show startle responses, change direction of travel, or dive. Sea otters reacting to overflights may divert time and attention from biologically important behaviors, such as feeding. In a recent questionnaire study conducted by the USFWS (83 FR 18330, April 26, 2018), respondent sea otter survey biologists indicated that only 26 percent of sea otters located directly below aircraft (flight heights unspecified) reacted to the presence of the aircraft, and only about 10 percent reacted at a distance of 250 m (820 ft) perpendicular to the flight line. Therefore, aircraft overflights are expected to disturb only a fraction of the otters overflown, especially considering their infrequent use by NOS.

Appendix D details the fissiped-specific mitigation measures that have been suggested by USFWS and adopted by NOS to prevent disturbance and harassment of polar bears and sea otters by vessels and aircraft. These measures include:

- Do not operate vessels in such a way as to separate northern sea otters from other members of their group;
- If northern sea otters are observed in groups of fewer than 10 animals, do not approach within 100 m (109 yds). If the group size is greater than 10, do not approach within 500 m (547 yds);
- Ensure that vessels maintain a 1.6 km (1 mi) separation distance from polar bears observed on ice, land, or water;
- If a swimming bear(s) is encountered, allow it to continue unhindered. Never approach, herd, chase, or attempt to lure swimming bear(s). Reduce speed when visibility is low and avoid sudden changes in travel direction;
- Navigate slowly, steer around polar bears, and do not approach, circle, pursue or otherwise force bears to change direction when observed in the water;
- Avoid multiple changes in direction and speed and do not restrict bears' movements on land or sea;
- Do not conduct activities within 1.6 km (1 mi) of known or suspected polar bear dens;
- Maintain an altitude of at least 457 m (1500 ft) when flying within 85 m (0.5 mi) of polar bears;
- Unless taking off from or landing at an airport/airstrip, pilots should maintain a minimum of 457 m (1,500 ft) flight altitude and 0.8-km (0.5-mi) horizontal distance from polar bears in the water, and on ice or land. Avoid circling or turning aircraft near polar bears;
- Maintain an altitude of at least 205 m (1000 ft) when flying over northern sea otters; and

- Avoid disturbing denning bears. Between November and April, special care is needed to avoid disturbance of denning bears. If activities are to take place during that time period, USFWS should be contacted to determine if any additional mitigation is required. In general, activities are not permitted within one mile of known den sites.

Vessel sound would not have any effects on the critical habitat of sea otters. Polar bear critical habitat has characteristics based on feeding and finding prey such as seals. Vessel sound could displace seals from pupping lairs or haul outs, seals could abandon breathing holes, and polar bears could be scared away from seal kills. (Additional discussion of impacts on prey species such as seals can be found in Section 3.5.2.3.3 Pinnipeds). Thus, the ability of critical habitat to provide foraging opportunities to polar bears may be adversely affected. However, it is not expected that impacts on prey species would be substantial, and impacts on critical habitat from vessel sound are likely to be temporary and localized.

Considering that the proposed volume of vessels associated with NOS project activities within the West Coast and Alaska Regions would be very small as compared with all other shipping and vessel traffic, and the assumption that individuals or groups of fissipeds may be familiar with various and common vessel-related sounds, particularly within frequented shipping lanes, the effects of vessel sound on fissipeds under Alternative A would continue to be **adverse** and **minor**. Small disruptions of behavioral patterns or displacement of individuals or groups would continue to be temporary or short-term with no life-threatening injury to individual fissipeds. Displacement of fissipeds from preferred breeding, feeding, or nursery grounds, or designated critical habitat would continue to be limited to the project area or its immediate surroundings. Multiple activities in one area could lead to larger magnitudes and more widespread impacts. However, vessel sound is expected to result in **insignificant adverse** effects on individuals or populations of pinnipeds, including ESA-listed species and designated critical habitat.

3.5.2.3.4.3 Vessel Presence and Movement of Equipment in the Water

The presence of vessels used by NOS and associated project equipment have the potential to disturb polar bears. Reactions and responses of polar bears to vessel presence could range from walking, running, or swimming away, to no response at all. Polar bear encounters could occur anywhere but are most likely to occur near coastal areas. Vessel operations which occur in open water are unlikely to greatly affect polar bears because few polar bears are likely to be present in the water far from shore. However, some vessels have occasionally reported seeing a swimming polar bear in open water (NMFS, 2016a). Swimming can be energetically expensive for polar bears, particularly for bears that engage in long-distance travel between the leading ice edge and land. However, if an encounter between a vessel and a swimming bear occurs, it would most likely result in only a small disturbance (e.g., the bear may change its direction or temporarily swim faster) as the vessel passes the swimming bear. Most disturbance by vessels would likely occur while polar bears are on ice or land. Vessel presence may temporarily disturb small numbers of polar bears resting or foraging on marine mammal carcasses along the coast or on barrier islands. Since vessels used by NOS would not typically be concentrated in any one area for extended periods, any impacts to polar bears would be limited to temporary or short-term disturbances. Polar bears could also be affected indirectly if operation of vessels used by NOS disturbs or scatters their fish or seal prey species.

Sea otters are easily disturbed by human presence and typically respond to an approaching vessel by swimming away from the area (AKDOT, 2006). Such disturbance would be temporary and would only last during a project. Also, the presence of vessels used by NOS would not be at numbers or frequencies expected to cause anything more than possible localized and temporary behavioral changes in sea otters.

Water disturbance by remotely operated and autonomous vehicles can temporarily disturb and displace nearby fissipeds both in the water and on land or ice. The impact should be minimal and likely brief in duration as the ROV or equipment would quickly pass by; however, impacts could increase if the frequency of disturbance becomes greater or if the equipment gets too close to land or ice in locations where fissipeds occur. In either case, if displaced, fissipeds are expected to return to the area and resume normal activities once the disturbance is no longer present. Equipment such as echo sounders is typically attached to a crewed vessel or remotely operated or autonomous vehicle, thus effects on fissipeds would occur from the presence and operation of the carrier rather than from the presence of the equipment itself. ADCPs and acoustic communication systems are often operated from tethered systems, buoys, fixed moorings, or are hull mounted or on remotely operated or autonomous underwater vehicles. As with echo sounders, any effects on fissipeds would occur from the presence and operation of the vessel, rather than from presence of the equipment itself. Deployment of all autonomous systems, as well as other equipment and divers, would be suspended if any protected species is sighted within 91 m (100 yds) of the vessel. Work already in progress may continue if the activity is not expected to adversely affect the animal.

Sound speed data collection equipment, grab samplers, and drop/towed cameras are lowered and raised through the water column. This movement through the water could temporarily disturb and displace nearby fissipeds. These impacts would be temporary as fissipeds are expected to return once water column turbulence ceases or the equipment has departed from the area. The ropes and wires used to lower a sound speed profiler or to connect a probe to the equipment on a ship can cause entanglements with sea otters, but this would be unlikely to occur with polar bears as they spend most of their time on land or ice and generally keep clear of vessels. Sea otters are known to be vulnerable to entanglements with fishing gear, but the tendency of many marine mammals, including sea otters, to avoid approaching vessels (in contrast with their tendency to congregate around fishing vessels) presumably reduces the risk of entanglement. Additionally, prior to using the equipment, NOS would ensure there is at least one PSO observing the area for protected species at all times.

An important consideration for all crewed vessel operation is the possibility of marine mammal vessel strikes. Ship strikes can lead to death by massive trauma, hemorrhaging, broken bones, or propeller wounds. Ship strikes are not known to be a significant cause of sea otter mortality. There is also very little risk of polar bears being injured or killed as a result of ship strikes because of the infrequency of polar bears in open-water areas and their ability to detect and avoid vessels as they approach in the water. Additionally, NOS would ensure visual observation during all vessel operations (regardless of size) so as to avoid polar bears and sea otters. Marine mammal strikes by ROVs and autonomous vehicles are of low concern because of their slow speeds, small size, and built-in proximity avoidance systems.

Polar bears can den on land and on sea ice. The presence of vessels, as well as vessel sound, could disturb bears at den sites, and depending on the timing in the denning cycle, could have varying effects on the female bear and family group. During the early stages of denning, when the pregnant female has limited investment at the site, disturbance could cause her to abandon the site in search of another one. At emergence, cubs are acclimating to their new environment, and the female bear is vigilant to protect her offspring (BOEM, 2015a). Visual and acoustic stimuli may disturb the female to the point of abandoning the den site before the cubs are physiologically ready to move. Also, it is possible that vessels anchoring near ice floes or denning locations could disturb or displace polar bears.

The mitigation measures discussed in Section 3.5.2.3.4.2 for reducing the impacts of vessel and equipment sound on fissipeds also apply for reducing impacts from vessel presence and movement of equipment in the water.

Vessel presence and movement of equipment in the water may affect the critical habitat of both sea otters and polar bears. Prey species of polar bears, such as fish and seals, may be disturbed by vessels and equipment (see discussion in Section 3.7.2 Fish and 3.5.2.3.3 Pinnipeds). This could affect the polar bear, which has critical habitat characteristics based on feeding and finding prey. However, it is not expected that impacts on prey species would be substantial, and thus impacts on critical habitat from vessel presence and movement of equipment are likely to be temporary and localized. Vessel presence is not likely to substantially affect aquatic macroinvertebrates, the main prey species of sea otters (see Section 3.8 Aquatic Macroinvertebrates). However, vessel operations have the potential to disrupt kelp beds, which are a PCE of sea otter critical habitat used for resting and for protection from marine predators.

Since the likelihood of a vessel strike would continue to be very low, the overall effects on fissipeds, including ESA-listed species and designated critical habitat, from vessel presence and movement of equipment in the water under Alternative A would continue to be **adverse** and **minor**. Small disruptions of behavioral patterns or displacement of individuals or groups of fissipeds would continue to be temporary or short-term with no life-threatening injury to individual pinnipeds. Displacement of fissipeds from preferred breeding, feeding, or nursery grounds, or designated critical habitat would continue to be limited to the project area or its immediate surroundings. Multiple activities in one area could lead to larger magnitudes and more widespread impacts due to vessel operations; however, impacts would still continue to be considered **insignificant**. In the unlikely event that a vessel strike occurs, its impact would depend on the population status of the species affected. Although very unlikely, debilitating injury or mortality of one or a few individuals could occur; if population-level impacts are not expected, then impacts would be **moderate**, although the magnitude of impact could be greater if an ESA-listed species is affected. Additionally, if polar bears are disturbed at denning sites, impacts on both animals and critical habitat designated to protect denning areas could be **moderate** as there could be extended displacement of individuals from preferred breeding habitat and/or designated critical habitat, but the continued viability of the population would not be threatened.

3.5.2.3.4.4 Human Activity

Human activity could affect fissipeds primarily during activities on land, such as tide gauge and shore-based reference station installation maintenance, and removal. Sound and movement from human activity onboard vessels could also affect fissipeds that are on land or ice; however, the sound and presence from the vessels themselves would likely be the greater cause of impacts, as discussed above.

Onshore human activity during tide gauge installation and shore-based GPS reference station installation could temporarily disturb and displace any polar bears in the area; it is not expected that sea otters would be affected by onshore activities. Female polar bears denning within approximately 1.6 km (1 mile) of an onshore activity could be disturbed by sound. Disturbance of females in maternity dens could result in either abandonment of the cubs or premature exposure of cubs to the elements, resulting in mortality (see discussion above in Section 3.5.2.3.4.3 on disturbance of polar bears at denning sites).

Since polar bears are curious, there is the potential for human-bear interactions during tide gauge and GPS reference station installation, potentially resulting in injury or mortality of both bears and humans. NOS would follow human/bear interaction guidelines as issued by USFWS.

Occasionally, there could be some disturbance or displacement of nearby polar bears due to sound and activity if field personnel need to conduct maintenance in such situations as when a buoy breaks its mooring, a tide gauge stops sending messages, or batteries need to be recharged. Additionally, in remote areas reached by boat or aircraft, impacts on polar bears could occur and would be similar to those for tide gauge installation and described above in Sections 3.5.2.3.4.2 and3.5.2.3.4.3 for vessel sound and vessel presence. Sound and activity from tide gauge and shore-based GPS reference station removal could cause temporary or short-term localized disturbance and changes in behavior of nearby polar bears, similar to tide gauge installation. In addition, shore/coastal habitat could be disturbed or altered as a small area of ground would be covered by a GPS reference station. Although this could affect polar bear habitat, it is not likely that the disturbance would be large enough to alter the habitat to the point where polar bears would no longer use the site. Mitigation measures that would minimize adverse impacts on polar bears from the use of aircraft are discussed in Section 3.5.2.3.4.2.

During SCUBA operations, divers would move through the water column, possibly temporarily disturbing sea otters that may be in the area; it is very unlikely that SCUBA would occur near a polar bear. Sea otters would continue with the activities they were engaged in once divers depart and water column turbulence ceases. When using a boat or platform to conduct SCUBA operations, at least one PSO would maintain visual watch for protected species to ensure none are sighted within the working area. If a listed species moves into the work area, cessation of operation of any moving equipment within 15 m (50 ft) of the animal would occur and only resume when the species has left the project area. SCUBA divers involved in in-water activities would have proper training and be capable of responsible dive practices such that they minimize injury to organisms and avoid unnecessary habitat impacts. During all buoy deployment and retrieval operations, buoys would be lowered and raised slowly to minimize risk to listed species. In addition, observers would monitor for listed species in the area prior to and during deployment and retrieval. Work would be stopped if listed species are observed in the area to minimize entanglement risk.

