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ENVIRONMENTAL ASSESSMENT FOR ARCTIC SHIELD 2024

June 2024

U.S. Coast Guard
District 17
Juneau, Alaska

U.S. Department of Homeland Security

United States Coast Guard

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EXECUTIVE SUMMARY

INTRODUCTION

This document is an Environmental Assessment (EA) prepared in accordance with the National Environmental Policy Act, 42 U.S.C. Section (§) 4321, et seq., Council on Environmental Quality (CEQ) Regulations, 40 C.F.R. §1500 et seq., and the *U.S. Coast Guard Environmental Planning Policy* dated 23 April 2019, COMDTINST 5090.1.

The Coast Guard's Proposed Action is to implement the Arctic Shield Operational Plan (OPLAN) for 2024 to perform the existing Coast Guard statutory missions in the Arctic Region. In previous years of environmental compliance for Arctic Shield operations, the Coast Guard has determined, and the CEQ has concurred, that the performance of its statutory missions are subject to Categorical Exclusions (CATEX); specifically, CATEXs 22 and 23 listed in Figure 2-1 of COMDTINST M16475.1D. However, COMDTINST 5090.1 cancelled M16475.1D. In Section 7 of COMDTINST 5090.1 (*Environmental Aspect and Impact Considerations*) states that the Commandant (CG-47) determined that COMDTINST 5090.1 falls under Department of Homeland Security (DHS) DHS CATEX A3, which references Figure 2-1: *Coast Guard Categorical Exclusions*. Also, Section 7 states that it is the responsibility of the appropriate Proponent (i.e., person controlling the execution of the proposed action) to evaluate specific actions resulting from the general policies found in COMDTINST 5090.1 for compliance with federal environmental regulations and other applicable environmental mandates (e.g., NEPA, 40 CFR §§1500–1508), DHS Instruction Manuals, Coast Guard Environmental Planning documents).

Thus, in accordance with COMDTINST 5090.1, the Coast Guard has chosen to analyze the impact or harm of Arctic Shield 2024 in this Environmental Analysis. The information and analysis contained in this EA will determine whether an increased United States Coast Guard (hereafter referred to as "Coast Guard") presence for operations under or related to Arctic Shield, occurring from mid-May to mid-November of 2024, would result in significant impact or harm to the environment, requiring the preparation of an environmental impact statement, or if no significant impact or harm would occur and a finding of no significant impact (FONSI) would be appropriate. For the purposes of this EA, the Arctic (hereafter referred to as the "Arctic" or the "Arctic Region") is defined below. In order to accurately capture all areas that may be impacted, both directly and indirectly, as required by 50 C.F.R. §402.02, the Coast Guard has determined that the proposed action area is the "Arctic" as defined by the United States Arctic Research and Policy Act (ARPA) of 1984, Public Law 98-373 §112[1], with the following modification: the southern boundary of the proposed action area runs from the point of intersection of the Maritime Boundary Line and the line of 54° North latitude, and follows the line of 54°N eastward to a point of intersection at longitude 168.00° West and latitude 54.00°N, thence follows a rhumb line in an east/northeast direction to a point of intersection at longitude 160.00° W and the ARPA boundary line, which is near Cape Seniavin on the Alaska Peninsula (Figure 1-1).

Arctic Shield 2024–2029 will occur in similar context and intensity as the Proposed Action for Arctic Shield 2017. For Artic Shield 2017, the Coast Guard prepared an EA that resulted in a FONSI. Because the Arctic Shield 2024 scope and intensity is similar 2017, the Coast Guard has determined that an EA is necessary in order to determine

[1] United States Arctic Research and Policy Act of 1984 defines the Arctic as "all United States and foreign territory north of the Arctic Circle and all United States territory north and west of the boundary formed by the Porcupine, Yukon, and Kuskokwim Rivers; all contiguous seas, including the Arctic Ocean and the Beaufort, Bering and Chukchi Seas; and the Aleutian chain."

whether Arctic Shield 2024 will have significant impact or harm on the human environment.

The Coast Guard's mission is to protect the public, the environment, and U.S. economic interests in the Nation's ports and waterways, along the coast, on international waters, or in any maritime region as required to support national security. The Coast Guard's vision for the Arctic Region is to "ensure safe, secure, and environmentally responsible maritime activity in the Arctic" (U.S. Coast Guard 2013b).

PURPOSE AND NEED FOR ACTION

The Coast Guard District 17 proposes to implement the Arctic Shield Operations Plan (OPLAN) to conduct operations and training events for Coast Guard personnel to be ready to meet statutory mission demands in the U.S. Arctic Region. The purpose of the Proposed Action is to fulfill the Coast Guard's Arctic Strategy (USCG 2013) by providing consistent and reliable Coast Guard presence in the Arctic from mid-May to mid-November. The requirement for the Coast Guard to be present in the Arctic during the ice-free season in the Bering, Chukchi, and Beaufort Seas is so the Coast Guard can react quickly to matters such as safety of life at sea, law enforcement, and collisions at-sea. The Coast Guard response would not have to rely on assets that are at a considerable distance from this area.