Overall, the impacts of human activity on fissipeds, including ESA-listed species, under Alternative A would continue to be **adverse** and **minor** as there would continue to be only small disruptions of behavioral patterns and any displacement would continue to be limited to the project area or immediate surroundings. Impacts would thus be **insignificant**. It is not expected that human activity would impact designated critical habitat where the locations for tide gauges and GPS reference stations would continue to be located away from critical habitat areas. However, if polar bears are disturbed at denning sites, impacts on both animals and critical habitat designated to protect denning areas could be **moderate** as there could be extended displacement of individuals from preferred breeding habitat and/or designated critical habitat, but the continued viability of the population would not be threatened. Additionally, if polar bear-human interactions occur, impacts could also be **moderate**, although population-level impacts would not be expected.

3.5.2.3.4.5 Accidental Leakage or Spillage of Oil, Fuel, and Chemicals

Severity of oil, fuel, and chemical spills on fissipeds depends on the type of contaminant, exposure pathway, and degree of weathering of the substance. Oil and fuel harm fissipeds via acute toxicity, sublethal health effects that reduce fitness, and disruption of marine communities. In the highly unlikely event of an accidental oil or fuel spill into the marine environment from a vessel used by NOS, sea otters and polar bears would be particularly vulnerable due to their reliance on fur to maintain body heat. Polar bears could be exposed to oil while swimming or coming ashore onto impacted beaches. Sea otters are susceptible to oiling because they depend on the insulation of dense fur to keep warm and may ingest oil during grooming and feeding (AKDOT, 2006). Once oiled, sea otters quickly become hypothermic as oil compromises the insulative property of their fur. Oiling of polar bear fur reduces its insulation value, causes irritation or damage to the skin, and may further contribute to impaired thermoregulation (USFWS, 2016a). Both species can be adversely impacted by inhaling volatile oil and fuel components and through ingestion while grooming, resulting in gastrointestinal disorders. Polar bears could also ingest oil while grooming and feeding on oiled seals (ringed and bearded seals are the primary prey of polar bears) or scavenging oiled carcasses. However, a small spill would not be likely to result in death or life-threatening injuries, and the risk of fissipeds being exposed to oil and fuel spills would be very low.

Fissipeds can also be affected indirectly by oil, fuel, and chemical spills through changes in the ecosystem that adversely affect prey species and habitats, including degradation of water quality. This could also affect critical habitat areas designated for feeding and foraging characteristics for sea otters and polar bears as both of them prey on species that could be impacted by accidental spills. Small spills could also make localized areas of critical habitat temporarily unavailable because of disturbance while cleanup occurs, or temporarily decrease the value of critical habitat through contamination. However, since it would be highly unlikely that an accidental spill would occur, adverse impacts on prey and habitat, including critical habitat, would be very low.

Such accidents may be caused by equipment malfunction, human error, or natural phenomena and are not expected during the course of NOS operations. In the unlikely event of an accidental spill, there would be very low likelihood for contaminants to make contact with the water because vessel operations personnel are required to respond immediately using established spill response procedures. For example, on NOAA fleet vessels, in the event of an oil, hazardous substance, or marine pollutant spill, the Commanding Officer takes appropriate action to minimize the effects of the spill. OMAO Procedure 0701-06 VRP/SOPEP provides policy and guidance to all NOAA vessels regarding oil pollution emergency planning and response, in accordance with MARPOL 73/78, Annex I. The plan contains all the information and instruction required for responding to shipboard oil spills, such as general spill mitigation and response, shipboard spill mitigation and response, reporting requirements, completing Corrective Action Assessments, trainings, drills, and exercises. This plan has been approved by the USCG, and complies with the Oil Pollution Act of 1990 and Federal Water Pollution Act of 1973.

Since the likelihood of occurrence of an accidental spill from a vessel used by NOS would continue to be very low, impacts on fissipeds under Alternative A are expected to be **adverse** and **negligible**. In the event that an accidental spill does occur, the volume of oil, fuel, and/or chemicals would continue to be fairly small given the size of vessels used by NOS and the amounts of fuel and other chemicals they typically carry. Additionally, all hazardous or regulated materials would continue to be handled in accordance with applicable laws, and crew members would continue to be appropriately trained in materials storage and usage. Thus, the impact on fissipeds would continue to be **adverse** and **minor** as impacts would continue to be temporary or short-term without any impacts on population levels. Displacement of fissipeds that move away to avoid spilled substances would continue to be short-term and limited to the project area or its immediate surroundings. Impacts on fissipeds, including ESA-listed species and designated critical habitat, would continue to be **insignificant**.

3.5.2.3.4.6 Trash and Debris

Marine debris poses two types of negative impacts on marine mammals: entanglement and ingestion. Entanglement is a far more likely cause of mortality to marine mammals than ingestion. Entanglements occur when cables, lines, nets, or other objects suspended in the water column become wrapped around marine mammals, potentially causing injury, interference with essential behaviors and functions, and possibly mortality. During proposed activities, numerous cables, lines, and other objects could be towed behind the vessel near the water surface. Although it is possible that such lines and cables could detach from a vessel and become debris in which fissipeds could get entangled, it is not very likely. It is not expected that polar bears would be susceptible to entanglement since they spend most of their time on land or ice. Conversely, sea otters are known to be vulnerable to entanglements, particularly with fishing gear; however, the likelihood of vessels used by NOS producing debris in which they could become entangled is low.

Impacts from discarded trash and debris are expected to be avoided through vessel operators' required compliance with USCG and EPA regulations. In addition, no intentional vessel discharges would occur if a protected species is sighted within 91 m (100 yds) of the vessel used by NOS, and all MARPOL discharge protocols would be followed. Thus, impacts of trash and debris on fissipeds, including ESA-listed species, under Alternative A would continue to be **adverse** and **negligible** as any disturbance of animals would continue to be temporary, no mortality or debilitating injury would be expected, and there would continue to be no displacement from preferred or designated critical habitat; thus, impacts would continue to be **insignificant**. It is also not expected that trash and debris would have any impacts on designated critical habitat.

3.5.2.3.4.7 Air Emissions

Since the pre-industrial era, increased emissions of anthropogenic GHGs (CO_2, CH_4, and N_2O) have resulted in higher atmospheric concentrations of these gases and have influenced atmospheric, terrestrial, and oceanic conditions (Limpinsel et al., 2017). Smokestack and two-stroke outboard motor emissions from vessels would release air pollutants. The type and amount of air emissions from vessels used by NOS would depend on the type of fuel, engine, and engine efficiency. Fissipeds may be exposed to smokestack or outboard motor emissions when breathing the air; however, such emissions would be temporary and ephemeral as they would dissipate rapidly into the air and may not reach animals on land or ice.

Burning fossil fuels pollutes not just the air but also the oceans as the waters absorb carbon dioxide, which lowers the pH of surface waters and leads to acidification. Changes in seawater carbon chemistry, in particular interference with the formation of $CaCO_3$ in marine shells and skeletons, may affect marine biota through a variety of biochemical, physiological, and physical processes. Furthermore, the amount of emissions from vessels used by NOS would continue to be a very small fraction as compared to emissions from all other vessel activity in the oceans. Thus, impacts on fissipeds, including ESA-listed species and designated critical habitat, from air emissions under Alternative A are expected to be **adverse** and **negligible** as there would continue to be no disturbance of communication or behavior, no displacement, and no debilitating injury of individuals; thus, impacts would continue to be **insignificant**.

3.5.2.3.5 Conclusion

Since the effects of impact causing factors on marine mammals range from negligible to minor, the overall impact of Alternative A on marine mammals, including ESA-listed species and designated critical habitat, would continue to be **adverse** and **minor**; thus, impacts of Alternative A would continue to be **insignificant**.

3.5.2.4 Alternative B: Conduct Surveys and Mapping for Coastal and Marine Data Collection with Equipment Upgrades, Improved Hydroacoustic Devices, and New Tide Stations

As under Alternative A, impacts of Alternative B are considered for the same impact causing factors for each type of marine mammal (cetaceans, pinnipeds, sirenians, and fissipeds). Under Alternative B, all of the activities and equipment operations proposed in Alternative A would continue but at a higher level of effort, although the percentage of nautical miles covered by project activities in each region would be the same as under Alternative A. Thus, the greatest number of nautical miles surveyed each year would be in the Southeast Region (approximately 47 percent of the survey effort). The level of effort in the other four regions would be at similar levels (approximately 10 percent of the survey effort in each region), although slightly greater in the Alaska Region where the percentage of survey effort would be approximately 18 percent (see **Table 3.5-14**). In general, it is expected that level of effort and overall impacts trend together (i.e., greater impacts where the survey effort is higher), but there are other factors, such as location and depth of surveys, sound production and hearing frequency of the animals, and population density of marine mammals, that add nuance to this trend. Overall, NOS projects would comprise a very small part of all ocean activities as vessels used by NOS would represent a very small proportion of all vessel traffic in the action area (as discussed in Section 2.4.1). Additionally, whenever possible, the location and timing of a given project would be purposefully coordinated to ensure that areas are not repeatedly surveyed. This ensures that the potential environmental impacts directly resulting from NOS projects would not be exacerbated by repeated projects within a given area.

Projects under Alternative B would take place in the same geographic areas and timeframes as under Alternative A; however, Alternative B would include more projects and activities, and thus more nautical miles traveled, than Alternative A. Under Alternative B, NOS projects would cover a total of 2,896,712 nm (5,364,710 km) across all five regions over the five-year period (note that survey effort in the Great Lakes is not included as no marine mammals occur there). Overall, vessels used by NOS would cover an additional 263,337 nm (487,701 km) under Alternative B (see **Table 3.5-14**) as compared to Alternative A (2,633,374nm [4,877,009 km] total) across all regions over the five-year period.

Table 3.5-14. Survey Effort under Alternative B, by Geographic Region by Year

Region	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Survey Effort (in nautical miles)						
Greater Atlantic Region (without Great Lakes)	66,904	116,333	56,068	51,603	51,603	342,512
Southeast Region	242,369	231,204	288,695	309,906	309,906	1,382,080
West Coast Region	65,514	63,700	61,571	64,024	64,024	318,833
Alaska Region	103,258	131,971	191,890	45,485	45,460	518,064
Pacific Islands Region	77,231	60,390	76,716	60,443	60,443	335,223

The types and mechanisms of impacts would remain the same in Alternative B as discussed for Alternative A. Therefore, in general, the difference between the two alternatives is a matter of scale with an increased activity level, although distributed unevenly among the different types of activities, leading to a corresponding, incremental increase in effects under Alternative B as compared to Alternative A. Section 2.5 discusses the differences between Alternatives A and B, and **Table 2.6-1** provides a comparison of annually planned and performed NOS projects and activities. While the total number of activities increases by approximately 10 percent between Alternatives A and B, the numbers for individual activities do not increase uniformly. For example, the number of nautical miles for crewed vessel operations increases by 11 percent from Alternative A to B; however, the number of nautical miles using ADCPs increases by 90 percent, and ROV use increases by 202 percent.

Under Alternative B there would be projects using crewed vessel operations covering 577,000 nm (1,070,000 km), as compared to 518,000 nm (959,000 km) under Alternative A. Vessel operations could contribute to impacts on marine mammals related to vessel and equipment sound, vessel presence and movement, accidental spills, trash and debris, and air emissions. Although the amount of crewed vessel operations would be greater under Alternative B than under Alternative A, additional projects over 59,000 nm (111,000 km) across five regions would result in greater impacts overall, but not so great that the magnitude of a particular impact causing factor would increase (e.g., from negligible to minor). The increase in use of active underwater acoustic equipment and ROVs would be more pronounced than increases in other activities. Projects involving echo sounders, ADCPs, and acoustic communication systems would increase under Alternative B as compared to Alternative A. This reflects the increased use of technology under Alternative B and is a greater increase than for other activities on a percentage basis, but overall, the increase is still not very high, especially as compared to the extent of the action area.

3.5.2.4.1 Cetaceans

Impacts of Alternative B on cetaceans, including ESA-listed species and designated critical habitat, would be the same or slightly, but not appreciably, larger than those under Alternative A for the following impact causing factors: vessel and equipment sound; vessel presence and movement of equipment in the water; human activity; accidental leakage or spillage of oil, fuel, and chemicals; and trash and debris. Although the impacts of active underwater acoustic sources would also be similar under Alternative B as under Alternative A, they are discussed in detail below because the impacts of underwater sound on marine mammals are of main concern and to show the modeled increase in PTS/injury exposures and behavioral disruption exposures of cetaceans from the projected increase in the use of echo sounders, ADCPs, and acoustic communication systems (see Appendix E).

3.5.2.4.1.1 Active Underwater Acoustic Sources

As with Alternative A, active underwater acoustic sources under Alternative B would include echo sounders, ADCPs, and acoustic communication systems as described in Section 2.4. Descriptions of all active sources considered in this study can be found in Appendix E; the representative sources used in exposure modeling are the same as described in Alternative A and listed in **Table 3.5-7**.

The active underwater acoustic sources were evaluated in the same way under Alternative B as for Alternative A. Quantitative acoustic exposure to marine mammals, including cetaceans, from operation of sound sources was modeled for nine sources (see Appendix E). Acoustic modeling was conducted by determining the sound field expected from each source and estimating the number of marine mammals that may be exposed above sound thresholds for PTS/injury and behavioral disruption during surveys (see Appendix E for more information). To gauge potential for impact, received sound levels that may result in PTS/injury or behavioral disruption to the animal were needed. For this study, the current NMFS criteria for both PTS/injury (NMFS, 2018a) and behavioral disruption (84 FR 72308, December 31, 2019) were used (see Appendix E). Additionally, Section 3.5.2.3.1.1 under Alternative A for cetaceans discusses the assumptions made and the data sources used in the modeling scenarios to predict exposures of marine mammals.

Summarized total potential PTS/injury exposures over five years for all sources for cetaceans in each region are shown in **Table 3.5-15** (no PTS/injury exposure was predicted for any species in the Pacific Islands Region). Note that the estimated exposures have overall decreased between the Draft PEIS and the Final PEIS for the reasons discussed in Section 3.5.2.3.1.1 under Alternative A. Summarized total potential behavioral disruption exposures of cetaceans for all sources in each region are shown in **Table 3.5-17**. For annual numbers, see Appendix E. Species that may be in the area but for which no impacts were predicted are not included in the tables. Discussion of how PTS/injury exposures and behavioral disruption exposures were modeled and calculated can be found in Sections 3.5.2.3.1.1.1 and 3.5.2.3.1.1.2 and in Appendix E.

Table 3.5-15. Total Predicted Exposures for Cetacean Species and Range Accounting for 95 Percent of Exposure Above PTS Threshold Under Alternative B

Species	Total Exposures*	Exposure Range (m)
Southeast Region**		
Dwarf sperm whale	3.17	35
Pygmy sperm whale	2.37	35
Greater Atlantic Region		
Harbor porpoise	14.57	34
Dwarf sperm whale	1.18	32
Pygmy sperm whale	0.15	32
West Coast Region		
Dall's porpoise	6.78	24
Harbor porpoise	6.01	28
Alaska Region		
Harbor porpoise	4.96	27
Dall's porpoise	4.33	20

*Exposures are based on a probabilistic model that is scaled by animal density and may therefore include fractional counts.

**Exposure modeling for the Southeast Region was conducted for the Gulf of Mexico.

Under Alternative B, PTS/injury exposures to high-frequency cetaceans could occur in four of the five regions with ranges to exposures in the simulations ~30 m (~100 ft). High-frequency cetaceans (Dall's and harbor porpoises, and dwarf and pygmy sperm whales) have been shown to be more sensitive to sounds than other cetacean species, and therefore have comparatively low thresholds for PTS/injury exposures (NMFS, 2018a). Compared to Alternative A, use of underwater acoustic sources under Alternative B would continue at a higher level of effort. Over the five-year timeframe, a total of up to five additional animals would be exposed above the PTS/injury threshold across four regions under Alternative B as compared to Alternative A. Such small increases in animals exposed above threshold over the extensive project area and over five years would not be expected to result in population level adverse impacts, particularly as supported by the comparison to PBR levels (see Section 3.5.2.3.1.1.1 for discussion and **Table 3.5-16**).

Table 3.5-16. Comparison of Exposure Above PTS Threshold for Cetacean Species Under Alternative B with Current Potential Biological Removal (PBR) Levels

Species	Total Exposures	Average Annual Exposures	PBR Levels*
Southeast Region			
Dwarf sperm whale	3.17	0.63	2.5**
Pygmy sperm whale	2.37	0.47	2.5**

Species	Total Exposures	Average Annual Exposures	PBR Levels*
Greater Atlantic Region			
Harbor porpoise	14.57	2.91	851
Dwarf sperm whale	1.18	0.24	46
Pygmy sperm whale	0.15	0.03	46
West Coast Region			
Dall’s porpoise	6.78	1.36	99***
Harbor porpoise	6.01	1.20	35 to 349****
Alaska Region			
Harbor porpoise	4.96	0.99	2.2 to 11*****
Dall's porpoise	4.33	0.87	131

*Sources for PBR Levels: Carretta et al., 2022; Hayes et al., 2022; and Muto et al., 2021

**Differs from PBR levels reported in the Draft PEIS due to numbers presented in the Draft PEIS for incorrect stock.

***Differs from PBR levels reported in the Draft PEIS due to changes between the 2019 and the 2021 SARs.

****PBR levels for harbor porpoise in the West Coast Region is shown as the range across six stocks.

**** PBR levels for the Southeast Alaska stock; PBR levels are undetermined for the Gulf of Alaska and Bering Sea stocks.

Table 3.5-17. Total Predicted Exposures for Cetacean Species and Time in Seconds Above the Behavioral Disruption Threshold Under Alternative B

Species	Total Exposures*	Average time above 160 dB (s)**
Alaska Region		
Pacific white-sided dolphin	944.80	63
Beluga whale	281.66	85
Harbor porpoise	94.21	88
Dall’s porpoise	89.91	69
Common minke whale	65.30	47
Bowhead whale	64.79	53
Humpback whale, Central North Pacific	48.76	95
Resident killer whale	37.79	58
Fin whale	30.83	50
Transient killer whale	25.06	58
Beluga, Cooke Inlet	14.02	85
Humpback whale, Western North Pacific	5.35	95
Gray whale	1.83	51
Sperm whale	0.15	56
North Pacific right whale	0.03	53

Species	Total Exposures*	Average time above 160 dB (s)**
Southeast Region* **		
Atlantic spotted dolphin	1,068.80	56
Common bottlenose dolphin	652.30	89
Pantropical spotted dolphin	412.28	52
Clymene dolphin	137.02	52
Rough-toothed dolphin	74.56	75
Spinner dolphin	72.21	58
Risso’s dolphin	64.43	69
Striped dolphin	39.64	50
False killer whale	39.49	55
Pilot whale, short finned	20.62	60
Pilot whale, long finned	20.28	60
Pygmy sperm whale	19.70	52
Pygmy killer whale	17.68	52
Sperm whale	15.59	64
Melon-headed whale	15.59	50
Dwarf sperm whale	12.35	52
Fraser’s dolphin	9.58	50
Blainville beaked whale	8.97	67
Gervais’ beaked whale	8.97	67
Mesoplodont beaked whales (all)	8.97	67
Cuvier’s beaked whale	2.78	64
Transient killer whale	2.45	58
Rice’s whale	0.81	82
Greater Atlantic Region		
Short-beaked common dolphin	2,949.76	102
Atlantic white-sided dolphin	2,189.32	101
Atlantic spotted dolphin	1,219.79	89
Common bottlenose dolphin	1,095.20	184
Harbor porpoise	716.00	55
Risso’s dolphin	490.49	112
Pilot whale, long finned	340.51	63
Pilot whale, short finned	217.60	63
Fin whale	189.84	98
Humpback whale	94.53	97
Common minke whale	105.75	101
Cuvier’s beaked whale	58.87	55
Dwarf sperm whale	58.12	57
Rough-toothed dolphin	51.96	110
Gervais beaked whale	44.52	55

Species	Total Exposures*	Average time above 160 dB (s)**
Sowerby's beaked whale	44.52	55
Blainville beaked whale	44.52	55
True's beaked whale	44.52	55
Mesoplodont beaked whales (all)	44.52	55
Striped dolphin	22.74	50
Sperm whale	17.21	50
Pantropical spotted dolphin	17.47	62
Sei whale	15.16	98
North Atlantic right whale	14.37	62
Melon-headed whale	9.24	50
Pygmy sperm whale	8.06	57
Clymene dolphin	5.10	100
Fraser's dolphin	3.90	38
False killer whale	3.11	64
White-beaked dolphin	2.75	83
Spinner dolphin	1.66	41
Northern bottlenose whale	0.64	42
Bryde's whale	0.41	112
Blue whale	0.06	43
West Coast Region		
Short-beaked common dolphin	27,131.09	55
Long-beaked common dolphin	18,138.00	82
Pacific white-sided dolphin	7,176.51	67
Striped dolphin	4,412.32	25
Northern right whale dolphin	2,753.60	25
Gray whale	2,591.46	51
Risso's dolphin	304.75	66
Common bottlenose dolphin	278.03	110
Humpback whale, Central America	241.77	128
Common minke whale	206.62	51
Fin whale	151.52	62
Dall's porpoise	141.78	75
Harbor porpoise	122.12	96
Mesoplodont beaked whales (all)	80.60	26
Sperm whale	39.68	29
Blue whale	75.72	27
Humpback whale, Central North Pacific	48.76	95
Cuvier's beaked whale	36.24	33
Baird's beaked whale	36.10	55
Sei whale	28.10	62

Species	Total Exposures*	Average time above 160 dB (s)**
Offshore killer whale	24.26	64
Transient killer whale	23.94	64
Resident killer whale	22.18	64
Pilot whale, short finned	19.00	82
Humpback whale, Western North Pacific	5.35	95
Pacific Islands Region		
Pygmy sperm whale	12,435.84	63
Rough-toothed dolphin	12,412.61	71
Striped dolphin	8,719.21	55
Pantropical spotted dolphin	4,076.24	62
Fraser's dolphin	3,468.50	50
Pygmy killer whale	1,177.85	64
False killer whale	432.27	56
Risso's dolphin	111.72	69
Common bottlenose dolphin	71.34	112
Spinner dolphin	51.72	84
Humpback whale, Central North Pacific	48.76	95
Melon-headed whale	37.82	59
Pilot whale, short finned	28.00	62
Humpback whale, Western North Pacific	5.35	95
Bryde's whale	4.94	70
Sperm whale	4.31	67
Longman's beaked whale	2.91	54
Cuvier's beaked whale	2.87	54
Sei whale	2.74	75
Fin whale	1.84	75
Blainville beaked whale	1.46	55
Resident killer whale	0.77	56
Transient killer whale	0.77	56
Blue whale	0.23	54

*Exposures are based on a probabilistic model that is scaled by animal density and may therefore include fractional counts.

**Exposure above threshold over 24 hours.

***Exposure modeling for the Southeast Region was conducted for the Gulf of Mexico.

Under Alternative B, behavioral disruption exposures to cetaceans could occur in all five regions. Compared to Alternative A, use of underwater acoustic sources under Alternative B would occur at a higher level of effort. Depending on the species, behavioral disruption exposure of cetaceans under Alternative B could increase from one to a few thousand animals in each region over the five-year timeframe as compared to Alternative A. However, for the simulated animals exposed above the 160 dB threshold, the average amount of time an individual receives sound levels above the behavioral threshold remains less than two minutes, and often less than one minute. The disturbances, therefore, are expected to be transient, and surveys, once completed in an area, would not generally be repeated, thus limiting an individual's behavioral disruption. Behavioral exposures need to occur over the timespan of weeks to have a population level effect on marine mammals, as in the case of seismic surveys that have months' worth of activity (Southall et al., 2016). Any disruption that occurs for a matter of hours or for less than a day would not likely have a population-level impact. Thus, although many individuals of some species could experience behavioral disturbance from NOS acoustic sources, the small increments of time that the animals are exposed above threshold over five years and over the extensive project area would not be expected to result in population level adverse impacts.

In coordination with NMFS and USFWS, NOS has developed mitigation measures to reduce potential impacts of active acoustic sources on marine mammals (as discussed in Section 3.5.2.3.1.1 under Alternative A, and see Appendix E).

The potential impacts of Alternative B on cetaceans include injury exposures in the form of hearing loss (PTS), but such injury would be rare and confined to a few high-frequency cetaceans in four regions (from six animals in the Southeast Region up to 15 animals in the Greater Atlantic Region over the five-year timeframe, see **Table 3.5-15**). While more individual animals are expected to experience behavioral disruptions than injury (on the order of tens of thousands of animals across all five regions over the five-year timeframe), the amount of time individuals may exceed the behavioral threshold would be on average less than two minutes (**Table 3.5-17**). Similarly, the potential for masking would be minimal during surveys because the narrow beams of most active acoustic sources mean animals would not spend much time in ensonified zones. Overall, the potential impacts are likely limited to short-term disruption of acoustic habitat and behavioral patterns. Although both PTS/injury and behavioral disruption exposure of cetaceans would be higher under Alternative B than under Alternative A, the effects of underwater sound from active acoustic sources on cetaceans under Alternative B would still be **adverse** and **minor** because impacts would be temporary or short-term and would not be considered outside the natural range of variability of species' populations, their habitats, or the natural processes sustaining them. Impacts could include disruptions of behavioral patterns such as temporary disruption of communication and/or echolocation, disturbance of individuals or groups of cetaceans, and possible displacement of individuals or groups, but without substantial interference to feeding, reproduction, or other biologically important functions affecting population levels. Displacement of cetaceans from preferred breeding, feeding, or nursery grounds, migratory routes, or designated critical habitat would be limited to the project area or its immediate surroundings. Impacts of Alternative B on cetaceans, including ESA-listed species, would be **insignificant**.

3.5.2.4.2 Pinnipeds

Impacts of Alternative B on pinnipeds, including ESA-listed species and designated critical habitat, would be the same or slightly, but not appreciably, larger than those under Alternative A for the following impact causing factors: vessel and equipment sound; vessel presence and movement of equipment in the water; human activity; accidental leakage or spillage of oil, fuel, and chemicals; trash and debris; and air emissions. Although the impacts of active underwater acoustic sources would also be similar under Alternative B as under Alternative A, they are discussed below because the impacts of underwater sound on marine mammals are of main concern and to show the modeled increase in behavioral disruption exposures of pinnipeds from the projected increase in the use of echo sounders, ADCPs, and acoustic communication systems (see Appendix E).

3.5.2.4.2.1 Active Underwater Acoustic Sources

As with Alternative A, active underwater acoustic sources under Alternative B would include echo sounders, ADCPs, and acoustic communication systems as described in Section 2.4. Descriptions of all active sources considered in this study can be found in Appendix E, Technical Acoustic Analysis of Oceanographic Surveys; the representative sources used in exposure modeling are the same as described in Alternative A and listed in **Table 3.5-7**. Since Alternative B involves improvements in techniques and technology with an increased use of underwater acoustic sources, the behavioral disruption exposure estimates are higher than under Alternative A.

The active underwater acoustic sources were evaluated in the same way under Alternative B as for Alternative A. Quantitative acoustic exposure to marine mammals, including pinnipeds, from operation of sound sources was modeled for nine sources (see Appendix E). Acoustic modeling was conducted by determining the sound field expected from each source and estimating the number of pinnipeds that may be exposed above sound thresholds for PTS/injury and behavioral disruption during surveys. To gauge potential for impact, received sound levels that may result in PTS/injury or behavioral disruption to the animal were needed. For this study, the current NMFS criteria for both PTS/injury (NMFS, 2018a) and behavioral disruption (84 FR 72308, December 31, 2019) were used (see Appendix E). Methodology for modeling the impacts of active underwater acoustic sources is presented in Appendix E. Additionally, Section 3.5.2.3.1.1 under Cetaceans discusses the assumptions made and the data sources used in the modeling scenarios to predict exposures of marine mammals, including pinnipeds.

Based on the modeling, and taking into account animal behavior, source characteristics, and animal hearing capability, no PTS/injury exposures of pinnipeds is expected to occur. Note that the estimated exposures have overall decreased between the Draft PEIS and the Final PEIS for the reasons discussed in Section 3.5.2.3.1.1 under Cetaceans. Summarized total potential behavioral disruption exposures of pinnipeds over five years for all sources are shown in **Table 3.5-18**. For annual numbers, see Appendix E. Species that may be in the area but for which no impacts were predicted are not included in the tables. Discussion of how behavioral disruption exposure was modeled and calculated can be found in Section 3.5.2.3.2.1.1 and in Appendix E.

Table 3.5-18. Total Predicted Exposures for Pinniped Species and Time in Seconds Above the Behavioral Disruption Threshold Under Alternative B

Species	Total Exposures*	Average time above 160 dB (s)**
Alaska Region		
Northern fur seal***	23,136.32	138
Spotted seal	11,028.62	104
Harbor seal	7,826.85	104
Northern elephant seal***	6,635.49	118
Bearded seal	1,596.14	104
Ribbon seal	1,537.25	104
Ringed seal	1,213.36	104
Walrus	652.52	95
Steller sea lion***	513.13	104

Species	Total Exposures*	Average time above 160 dB (s)**
Greater Atlantic Region		
Harp seal	669.17	174
Gray seal	541.65	168
Harbor seal	331.13	193
Hooded seal	304.77	174
West Coast Region		
California sea lion	36,685.87	96
Northern fur seal	23,730.92	138
Northern elephant seal	6,635.49	118
Harbor seal	6,428.05	138
Stellar sea lion	2,945.39	138
Guadalupe fur seal	266.86	138
Pacific Islands Region		
Hawaiian monk seal	685.25	86

*Exposures are based on a probabilistic model that is scaled by animal density and may therefore include fractional counts.

**Exposure above threshold over 24 hours.

***Populations span Alaska and West Coast regions.

Under Alternative B, behavioral disruption exposures of pinnipeds could occur in four regions. Compared to Alternative A, use of underwater acoustic sources under Alternative B would occur at a higher level of effort. Depending on the species, behavioral disruption exposure of pinnipeds under Alternative B could increase from a few dozen to a few thousand animals in each region over the five-year timeframe as compared to Alternative A. However, for the simulated animals exposed above the 160 dB threshold, the average amount of time an individual receives sound levels above the behavioral threshold remains less than four minutes, and often less than two minutes. The disturbances, therefore, are expected to be transient, and surveys, once completed in an area, would not generally be repeated, thus limiting an individual's behavioral disruption. Behavioral exposures need to occur over the timespan of weeks to have a population level effect on marine mammals, as in the case of seismic surveys that have months' worth of activity (Southall et al., 2016). Any disruption that occurs for a matter of hours or for less than a day would not likely have a population-level impact. Thus, although many individuals of some species could experience behavioral disturbance from NOS acoustic sources, the small increments of time that the animals are exposed above threshold over five years and over the extensive project area would not be expected to result in population level adverse impacts.

In coordination with NMFS and USFWS, NOS has developed mitigation measures to reduce potential impacts of active acoustic sources on marine mammals (as discussed in Section 3.5.2.3.2.1 under Alternative A, and see Appendix D).

Under Alternative B, no PTS/injury exposure is expected. While individual animals would be expected to experience behavioral disruptions (from hundreds to tens of thousands of animals across four regions over the five-year timeframe), the amount of time individuals may exceed the behavioral exposure threshold would be on average less than four minutes (**Table 3.5-18**). Similarly, the potential for masking would be minimal during surveys because the narrow beams of most active acoustic sources mean animals would not spend much time in ensonified zones. Overall, the potential impacts are likely limited to short-term disruption of acoustic habitat and behavioral patterns. Although behavioral disruption exposure of pinnipeds would be higher under Alternative B than under Alternative A, the effects of underwater sound from active acoustic sources on pinnipeds under Alternative B would still be **adverse** and **minor** because impacts would be temporary or short-term and would not be considered outside the natural range of variability of species' populations, their habitats, or the natural processes sustaining them. Impacts could include disruptions of behavioral patterns such as temporary disruption of communication and disturbance of individuals or groups of pinnipeds, and possible displacement of individuals or groups, but without substantial interference to feeding, reproduction, or other biologically important functions affecting population levels. Displacement of pinnipeds from preferred breeding, feeding, or nursery grounds or designated critical habitat would be limited to the project area or its immediate surroundings. Impacts of Alternative B on pinnipeds, including ESA-listed species, would be **insignificant**.

3.5.2.4.3 Sirenians

Impacts of Alternative B on sirenians, including ESA-listed species and designated critical habitat, would be the same or slightly, but not appreciably, larger than those under Alternative A for the following impact causing factors: vessel and equipment sound; vessel presence and movement of equipment in the water; human activity; accidental leakage or spillage of oil, fuel, and chemicals; and trash and debris. Although the impacts of active underwater acoustic sources would also be similar under Alternative B as under Alternative A, they are discussed below because the impacts of underwater sound on marine mammals are of main concern and to show the modeled increase in behavioral disruption exposures of sirenians from the projected increase in the use of echo sounders, ADCPs, and acoustic communication systems (see Appendix E).

3.5.2.4.3.1 Active Underwater Acoustic Sources

As with Alternative A, active underwater acoustic sources under Alternative B would include echo sounders, ADCPs, and acoustic communication systems as described in Section 2.4. Descriptions of all active sources considered in this study can be found in Appendix E; the representative sources used in exposure modeling are the same as described in Alternative A and listed in **Table 3.5-7**. Since Alternative B involves improvements in techniques and technology with an increased use of underwater acoustic sources, the behavioral disruption exposure estimates are higher than under Alternative A.

The active underwater acoustic sources were evaluated in the same way under Alternative B as for Alternative A. Quantitative acoustic exposure to marine mammals, including sirenians, from operation of acoustic sources was modeled for nine sources (see Appendix E). Acoustic modeling was conducted by determining the sound field expected from each source and estimating the number of manatees that may be exposed above sound thresholds for PTS/injury and behavioral disruption during surveys. To gauge the potential for impact, received sound levels that may result in PTS/injury or behavioral disruption to the animals were needed. For this study, the current NMFS criteria for both PTS/injury (NMFS, 2018a) and behavioral disruption (84 FR 72308, December 31, 2019) were used (see Appendix E). Methodology for modeling the impacts of active underwater acoustic sources is presented in Appendix E. Additionally, Section 3.5.2.3.1.1 under Cetaceans discusses the assumptions made and the data sources used in the modeling scenarios to predict exposures of marine mammals, including sirenians.

Based on the modeling and taking into account animal behavior, source characteristics, and animal hearing capability, no PTS/injury exposures of manatees are expected to occur. Note that the estimated exposures have overall decreased between the Draft PEIS and the Final PEIS for the reasons discussed in

Section 3.5.2.3.1.1 under Cetaceans. Summarized total potential behavioral disruption exposures of manatees over five years for all sources are shown in **Table 3.5-19**. For annual numbers, see Appendix E. Discussion of how behavioral disruption exposures were modeled and calculated can be found in Sections 3.5.2.3.3.1.1 and in Appendix E.

Table 3.5-19. Total Predicted Exposures for Manatees and Time in Seconds Above the Behavioral Disruption Threshold Under Alternative B

Species	Total Exposures*	Average time above 160 dB (s)**
Greater Atlantic Region		
Manatee	255.56	196
Southeast Region***		
Manatee	78.19	196

*Exposures are based on a probabilistic model that is scaled by animal density and may therefore include fractional counts.

**Exposure above threshold over 24 hours.

***Exposure modeling for the Southeast Region was conducted for the Gulf of Mexico and Caribbean.

Under Alternative B, behavioral disruption exposures of sirenians could occur in two regions. Compared to Alternative A, use of underwater acoustic sources under Alternative B would occur at a higher level of effort. Behavioral disruption exposure of manatees under Alternative B could increase up to 22 animals over the five-year timeframe as compared to Alternative A. However, for the simulated animals exposed above the 160 dB threshold, the average amount of time an individual receives sound levels above the behavioral threshold remains less than four minutes. The disturbances, therefore, are expected to be transient, and surveys, once completed in an area, would not generally be repeated, thus limiting an individual's behavioral disruption. Behavioral exposures need to occur over the timespan of weeks to have a population level effect on marine mammals, as in the case of seismic surveys that have months' worth of activity (Southall et al., 2016). Any disruption that occurs for a matter of hours or for less than a day would not likely have a population-level impact. Thus, although many individuals could experience behavioral disturbance from NOS acoustic sources, the small increments of time that the animals are exposed above threshold over five years and over the extensive project area would not be expected to result in population level adverse impacts.

In coordination with NMFS and USFWS, NOS has developed mitigation measures to reduce potential impacts of active acoustic sources on marine mammals (as discussed in Section 3.5.2.3.3.1 under Alternative A, and see Appendix D).

Under Alternative B, no PTS/injury exposure is expected. While some individual animals are expected to experience behavioral disruptions (<334 individuals in two regions over the five-year timeframe), the amount of time they may exceed the behavioral exposure threshold would be less than four minutes (**Table 3.5-19**). Similarly, the potential for masking would be minimal during surveys because the narrow beams of most active acoustic sources mean animals would not spend much time in ensonified zones. Overall, the potential impacts are likely limited to short-term disruption of acoustic habitat and behavioral patterns. Although behavioral disruption exposure of manatees would be higher under Alternative B than under Alternative A, the effects of underwater sound from active acoustic sources on sirenians under

Alternative B would still be **adverse** and **minor** because impacts would be temporary or short-term and would not be considered outside the natural range of variability of species' populations, their habitats, or the natural processes sustaining them. Impacts could include disruptions of behavioral patterns such as temporary disruption of communication and disturbance of individuals or groups of sirenians, and possible displacement of individuals or groups, but without substantial interference to feeding, reproduction, or other biologically important functions affecting population levels. Displacement of sirenians from preferred breeding, feeding, or nursery grounds or designated critical habitat would be limited to the project area or its immediate surroundings. Impacts of Alternative B on sirenians would be **insignificant**.

3.5.2.4.4 Fissipeds

Impacts of Alternative B on fissipeds, including ESA-listed species and designated critical habitat, would be the same or slightly, but not appreciably, larger than those under Alternative A for the following impact causing factors: vessel and equipment sound; vessel presence and movement of equipment in the water; human activity; accidental leakage or spillage of oil, fuel, and chemicals; trash and debris; and air emissions. Although the impacts of active underwater acoustic sources would also be similar under Alternative B as under Alternative A, they are discussed below because the impacts of underwater sound on marine mammals are of main concern and to show the modeled increase in behavioral disruption exposures of fissipeds from the projected increase in the use of echo sounders, ADCPs, and acoustic communication systems (see Appendix E).

3.5.2.4.4.1 Active Underwater Acoustic Sources

As with Alternative A, active underwater acoustic sources under Alternative B would include echo sounders, ADCPs, and acoustic communication systems as described in Section 2.4. Descriptions of all active sources considered in this study can be found in Appendix E; the representative sources used in exposure modeling are the same as described in Alternative A and listed in **Table 3.5-7**. Since Alternative B involves improvements in techniques and technology with an increased use of underwater acoustic sources, the behavioral disruption exposure estimates are higher than under Alternative A.

The active underwater acoustic sources were evaluated in the same way under Alternative B as for Alternative A. Quantitative acoustic exposure of, marine mammals, including fissipeds, from operation of sound sources was modeled for nine sources (see Appendix E). Acoustic modeling was conducted by determining the sound field expected from each source and estimating the number of fissipeds that may be exposed above sound thresholds for PTS/injury and behavioral disruption during surveys. To gauge potential for impact, received sound levels that may result in PTS/injury or behavioral disruption to the animal were needed. For this study, the current NMFS criteria for both PTS/injury (NMFS, 2018a) and behavioral disruption (84 FR 72308, December 31, 2019) were used (see Appendix E). Methodology for modeling the impacts of active underwater acoustic sources is presented in Appendix E. Additionally, Section 3.5.2.3.1.1 under Cetaceans discusses the assumptions made and the data sources used in the modeling scenarios to predict exposures of marine mammals, including fissipeds.

Based on the modeling and taking into account animal behavior, source characteristics, and animal hearing capability, no PTS/injury exposures of fissipeds are expected to occur. Note that the estimated exposures have overall decreased between the Draft PEIS and the Final PEIS for the reasons discussed in Section 3.5.2.3.1.1 under Cetaceans. Summarized total potential behavioral disruption exposures of fissipeds over five years for all sources are shown in **Table 3.5-20**. For annual numbers, see Appendix E. Species that may be in the area but for which no impacts were predicted are not included in the tables.

Discussion of how behavioral disruption exposures were modeled and calculated can be found in Sections 3.5.2.3.4.1.1 and in Appendix E.

Table 3.5-20. Total Predicted Exposures for Fissiped Species and Time in Seconds Above the Behavioral Disruption Threshold Under Alternative B

Species	Total Exposures*	Average time above 160 dB (s)**
Alaska Region		
Sea otter, SE	533.98	124
Sea otter, SC	373.89	124
Polar bear	59.60	177
West Coast Region		
Sea otter, CA	591.56	124
Sea otter, SE	533.98	124
Sea otter, WA	212.40	124

*Exposures are based on a probabilistic model that is scaled by animal density and may therefore include fractional counts.

**Exposure above threshold over 24 hours.

Under Alternative B, behavioral disruption exposures of fissipeds could occur in two regions. Compared to Alternative A, use of underwater acoustic sources under Alternative B would occur at a higher level of effort. Behavioral disruption exposure of fissipeds under Alternative B could increase by approximately five polar bears and a few hundred sea otters in each region over the five-year timeframe as compared to Alternative A. However, for the simulated animals exposed above the 160 dB threshold, the average amount of time an individual receives sound levels above the behavioral threshold remains less than three minutes. The disturbances, therefore, are expected to be transient, and surveys, once completed in an area, would not generally be repeated, thus limiting an individual's behavioral disruption. Behavioral exposures need to occur over the timespan of weeks to have a population level effect on marine mammals, as in the case of seismic surveys that have months' worth of activity (Southall et al., 2016). Any disruption that occurs for a matter of hours or for less than a day would not likely have a population-level impact. Thus, although many individuals of some species could experience behavioral disturbance from NOS acoustic sources, the small increments of time that the animals are exposed above threshold over five years and over the extensive project area would not be expected to result in population level adverse impacts.

In coordination with NMFS and USFWS, NOS has developed mitigation measures to reduce potential impacts of active acoustic sources on marine mammals (as discussed in Section 3.5.2.3.4.1 under Alternative A, and see Appendix D).

Under Alternative B, no PTS/injury exposure is expected. While individual animals are expected to experience behavioral disruptions (<60 polar bears and a few thousand sea otters across the two regions and over the five-year timeframe), the amount of time they may exceed the behavioral disruption threshold would be on average less than three minutes (**Table 3.5-20**). Similarly, the potential for masking would be minimal during surveys because the narrow beams of most active acoustic sources mean animals would not spend much time in ensonified zones. Overall, the potential impacts are likely limited to short-term disruption of acoustic habitat and behavioral patterns. Although behavioral disruption exposure of fissipeds would be higher under Alternative B than under Alternative A, the effects of underwater sound from active acoustic sources on fissipeds under Alternative B would still be **adverse** and **minor** because impacts would be temporary or short-term and would not be considered outside the natural range of variability of species' populations, their habitats, or the natural processes sustaining them. Impacts could include disruptions of behavioral patterns such as temporary disruption of communication and disturbance of individuals or groups of fissipeds, and possible displacement of individuals or groups, but without substantial interference to feeding, reproduction, or other biologically important functions affecting population levels. Displacement of fissipeds from preferred breeding, feeding, or nursery grounds or designated critical habitat would be limited to the project area or its immediate surroundings. Impacts of Alternative B on fissipeds, including ESA-listed species, would be **insignificant**.

3.5.2.4.5 Conclusion

Since the effects of impact causing factors on marine mammals range from negligible to minor, the overall impact of Alternative B on marine mammals, including ESA-listed species and designated critical habitat, would be **adverse** and **minor**; thus, impacts of Alternative B would be **insignificant**.

3.5.2.5 Alternative C: Upgrades and Improvements with Greater Funding Support

As for Alternatives A and B, impacts of Alternative C are discussed for the same impact causing factors for each type of marine mammal (cetaceans, pinnipeds, sirenians, and fissipeds). Under Alternative C, all of the activities and equipment operations proposed in Alternatives A and B would continue but at a higher level of effort, because there would be an overall funding increase of 20 percent relative to Alternative B. However, the percentage of nautical miles in each region would be the same as under Alternatives A and B. Thus, the greatest number of nautical miles surveyed each year would be in the Southeast Region (with approximately 47 percent of the survey effort). The other four regions would be at similar levels of effort (approximately 10 percent of the survey effort in each region), although slightly greater in the Alaska Region where the percentage of survey effort would be approximately 18 percent (see **Table 3.5-21**). In general, it is expected that level of effort and overall impacts trend together (i.e., greater impacts where the survey effort is higher), but there are other factors, such as location and depth of surveys, sound production and hearing frequency of the animals, and population density of marine mammals, that add nuance to this trend. Overall, NOS projects would comprise a very small part of all ocean activities as vessels used by NOS would represent a very small proportion of all vessel traffic in the action area (as discussed in Section 2.4.1). Additionally, whenever possible, the location and timing of a given project would be purposefully coordinated to ensure that areas are not repeatedly surveyed. This ensures that the potential environmental impacts directly resulting from NOS projects would not be exacerbated by repeated projects within a given area.

Table 3.5-21. Survey Effort under Alternative C, by Geographic Region by Year

Region	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Survey Effort (in nautical miles)						
Greater Atlantic Region (without Great Lakes)	72,986	126,909	61,166	56,295	56,295	373,650
Southeast Region	264,403	252,222	314,940	338,080	338,080	1,507,724
West Coast Region	71,470	69,491	67,168	69,845	69,845	347,818
Alaska Region	112,645	143,968	209,334	49,620	49,592	565,160
Pacific Islands Region	84,252	65,880	83,690	65,938	65,938	365,698

Projects under Alternative C would take place in the same geographic areas and timeframes as under Alternatives A and B; however, Alternative C would include more projects and activities, and thus more nautical miles traveled, than Alternatives A and B. Under Alternative C, NOS projects would cover a total of 3,160,049 nm (5,852,411 km) across all five regions over the five-year period (note that survey effort in the Great Lakes is not included as no marine mammals occur there). Overall, there would be an additional 263,337 nm (487,701 km) covered by vessels under Alternative C (see **Table 3.5-21**) as compared to Alternative B (2,896,712 nm [5,364,710 km] total), and an additional 526,675 nm (975,402 km) as compared to Alternative A (2,633,374 nm [4,877,009 km] total) across all regions over the five-year period. The types and mechanisms of impacts would remain the same in Alternative C as discussed for Alternatives A and B across all regions over the five-year period. Therefore, in general, the difference between the alternatives is a matter of scale with an increased activity level, although distributed unevenly among the different types of activities, leading to a corresponding, incremental increase in effects under Alternative C as compared to Alternatives A and B. While the total number of activities increases by approximately 10 percent between each subsequent alternative, the numbers for individual activities do not increase uniformly between alternatives. For example, the number of nautical miles crewed vessel operations increases by 23 percent from Alternative A to C and 10 percent from Alternative B to C. However, the number of nautical miles using ADCPs increases by 137 percent from Alternative A to C and 36 percent from Alternative B to C; and ROV use increases 257 percent from Alternative A to C and 19 percent from Alternative B to C.

Under Alternative C, there would be projects using crewed vessel operations covering 637,000 nm (1,180,000 km), as compared to 518,000 nm (959,000 km) under Alternative A. Vessel operations could contribute to impacts on marine mammals related to vessel and equipment sound, vessel presence and movement, accidental spills, trash and debris, and air emissions. Although the amount of crewed vessel operations would be greater under Alternative C than under Alternative A, an additional 119,000 nm (220,000 km) across five regions would result in greater impacts overall, but not so great that the magnitude of a particular impact causing factor would increase (e.g., from negligible to minor). The increase in use of active underwater acoustic equipment and ROVs would be more pronounced than increases in other activities. Projects involving echo sounders, ADCPs, and acoustic communication systems would increase under Alternative C as compared to Alternatives A and B. This reflects the increased use of technology and increased funding under Alternative C and is a greater increase than for other activities on a percentage basis, but overall, the increase is still not very high, especially as compared to the extent of the action area.

3.5.2.5.1 Cetaceans

Impacts of Alternative C on cetaceans, including ESA-listed species and designated critical habitat, would be the same or slightly, but not appreciably, larger as those under Alternatives A and B for the following impact causing factors: vessel and equipment sound; vessel presence and movement of equipment in the water, human activity, accidental leakage or spillage of oil, fuel, and chemicals; and trash and debris. Overall, impacts on cetaceans from these factors would be insignificant. Although the impacts of active underwater acoustic sources would also be similar under Alternative C as under Alternatives A and B, they are discussed below because the impacts of underwater sound on marine mammals are of main concern and to show the modeled increase in PTS/injury exposures and behavioral disruption exposures of cetaceans from the projected increase in the use of echo sounders, ADCPs, and acoustic communication systems (see Appendix E).

3.5.2.5.1.1 Active Underwater Acoustic Sources

As with Alternatives A and B, active underwater acoustic sources under Alternative C include echo sounders, ADCPs, and acoustic communication systems as discussed in Section 2.4. Descriptions of all active sources considered in this study can be found in Appendix E. The representative sources used in exposure modeling are the same as described in Alternative A and listed in **Table 3.5-7**. Since Alternative C involves improvements in techniques and technology with an increased use of underwater acoustic sources, as well as an overall funding increase of 20 percent relative to Alternative B, the PTS/injury and behavioral disruption exposure estimates are somewhat higher than under Alternatives A and B.

The active underwater acoustic sources were evaluated in the same way under Alternative C as for Alternatives A and B. Quantitative acoustic exposure to marine mammals, including cetaceans, from operating the sources was modeled for nine sources (see Appendix E). Acoustic modeling was conducted by determining the size of the sound field expected from each source and estimating the number of marine mammals that may be exposed above sound thresholds for PTS/injury and behavioral disruption during surveys. To gauge potential for impact, received sound levels that may result in PTS/injury or behavioral disruption to the animal were needed. For this study, the current NMFS criteria for both PTS/injury (NMFS, 2018a) and behavioral disruption (84 FR 72308, December 31, 2019) were used. Methodology for modeling the impacts of active underwater acoustic sources is presented in Appendix E. Additionally, Section 3.5.2.3.1.1 under Cetaceans discusses the assumptions made and the data sources used in the modeling scenarios to predict exposures of marine mammals.

Summarized total potential PTS/injury exposures over five years for all sources for cetaceans in each region are shown in **Table 3.5-22** (no PTS/injury exposure was predicted for any species in the Pacific Islands Region). Note that the estimated exposures have overall decreased between the Draft PEIS and the Final PEIS for the reasons discussed in Section 3.5.2.3.1.1 under Alternative A. Summarized total potential behavioral disruption exposures of cetaceans for all sources in each region are shown in **Table 3.5-24**. For annual numbers, see Appendix E. Species that may be in the area but for which no impacts were predicted are not included in the tables. Discussion of how PTS/injury exposures and behavioral disruption exposures were modeled and calculated can be found in Sections 3.5.2.3.1.1.1 and 3.5.2.3.1.1.2 and in Appendix E.

Table 3.5-22. Total Predicted Exposures for Cetacean Species and Range Accounting for 95 Percent of Exposure Above PTS Threshold Under Alternative C

Species	Total Exposures*	Exposure Range (m)
Southeast Region**		
Dwarf sperm whale	3.83	35
Pygmy sperm whale	2.79	35
Greater Atlantic Region		
Harbor porpoise	13.62	34
Dwarf sperm whale	1.47	32
Pygmy sperm whale	0.17	32
West Coast Region		
Harbor porpoise	8.11	28
Dall’s porpoise	6.57	24

Species	Total Exposures*	Exposure Range (m)
Alaska Region		
Harbor porpoise	5.70	27
Dall's porpoise	5.23	20

*Exposures are based on a probabilistic model that is scaled by animal density and may therefore include fractional counts.

**Exposure modeling for the Southeast Region was conducted for the Gulf of Mexico.

Under Alternative C, PTS/injury exposure of high-frequency cetaceans could occur in four of the five regions with ranges to exposures in the simulations ~30 m (~100 ft). High-frequency cetaceans (Dall's and harbor porpoises, and dwarf and pygmy sperm whales) have been shown to be more sensitive to sounds than other cetacean species, and therefore have comparatively low thresholds for PTS/injury exposures (NMFS, 2018a). Compared to Alternatives A and B, use of underwater acoustic sources under Alternative C would continue at a higher level of effort. Over the five-year timeframe, a total of up to eight additional animals compared to Alternative A and up to four additional animals compared to Alternative B would be exposed above the PTS/injury threshold across four regions. Such small increases in animals exposed above threshold over the extensive project area and over five years would not be expected to result in population level adverse impacts, particularly as supported by the comparison to PBR levels (see Section 3.5.2.3.1.1.1 for discussion and **Table 3.5-23**).

Table 3.5-23. Comparison of Exposure Above PTS Threshold for Cetacean Species Under Alternative C with Current Potential Biological Removal (PBR) Levels

Species	Total Exposures	Average Annual Exposures	PBR Levels*
Southeast Region			
Dwarf sperm whale	3.83	0.77	2.5**
Pygmy sperm whale	2.79	0.56	2.5**
Greater Atlantic Region			
Harbor porpoise	13.62	2.72	851
Dwarf sperm whale	1.47	0.29	46
Pygmy sperm whale	0.17		46
West Coast Region			
Dall's porpoise	8.11	1.62	99***
Harbor porpoise	6.57	1.31	35 to 349****
Alaska Region			
Harbor porpoise	5.70	1.14	2.2 to 11*****
Dall's porpoise	5.23	51.05	131

*Sources for PBR Levels: Carretta et al., 2022; Hayes et al., 2022; and Muto et al., 2022

**Differs from PBR levels reported in the Draft PEIS due to numbers presented in the Draft PEIS for incorrect stock.

***Differs from PBR levels reported in the Draft PEIS due to changes between the 2019 and the 2021 SARs.

****PBR levels for harbor porpoise in the West Coast Region is shown as the range across six stocks.

***** PBR levels for the Southeast Alaska stock; PBR levels are undetermined for the Gulf of Alaska and Bering Sea stocks.

Table 3.5-24. Total Predicted Exposures for Cetacean Species and Time in Seconds Above the Behavioral Disruption Threshold Under Alternative C

Species	Total Exposures*	Average time above 160 dB (s)**
Alaska Region		
Pacific white-sided dolphin	1,105.50	63
Beluga whale	307.27	85
Harbor porpoise	108.08	88
Dall's porpoise	107.84	69
Common minke whale	74.13	47
Bowhead whale	70.67	53
Humpback whale, Central North Pacific	56.69	95
Resident killer whale	44.21	58
Fin whale	34.54	50
Transient killer whale	29.59	58
Beluga, Cooke Inlet	16.24	85
Humpback whale, Western North Pacific	6.21	95
Gray whale	2.13	51
Sperm whale	0.16	56
North Pacific right whale	0.03	53
Southeast Region* **		
Atlantic spotted dolphin	1,254.12	56
Common bottlenose dolphin	748.43	89
Pantropical spotted dolphin	494.54	52
Clymene dolphin	160.09	52
Rough-toothed dolphin	87.04	75
Spinner dolphin	86.62	58
Risso's dolphin	75.64	69
Striped dolphin	47.55	50
False killer whale	46.10	55
Pilot whale, short finned	24.22	60
Pilot whale, long finned	23.80	60
Pygmy sperm whale	23.03	52
Pygmy killer whale	20.64	52
Sperm whale	18.70	64
Melon-headed whale	18.70	50
Dwarf sperm whale	14.83	52
Fraser's dolphin	11.49	50

Species	Total Exposures*	Average time above 160 dB (s)**
Blainville beaked whale	10.78	67
Gervais' beaked whale	10.78	67
Mesoplodont beaked whales (all)	10.78	67
Cuvier's beaked whale	3.32	64
Transient killer whale	2.90	58
Rice's whale	0.96	82
Greater Atlantic Region		
Short-beaked common dolphin	3,298.64	102
Atlantic white-sided dolphin	1,990.71	101
Atlantic spotted dolphin	1,418.39	89
Common bottlenose dolphin	1,217.20	184
Harbor porpoise	627.10	55
Risso's dolphin	561.77	112
Pilot whale, long finned	389.55	63
Pilot whale, short finned	249.25	63
Fin whale	187.53	98
Humpback whale	89.89	97
Common minke whale	101.72	101
Cuvier's beaked whale	70.61	55
Dwarf sperm whale	69.72	57
Rough-toothed dolphin	59.31	110
Gervais beaked whale	53.42	55
Sowerby's beaked whale	53.42	55
Blainville beaked whale	53.42	55
True's beaked whale	53.42	55
Mesoplodont beaked whales (all)	53.42	55
Striped dolphin	27.28	50
Sperm whale	20.72	50
Pantropical spotted dolphin	20.93	62
North Atlantic right whale	14.00	62
Sei whale	15.00	98
Melon-headed whale	11.06	50
Pygmy sperm whale	9.44	57
Clymene dolphin	5.73	100
Fraser's dolphin	4.69	38
False killer whale	3.25	64
White-beaked dolphin	2.78	83
Spinner dolphin	2.01	41
Northern bottlenose whale	0.74	42
Bryde's whale	0.47	112

Species	Total Exposures*	Average time above 160 dB (s)**
Blue whale	0.09	43
West Coast Region		
Short-beaked common dolphin	30,778.10	55
Long-beaked common dolphin	20,574.03	82
Pacific white-sided dolphin	8,167.96	67
Striped dolphin	5,142.33	25
Gray whale	2,993.57	55
Northern right whale dolphin	2,987.79	25
Risso’s dolphin	352.21	66
Common bottlenose dolphin	301.76	110
Humpback whale, Central America	279.29	128
Common minke whale	235.52	51
Fin whale	175.22	62
Dall's porpoise	169.00	75
Harbor porpoise	128.40	96
Mesoplodont beaked whales (all)	95.05	26
Blue whale	89.25	27
Humpback whale, Central North Pacific	56.69	95
Sperm whale	46.73	29
Cuvier's beaked whale	43.66	33
Baird's beaked whale	42.56	51
Sei whale	32.48	62
Transient killer whale	28.28	64
Offshore killer whale	28.02	64
Resident killer whale (SRKW)	26.17	64
Pilot whale, short finned	21.92	82
Humpback whale, Western North Pacific		95
Pacific Islands Region		
Rough-toothed dolphin	14,913.64	71
Striped dolphin	10,463.03	55
Pantropical spotted dolphin	4,891.49	62
Fraser's dolphin	4,162.23	50
Pygmy killer whale	1,415.19	64
False killer whale	519.37	56
Risso’s dolphin	134.22	69
Common bottlenose dolphin	85.78	112
Spinner dolphin	62.09	84
Humpback whale, Central North Pacific	56.69	95
Melon-headed whale	45.37	59
Pilot whale, short finned	33.61	62

Species	Total Exposures*	Average time above 160 dB (s)**
Humpback whale, Western North Pacific	6.21	95
Bryde's whale	5.93	70
Sperm whale	5.19	67
Longman's beaked whale	3.50	54
Cuvier's beaked whale	3.40	54
Sei whale	3.28	75
Fin whale	2.21	75
Blainville beaked whale	1.71	55
Resident killer whale	0.91	56
Transient killer whale	0.91	56
Blue whale	0.25	54

*Exposures are based on a probabilistic model that is scaled by animal density and may therefore include fractional counts.

**Exposure above threshold over 24 hours.

***Exposure modeling for the Southeast Region was conducted for the Gulf of Mexico.

Under Alternative C, behavioral disruption exposures to cetaceans could occur in all five regions. Compared to Alternatives A and B, use of underwater acoustic sources under Alternative B would occur at a higher level of effort. Depending on the species, behavioral disruption exposure of cetaceans under Alternative C could increase from one to a few thousand animals in each region over the five-year timeframe as compared to Alternatives A and B. However, for the simulated animals exposed above the 160 dB threshold, the average amount of time an individual would receive sound levels above the behavioral threshold remains less than two minutes, and often less than one minute. The disturbances, therefore, are expected to be transient, and surveys, once completed in an area, would not generally be repeated, thus limiting an individual's behavioral disruption. Behavioral exposures need to occur over the timespan of weeks to have a population level effect on marine mammals, as in the case of seismic surveys that have months' worth of activity (Southall et al., 2016). Any disruption that occurs for a matter of hours or for less than a day would not likely have a population-level impact. Thus, although many individuals of some species could experience behavioral disturbance from NOS acoustic sources, the small increments of time that the animals are exposed above threshold over five years and over the extensive project area would not be expected to result in population level adverse impacts.

In coordination with NMFS and USFWS, NOS has developed mitigation measures to reduce potential impacts of active acoustic sources on marine mammals (as discussed in Section 3.5.2.3.1.1 under Alternative A, and see Appendix D).

The potential impacts of Alternative C on cetaceans include injury exposures in the form of hearing loss (PTS), but such injury would be rare and confined to a few high-frequency cetaceans in four regions (from seven animals in the Southeast Region up to 16 animals in the Greater Atlantic Region over the five-year timeframe, see **Table 3.5-22**). While more individual animals are expected to experience behavioral disruptions than injury (on the order of greater than one hundred thousand animals across all five regions over the five-year timeframe), the amount of time individuals may exceed behavioral threshold would be on average for less than two minutes (**Table 3.5-24**). Similarly, the potential for masking would be minimal during surveys because the narrow beams of most active acoustic sources mean animals would not spend much time in ensonified zones. Overall, the potential impacts are likely limited to short-term disruption of acoustic habitat and behavioral patterns. Although both PTS/injury exposures and behavioral disruption exposures of cetaceans would be higher under Alternative C than under Alternatives A and B, the effects of underwater sound from active acoustic sources on cetaceans under Alternative C would still be **adverse** and **minor** because impacts would be temporary or short-term and would not be considered outside the natural range of variability of species' populations, their habitats, or the natural processes sustaining them. Impacts could include disruptions of behavioral patterns such as temporary disruption of communication and/or echolocation, disturbance of individuals or groups of cetaceans, and possible displacement of individuals or groups, but without substantial interference to feeding, reproduction, or other biologically important functions affecting population levels. Displacement of cetaceans from preferred breeding, feeding, or nursery grounds, migratory routes, or designated critical habitat would be limited to the project area or its immediate surroundings. Impacts of Alternative C on cetaceans, including ESA-listed species, would be **insignificant**.

3.5.2.5.2 Pinnipeds

Impacts of Alternative C on pinnipeds, including ESA-listed species and designated critical habitat, would be the same or slightly, but not appreciably, larger as those under Alternatives A and B for the following impact causing factors: vessel and equipment sound; vessel presence and movement of equipment in the water, human activity, accidental leakage or spillage of oil, fuel, and chemicals; trash and debris; and air emissions. Overall, impacts on pinnipeds from these factors would be insignificant. Although the impacts of active underwater acoustic sources would also be similar under Alternative C as under Alternatives A and B, they are discussed below because the impacts of underwater sound on marine mammals are of main concern and to show the modeled increase in behavioral disruption exposures of pinnipeds from the projected increase in the use of echo sounders, ADCPs, and acoustic communication systems (see Appendix E).

3.5.2.5.2.1 Active Underwater Acoustic Sources

As with Alternatives A and B, active underwater acoustic sources under Alternative C include echo sounders, ADCPs, and acoustic communication systems as discussed in Section 2.4. Descriptions of all active sources considered in this study can be found in Appendix E. The representative sources used in exposure modeling are the same as described in Alternative A and listed in **Table 3.5-7**. Since Alternative C involves improvements in techniques and technology with an increased use of underwater acoustic sources, as well as an overall funding increase of 20 percent relative to Alternative B, the behavioral disruption exposure estimates are higher than under Alternatives A and B.

The active underwater acoustic sources were evaluated in the same way under Alternative C as for Alternatives A and B. Quantitative acoustic exposure to marine mammals, including pinnipeds, from operating the sources were modeled for nine sources (see Appendix E). Acoustic modeling was conducted by determining the sound field expected from each source and estimating the number of marine mammals that may be exposed above sound thresholds for PTS/injury and behavioral disruption during surveys. To gauge potential for impact, received sound levels that may result in PTS/injury or behavioral disruption to the animal were needed. For this study, the current NMFS criteria for both PTS/injury (NMFS, 2018a) and behavioral disruption (84 FR 72308, December 31, 2019) were used). Methodology for modeling the impacts of active underwater acoustic sources is presented in Appendix E. Additionally, Section 3.5.2.3.1.1 under Cetaceans discusses the assumptions made and the data sources used in the modeling scenarios to predict exposures of marine mammals, including pinnipeds.

Based on the modeling, and taking into account animal behavior, source characteristics, and animal hearing capability, no PTS/injury exposures of pinnipeds is expected to occur. Note that the estimated exposures have overall decreased between the Draft PEIS and the Final PEIS for the reasons discussed in Section 3.5.2.3.1.1 under Cetaceans. Summarized total potential behavioral disruption exposures of pinnipeds over five years for all sources in the four regions where they could occur are shown in **Table 3.5-25**. For annual numbers, see Appendix E. Species that may be in the area but for which no impacts were predicted are not included in the tables. Discussion of how behavioral disruption exposures were modeled and calculated can be found in Section 3.5.2.3.2.1.1 and in Appendix E.

Table 3.5-25. Total Predicted Exposures for Pinniped Species and Time in Seconds Above the Behavioral Disruption Threshold Under Alternative C

Species	Total Exposures*	Average time above 160 dB (s)**
Alaska Region		
Northern fur seal***	25,778.11	138
Spotted seal	12,031.20	104
Harbor seal	9,181.91	104
Northern elephant seal***	7,656.14	118
Bearded seal	1,741.25	104
Ribbon seal	1,701.92	104
Ringed seal	1,323.67	104
Steller sea lion***	583.14	104
Walrus	711.84	95
Greater Atlantic Region		
Harp seal	629.76	174
Gray seal	509.72	168
Harbor seal	311.75	193
Hooded seal	279.63	174
West Coast Region		
Northern fur seal	26,485.39	138
California sea lion	43,805.08	96
Northern elephant seal	7,656.14	118
Harbor seal	7,481.23	138
Stellar sea lion	3,414.94	138
Guadalupe fur seal	308.98	138
Pacific Islands Region		
Hawaiian monk seal	823.93	86

*Exposures are based on a probabilistic model that is scaled by animal density and may therefore include fractional counts.

** Exposure above threshold over 24 hours.

*** Populations span Alaska and West Coast regions.

Under Alternative C, behavioral disruption exposures of pinnipeds could occur in four regions. Compared to Alternatives A and B, use of underwater acoustic sources under Alternative C would occur at a higher level of effort. Depending on the species, behavioral disruption exposure of pinnipeds under Alternative C could increase from a few hundred to a few thousand animals in each region over the five-year timeframe as compared to Alternatives A and B. However, for the simulated animals exposed above the 160 dB threshold, the average amount of time an individual receives sound levels above the behavioral threshold remains less than four minutes, and often less than two minutes. The disturbances, therefore, are expected to be transient, and surveys, once completed in an area, would not generally be repeated, thus limiting an individual's behavioral disruption. Behavioral exposures need to occur over the timespan of weeks to have a population level effect on marine mammals, as in the case of seismic surveys that have months' worth of activity (Southall et al., 2016). Any disruption that occurs for a matter of hours or for less than a day would not likely have a population-level impact. Thus, although many individuals of some species could experience behavioral disturbance from NOS acoustic sources, the small increments of time that the animals are exposed above threshold over five years and over the extensive project area would not be expected to result in population level adverse impacts.

In coordination with NMFS and USFWS, NOS has developed mitigation measures to reduce potential impacts of active acoustic sources on marine mammals (as discussed in Section 3.5.2.3.2.1 under Alternative A, and see Appendix D).

Under Alternative C, no PTS/injury exposure is expected. While individual animals would be expected to experience behavioral disruptions (from hundreds to tens of thousands of animals across four regions over the five-year timeframe), the amount of time individuals may exceed the behavioral threshold would be on average less than four minutes (**Table 3.5-25**). Similarly, the potential for masking would be minimal during surveys because the narrow beams of most active acoustic sources mean animals would not spend much time in ensonified zones. Overall, the potential impacts are likely limited to short-term disruption of acoustic habitat and behavioral patterns. Although behavioral disruption exposure of pinnipeds would be higher under Alternative C than under Alternatives A and B, the effects of underwater sound from active acoustic sources on pinnipeds under Alternative C would still be **adverse** and **minor** because impacts would be temporary or short-term and would not be considered outside the natural range of variability of species' populations, their habitats, or the natural processes sustaining them. Impacts could include disruptions of behavioral patterns such as temporary disruption of communication and disturbance of individuals or groups of pinnipeds, and possible displacement of individuals or groups, but without substantial interference to feeding, reproduction, or other biologically important functions affecting population levels. Displacement of pinnipeds from preferred breeding, feeding, or nursery grounds or designated critical habitat would be limited to the project area or its immediate surroundings. Impacts of Alternative C on pinnipeds, including ESA-listed species, would be **insignificant**.

3.5.2.5.3 Sirenians

Impacts of Alternative C on sirenians, as well as designated critical habitat, would be the same or slightly, but not appreciably, larger as those under Alternatives A and B for the following impact causing factors: vessel and equipment sound; vessel presence and movement of equipment in the water, human activity, accidental leakage or spillage of oil, fuel, and chemicals; and trash and debris. Overall, impacts on sirenians from these factors would be insignificant. Although the impacts of active underwater acoustic sources would also be similar under Alternative C as under Alternatives A and B, they are discussed below because the impacts of underwater sound on marine mammals are of main concern and to show the modeled increase in behavioral disruption exposures of sirenians from the projected increase in the use of echo sounders, ADCPs, and acoustic communication systems (see Appendix E).

3.5.2.5.3.1 Active Underwater Acoustic Sources

As with Alternatives A and B, active underwater acoustic sources under Alternative C include echo sounders, ADCPs, and acoustic communication systems as discussed in Section 2.4. Descriptions of all active sources considered in this study can be found in Appendix E, Technical Acoustic Analysis of Oceanographic Surveys The representative sources used in exposure modeling are the same as described in Alternative A and listed in **Table 3.5-7**. Since Alternative C involves improvements in techniques and technology with an increased use of underwater acoustic sources, as well as an overall funding increase of 20 percent relative to Alternative B, the behavioral disruption exposure estimates are higher than under Alternatives A and B.

The active underwater acoustic sources were evaluated in the same way under Alternative C as for Alternatives A and B. Quantitative acoustic exposure to marine mammals, including sirenians, from operating the sources was modeled for nine sources (see Appendix E). Acoustic modeling was conducted by determining the sound field expected from each source and estimating the number of marine mammals that may be exposed above sound thresholds for PTS/injury and behavioral disruption during surveys. To gauge potential for impact, received sound levels that may result in PTS/injury or behavioral disruption to the animal were needed. For this study, the current NMFS criteria for both PTS/injury (NMFS, 2018a) and behavioral disruption (84 FR72308, December 31, 2019) were used. Methodology for modeling the impacts of active underwater acoustic sources is presented in Appendix E. Additionally, Section 3.5.2.3.1.1 under Cetaceans discusses the assumptions made and the data sources used in the modeling scenarios to predict exposures of marine mammals, including sirenians.

Based on the modeling and taking into account animal behavior, source characteristics, and animal hearing capability, no PTS/injury exposures of manatees are expected to occur. Note that the estimated exposures have overall decreased between the Draft PEIS and the Final PEIS for the reasons discussed in Section 3.5.2.3.1.1 under Cetaceans. Summarized total potential behavioral disruption exposures of manatees over five years for all sources are shown in **Table 3.5-26**. For annual numbers, see Appendix E. Discussion of how behavioral disruption exposures were modeled and calculated can be found in Sections 3.5.2.3.3.1.1 and in Appendix E.

Table 3.5-26. Total Predicted Exposures for Manatees and Time in Seconds Above the Behavioral Disruption Threshold Under Alternative C

Species	Total Exposures*	Average time above 160 dB (s)**
Greater Atlantic Region		
Manatee	291.82	196
Southeast Region* **		
Manatee	78.95	196

*Exposures are based on a probabilistic model that is scaled by animal density and may therefore include fractional counts.

**Exposure above threshold over 24 hours.

***Exposure modeling for the Southeast Region was conducted for the Gulf of Mexico and Caribbean.

Under Alternative C, behavioral disruption exposures of sirenians could occur in two regions. Compared to Alternatives A and B, use of underwater acoustic sources under Alternative C would occur at a higher level of effort. Behavioral disruption exposure of manatees under Alternative C could increase by 59 animals as compared to Alternative A and 37 animals as compared to Alternative B over the five-year timeframe. However, for the simulated animals exposed above the 160 dB threshold, the average amount of time an individual receives sound levels above the 237 behavioral threshold remains less than four minutes. The disturbances, therefore, are expected to be transient, and surveys, once completed in an area, would not generally be repeated, thus limiting an individual's behavioral disruption. Behavioral exposures need to occur over the timespan of weeks to have a population level effect on marine mammals, as in the case of seismic surveys that have months' worth of activity (Southall et al., 2016). Any disruption that occurs for a matter of hours or for less than a day would not likely have a population-level impact. Thus, although many individuals could experience behavioral disturbance from NOS acoustic sources, the small increments of time that the animals are exposed above threshold over five years and over the extensive project area would not be expected to result in population level adverse impacts.

In coordination with NMFS and USFWS, NOS has developed mitigation measures to reduce potential impacts of active acoustic sources on marine mammals (as discussed in Section 3.5.2.3.3.1 under Alternative A, and see Appendix D).

Under Alternative C, no PTS/injury exposure is expected. Some individual animals are expected to experience behavioral disruptions (<371 individuals in two regions over the five-year timeframe), the amount of time they may exceed the behavioral threshold would be less than four minutes (**Table 3.5-26**). Similarly, the potential for masking would be minimal during surveys because the narrow beams of most active acoustic sources mean animals would not spend much time in ensonified zones. Overall, the potential impacts are likely limited to short-term disruption of acoustic habitat and behavioral patterns. Although behavioral disruption exposure of manatees would be higher under Alternative C than under Alternatives A and B, the effects of underwater sound from active acoustic sources on sirenians under Alternative C would still be **adverse** and **minor** because impacts would be temporary or short-term and would not be considered outside the natural range of variability of species' populations, their habitats, or the natural processes sustaining them. Impacts could include disruptions of behavioral patterns such as temporary disruption of communication and disturbance of individuals or groups of sirenians, and possible displacement of individuals or groups, but without substantial interference to feeding, reproduction, or other biologically important functions affecting population levels. Displacement of sirenians from preferred breeding, feeding, or nursery grounds or designated critical habitat would be limited to the project area or its immediate surroundings. Impacts of Alternative C on sirenians would be **insignificant**.

3.5.2.5.4 Fissipeds

Impacts of Alternative C on fissipeds, including ESA-listed species and designated critical habitat, would be the same or slightly, but not appreciably, larger as those under Alternatives A and B for the following impact causing factors: vessel and equipment sound; vessel presence and movement of equipment in the water, human activity, accidental leakage or spillage of oil, fuel, and chemicals; trash and debris; and air emissions. Overall, impacts on fissipeds from these factors would be insignificant. Although the impacts of active underwater acoustic sources would also be similar under Alternative C as under Alternatives A and B, they are discussed below because the impacts of underwater sound on marine mammals are of main concern and to show the modeled increase in behavioral disruption exposures of fissipeds from the projected increase in the use of echo sounders, ADCPs, and acoustic communication systems (see Appendix E).

3.5.2.5.4.1 Active Underwater Acoustic Sources

As with Alternatives A and B, active underwater acoustic sources under Alternative C include echo sounders, ADCPs, and acoustic communication systems as discussed in Section 2.4. Descriptions of all active sources considered in this study can be found in Appendix E. The representative sources used in exposure modeling are the same as described in Alternatives A and B and listed in **Table 3.5-7**. Since Alternative C involves improvements in techniques and technology with an increased use of underwater acoustic sources, as well as an overall funding increase of 20 percent relative to Alternatives A and B, the behavioral disruption exposure estimates are higher than under Alternatives A and B.

The active underwater acoustic sources were evaluated in the same way under Alternative C as for Alternatives A and B. Quantitative acoustic exposure to marine mammals, including fissipeds, from operation of sound sources was modeled for nine sources (see Appendix E). Acoustic modeling was conducted by determining the sound field expected from each source and estimating the number of marine mammals that may be exposed above sound thresholds for PTS/injury and behavioral disruption during surveys. To gauge potential for impact, received sound levels that may result in PTS/injury or behavioral disruption to the animal were needed. For this study, the current NMFS criteria for both PTS/injury (NMFS, 2018a) and behavioral disruption (84 FR 72308, December 31, 2019) were used). Methodology for modeling the impacts of active underwater acoustic sources is presented in Appendix E. Additionally, Section 3.5.2.3.1.1 under Cetaceans discusses the assumptions made and the data sources used in the modeling scenarios to predict exposures of marine mammals, including fissipeds.

Based on the modeling and taking into account animal behavior, source characteristics, and animal hearing capability, no PTS/injury exposures of fissipeds are expected to occur. Note that the estimated exposures have overall decreased between the Draft PEIS and the Final PEIS for the reasons discussed in Section 3.5.2.3.1.1 under Cetaceans. Summarized total potential behavioral disruption exposures of fissipeds over five years for all sources are shown in **Table 3.5-27**. For annual numbers, see Appendix E. Species that may be in the area but for which no impacts were predicted are not included in the tables. Discussion of how behavioral disruption exposures were modeled and calculated can be found in Sections 3.5.2.3.4.1.1 and in Appendix E.

Table 3.5-27. Total Predicted Exposures for Fissiped Species and Time in Seconds Above the Behavioral Disruption Threshold Under Alternative C

Species	Total Exposures*	Average time above 160 dB (s)**
Alaska Region		
Sea otters, SE	635.22	124
Sea otter, SC	430.34	124
Polar bear	65.01	177
West Coast Region		
Sea otter, CA	609.49	124
Sea otter, SE	635.22	124
Sea otter, WA	230.14	124

*Exposures are based on a probabilistic model that is scaled by animal density and may therefore include fractional counts.

**Exposure above threshold over 24 hours.

Under Alternative C, behavioral disruption exposures of fissipeds could occur in two regions. Compared to Alternatives A and B, use of underwater acoustic sources under Alternative C would occur at a higher level of effort. Behavioral disruption exposure of fissipeds under Alternative C could increase by ten polar bears and a thousand sea otters over the five-year timeframe as compared to Alternative A, and five polar bears and a few hundred sea otters as compared to Alternative B. However, for the simulated animals exposed above the 160 dB threshold, the average amount of time an individual receives sound levels above the behavioral threshold remains less than three minutes. The disturbances, therefore, are expected to be transient, and surveys, once completed in an area, would not generally be repeated, thus limiting an individual's behavioral disruption. Behavioral exposures need to occur over the timespan of weeks to have a population level effect on marine mammals, as in the case of seismic surveys that have months' worth of activity (Southall et al., 2016). Any disruption that occurs for a matter of hours or for less than a day would not likely have a population-level impact. Thus, although many individuals of some species could experience behavioral disturbance from NOS acoustic sources, the small increments of time that the animals are exposed above threshold over five years and over the extensive project area would not be expected to result in population level adverse impacts.

In coordination with NMFS and USFWS, NOS has developed mitigation measures to reduce potential impacts of active acoustic sources on marine mammals (as discussed in Section 3.5.2.3.4.1 under Alternative A, and see Appendix D).

Under Alternative C, no PTS/injury exposure is expected. While individual animals are expected to experience behavioral disruptions (<66 polar bears and a few thousand sea otters across the two regions and over the five-year timeframe), the amount of time they would exceed the behavioral threshold would be on average less than three minutes (**Table 3.5-27**). Similarly, the potential for masking would be minimal during surveys because the narrow beams of most active acoustic sources mean animals would not spend much time in ensonified zones. Overall, the potential impacts are likely limited to short-term disruption of acoustic habitat and behavioral patterns. Although behavioral disruption exposures of fissipeds would be higher under Alternative C than under Alternatives A and B, the effects of underwater sound from active acoustic sources on fissipeds under Alternative C would still be **adverse** and **minor** because impacts would be temporary or short-term and would not be considered outside the natural range of variability of species' populations, their habitats, or the natural processes sustaining them. Impacts could include disruptions of behavioral patterns such as temporary disruption of communication and disturbance of individuals or groups of fissipeds, and possible displacement of individuals or groups, but without substantial interference to feeding, reproduction, or other biologically important functions affecting population levels. Displacement of fissipeds from preferred breeding, feeding, or nursery grounds or designated critical habitat would be limited to the project area or its immediate surroundings. Impacts of Alternative C on fissipeds, including ESA-listed species, would be **insignificant**.

3.5.2.5.5 Conclusion

Since the effects of impact causing factors on marine mammals range from negligible to minor, the overall impact of Alternative C on marine mammals, including ESA-listed species and designated critical habitat, would be **adverse** and **minor**; thus, impacts of Alternative C would be **insignificant**.

3.5.2.6 Endangered Species Act Effects Determinations

Federal agencies are required under the ESA to formally determine whether their actions may affect listed species or their designated critical habitat. Effect determinations divide potential effects into three categories:

- No Effect;
- May Affect, but Not Likely to Adversely Affect; and
- May Affect, and is Likely to Adversely Affect.

Actions receiving a “No Effect” designation do not impact listed species or their designated critical habitat (hereafter listed resources) either positively or negatively and this designation is typically only used in situations where no listed resources are present in the action area. Actions receiving a “May Affect, but Not Likely to Adversely Affect” designation have only beneficial, insignificant, or discountable effects to listed resources. Effects are considered insignificant if they are of low relative impact, undetectable, not measurable, or cannot be evaluated. Adverse effects are considered discountable if they are extremely unlikely to occur. Actions designated as “May Affect, and is Likely to Adversely Affect” will negatively impact any exposed listed resources.

Potential impacts of underwater sound from active acoustic sources include injury exposures in the form of hearing loss (PTS), but such injury would be rare and confined to a few individuals of high-frequency cetaceans. While more individual animals comprising cetaceans, pinnipeds, sirenians, and fissipeds are expected to experience behavioral disruption exposures, the amount of time individuals may exceed the behavioral disruption threshold would only be for a few minutes. Similarly, the potential for masking would continue to be minimal during surveys because the narrow beam of most active acoustic sources means animals would not spend much time in ensonified zones. Overall, the potential impacts would likely continue to be limited to short-term disruption of acoustic habitat and behavioral patterns.

The acoustic modeling presented in the sections above and in Appendix E does not predict PTS/injury exposures of any ESA-listed species, only of four species of cetaceans which are not listed under the ESA. The modeling predicts behavioral disruption exposures of ESA-listed cetaceans in all five regions, ESA-listed pinnipeds in the Alaska, West Coast, and Pacific Islands regions, ESA-listed sirenians in the Greater Atlantic and Southeast regions, and ESA-listed fissipeds in the Alaska and West Coast regions. The amount of time that the animals would be exposed above the behavioral threshold is an important factor, in addition to considering if the sources are emitting sounds within the hearing range of the animals, for determining potential impacts. The duration of the time above threshold from NOS acoustic sources is typically on the order of two to five minutes; therefore, there would be a limited temporal disruption, and overall potential behavioral exposures would be limited. Behavioral exposures need to occur over the timespan of weeks to have a population level effect, as in the case of seismic surveys that have months’ worth of activity (Southall et al, 2016). Any disruption that occurs for a matter of hours or for less than a day would not likely have a population-level impact. Additionally, mitigation measures to further reduce impacts from underwater acoustic sources include those listed in Appendix D. Thus, NOS determines “May Affect, but Not Likely to Adversely Affect” for all species exposed above the behavioral threshold. **Table 3.5-28** summarizes the effects determinations for all ESA-listed marine mammals in the action area.

Sound from the proposed number of vessels used by NOS within the EEZ, as compared with all other shipping and vessel traffic and the assumption that individuals or groups of marine mammals may be familiar with various and common vessel-related sounds, could result in masking when operating in the vicinity of a busy shipping lane but would be temporary or short-term and limited to the project area or its immediate surroundings; thus, the effects on ESA-listed species from vessel sound would be discountable, and injury or mortality of ESA-listed species is not expected from vessel and equipment sound.

Given that the likelihood of a vessel strike would be expected to be discountable (i.e., extremely unlikely to occur), the effects of vessel presence and movement of equipment in the water would only cause small disruptions of behavioral patterns or displacement of individuals or groups that would be temporary or short-term, and displacement would be limited to the project area or its immediate surroundings. NOS has developed a suite of mitigation measures through consultation with the NMFS Office of Protected Resources (OPR) to further minimize the likelihood of vessel strikes included in Appendix D. Thus, the effects on ESA-listed species would be discountable, and injury or mortality of ESA-listed species is not expected from NOS vessel presence and movement.

The effects of human activity on cetaceans and sirenians would only be minimal disruptions of behavioral patterns and no expected displacement of animals. This would generally be the same for pinnipeds and fissipeds; however, there may be some short-term displacement limited to the project area or immediate surroundings. In the event of a polar bear sighting during tide gauge and GPS reference station installation, NOS would follow human/bear interaction guidelines as issued by USFWS. For polar bears, the implementation of mitigation measures with time and space restrictions would ensure that the effects of human activity, such as disturbance of polar bear dens and potential human-bear interactions would be avoided, thus effects would not reasonably occur, and injury or mortality of ESA-listed species is not expected from human activity.

The likelihood for an accidental spill is expected to be discountable (i.e., extremely unlikely to occur), and exposure of ESA-listed marine mammals and critical habitats to oil, fuel, and other contaminants is not expected. Such accidents may be caused by equipment malfunction, human error, or natural phenomena and are not expected during the course of NOS operations. In the unlikely event of an accidental spill, there would be very low likelihood for contaminants to make contact with the water because vessel operations personnel are required to respond immediately using established spill response procedures. Thus, effects from chemical contamination on ESA-listed species are not reasonably certain to occur.

Impacts from discarded trash and debris are expected to be avoided through vessel operators' required compliance with USCG and EPA regulations. Thus, effects from entanglement and ingestion of trash and debris on ESA-listed species are expected to be discountable (i.e., extremely unlikely to occur). Additionally, mitigation measures that would reduce or avoid entanglement impacts are included in Appendix D. As the emissions from vessels used by NOS would continue to be a very small fraction as compared to emissions from all other vessel activity in the oceans, the effects on ESA-listed species would be discountable (i.e., extremely unlikely to occur).

Since project activities may occur in some areas within or adjacent to designated critical habitats, there is the potential for impacts on critical habitat characteristics that support ESA-listed marine mammals. Critical habitat may be minimally disturbed but would remain functional to maintain viability of the species dependent on it. No destruction or adverse modification of any critical habitat would occur. Although prey species may be disturbed by some of the impact causing factors, which can affect critical habitat characteristics based on feeding and finding prey, it is not expected that impacts on prey species would be substantial enough to affect the fitness of individual animals. Due to the potential for effects on critical habitat that could be negligible or minor, as discussed in the impact analysis above, the Proposed

Action "May Affect, but Not Likely to Adversely Affect" the designated critical habitat of marine mammals occurring in the action area (**Table 3.5-28**).

Table 3.5-28. Summary of Effects Determinations for ESA-Listed Marine Mammals and Critical Habitat

ESA- Listed Marine Mammals	Species Determination	Critical Habitat Determination
Cetaceans – Mysticetes		
Bowhead whale	May Affect, but Not Likely to Adversely Affect	N/A* (no critical habitat designated)
Sei whale	May Affect, but Not Likely to Adversely Affect	N/A (no critical habitat designated)
Rice's whale	May Affect, but Not Likely to Adversely Affect	N/A (no critical habitat designated)
Blue whale	May Affect, but Not Likely to Adversely Affect	N/A (no critical habitat designated)
Fin whale	May Affect, but Not Likely to Adversely Affect	N/A (no critical habitat designated)
Gray whale (Western North Pacific DPS)	May Affect, but Not Likely to Adversely Affect	N/A (no critical habitat designated)
North Atlantic right whale	May Affect, but Not Likely to Adversely Affect	May Affect, Not Likely to Adversely Affect
North Pacific right whale	May Affect, but Not Likely to Adversely Affect	May Affect, but Not Likely to Adversely Affect
Humpback whale (Mexico DPS)	May Affect, but Not Likely to Adversely Affect	May Affect, Not Likely to Adversely Affect
Humpback whale (Central America DPS)	May Affect, but Not Likely to Adversely Affect	May Affect, Not Likely to Adversely Affect
Humpback whale (Western North Pacific DPS)	May Affect, but Not Likely to Adversely Affect	May Affect, Not Likely to Adversely Affect
Cetaceans – Odontocetes		
Beluga whale (Cook Inlet DPS)	May Affect, but Not Likely to Adversely Affect	May Affect, but Not Likely to Adversely Affect
Killer whale (Southern Resident DPS)	May Affect, but Not Likely to Adversely Affect	May Affect, but Not Likely to Adversely Affect
Sperm whale	May Affect, but Not Likely to Adversely Affect	N/A (no critical habitat designated)
False killer whale (Main Hawaiian Islands Insular DPS)	May Affect, but Not Likely to Adversely Affect	May Affect, but Not Likely to Adversely Affect

ESA- Listed Marine Mammals	Species Determination	Critical Habitat Determination
Pinnipeds – Otariids		
Guadalupe fur seal	May Affect, but Not Likely to Adversely Affect	N/A (no critical habitat designated)
Steller sea lion (Western DPS)	May Affect, but Not Likely to Adversely Affect	May Affect, but Not Likely to Adversely Affect
Pinnipeds – Phocids		
Bearded seal (Beringia DPS)	May Affect, but Not Likely to Adversely Affect	May Affect, Not Likely to Adversely Affect
Hawaiian monk seal	May Affect, but Not Likely to Adversely Affect	May Affect, but Not Likely to Adversely Affect
Ringed seal (Arctic subspecies)	May Affect, but Not Likely to Adversely Affect	May Affect, Not Likely to Adversely Affect
Sirenians – Manatees		
West Indian manatee (Antillean subspecies)	May Affect, but Not Likely to Adversely Affect	N/A (no critical habitat designated)
West Indian manatee (Florida subspecies)	May Affect, but Not Likely to Adversely Affect	May Affect, but Not Likely to Adversely Affect
Fissipeds – Mustelids		
Northern sea otter (Southwest Alaska DPS)	May Affect, but Not Likely to Adversely Affect	May Affect, but Not Likely to Adversely Affect
Southern sea otter	May Affect, but Not Likely to Adversely Affect	N/A (no critical habitat designated)
Fissipeds – Ursids		
Polar bear	May Affect, but Not Likely to Adversely Affect	May Affect, but Not Likely to Adversely Affect

*N/A = Not Applicable