The need of the Proposed Action is to meet a seasonal surge of human activity that fall under the umbrella of USCG statutory mission demands in the Arctic. There is a progressive, yearly decline in the thickness and extent of Arctic Sea ice creating navigation routes through the Northwest Passage and Northern Sea Route resulting in an increase of vessel activity in the Arctic U.S. Coast Guard 2016). Expanding commercial ventures in the Arctic have also expanded maritime traffic in the Bering Strait. From 2008 to 2015, traffic through the Bering Strait increased by 145 percent (U.S. Coast Guard 2016). These activities include a broad range of vessels including commercial icebreakers for the opening of sea lanes for cruise ships, oil and gas industry vessels, government and private research vessels, ore carriers, coastal resupply vessels, recreational/adventurer vessels, and commercial fishing boats. With increased traffic comes an increased potential for search and rescue (SAR), water pollution, illegal fishing, and infringement on the U.S. EEZ which requires Coast Guard presence.

Arctic Shield integrates seasonal operations and training events in which the Coast Guard conducts safety and security operations, evaluates its capabilities, and strengthens its relationships with federal and state partners as well as Alaskan communities. These activities have allowed the Coast Guard to better understand and overcome obstacles to communications, logistics, and harsh weather in the Arctic. The lessons learned have informed the Coast Guard about the specific requirements needed to succeed in the region as rapid changes in climate, activities, and technology continue to present new challenges.

Guided by the Coast Guard's Arctic Strategy Implementation Plan (with direction from the President of the United States; the National Security Strategy; National Military and Maritime Strategies; National Strategy for the Arctic Region; Arctic Region Policy NSPD-66/HSPD-25; National Strategies for Homeland Security; Maritime Domain Awareness; National Ocean Policy; and Executive Order 13580) Arctic Shield operations and training events will allow district D17 to meet the Coast Guard mission responsibilities in the U.S. Arctic Region of operation.

PROPOSED ACTION AND ALTERNATIVES

Arctic Shield activities over the next six years (2024–2029) would include the dispatch of two MH-60 helicopters to a Forward Operating Site (FOS) in the Arctic, likely from June into October. The Coast Guard would dispatch multiple cutters on a staggered schedule to the region, with typically no more than two Guard Cutters in the region directly supporting Arctic Shield at any given time. Although not supporting Artic Shield, there may also be an additional icebreaking capable cutter deployed to the region for a total of three cutters for certain time frames. The dispatched cutters and aircraft would perform the same humanitarian, law enforcement, and national security duties, functions, and missions of the Coast Guard as are performed in other areas of responsibility year-round in the sub-Arctic Region of Alaska. These include:

1. Searching for either passengers and crew that fall overboard from recreational, commercial, or government vessels in Arctic waters, or victims of crashed aircraft in the water;
2. Rescuing either passengers and crew that fall overboard from recreational, commercial, or government vessels in Arctic waters, or victims of crashed aircraft in the water;
3. Rescuing persons on vessels in Arctic waters in medical scenarios requiring evacuation by Coast Guard helicopter or Coast Guard rescue vessel, sometimes requiring a Coast Guard rescue swimmer to enter the water himself or herself to place the person in a harness or rescue basket to be winched into a hovering helicopter;
4. Freeing a beset vessel which may require towing or escort to safety;
5. Establishing aids-to-navigation in Arctic waters;
6. Enforcing federal law in the U.S. Territorial Sea and the High Seas of Arctic waters;
7. Maintaining awareness of vessel and aircraft activities in the Arctic maritime domain;
8. Broadening Coast Guard partnerships with Alaska Native Villages in the Arctic; and,
9. Enhancing and improving preparedness, prevention, and response capabilities.

The Proposed Action consists of the following main elements employed to meet the objectives of Arctic Shield:

1. Land/shore operations;
2. Sea/Surface operations;
3. Air Operations
4. Acoustic Sources

Shore operations for Arctic Shield 2024 include the use of Kotzebue as a main Forward Operating Location (FOL) and logistics/staging location. Nome or Utqiagvik (Barrow) may also be used for this purpose. Required vessel inspections as well as voluntary safety inspections will occur shoreside at an Arctic locations such as Nome, Utqiagvik (Barrow), Kotzebue, or Kivalina. Emergency Search and Rescue medivacs would depart from an FOL.

Air operations for Arctic Shield include Search and Rescue activities as well as routine patrols, Arctic domain awareness flights, and reconnaissance. Air assets typically used by the Coast Guard in Arctic Shield are MH-60T Jayhawk helicopters.

Sea operations include Search and Rescue activities, routine patrols, and the use of at-sea berthing and support facilities. Sea assets typically used by the Coast Guard in Arctic Shield activities include high and medium endurance cutters and a buoy tender.

Training during Arctic Shield includes flight training with the air assets, small boat training using sea assets, and oil recovery training (oil response itself is not covered under Arctic Shield 2017).

Tribal and local government engagement includes formal and informal government-to-government and community engagement with federally recognized tribes, Alaska Native organizations, and local community leaders. Education and training outreach would be provided through programs, such as Kids Don't Float, Water Safety, and Commercial Fishing Vessel Standards Safety Outreach, community service visits, cutter tours, and outreach and service at athletic events.

EFFECTS OF NO ACTION ALTERNATIVE

Under the No Action Alternative, the Coast Guard would not be able to fulfill its statutorily authorized missions during the Arctic in 2024. The Coast Guard also enforces the Marine Mammal Protection Act (MMPA) and Endangered Species Act (ESA), and without a Coast Guard presence in the Arctic, enforcement of these laws would be significantly reduced. The No Action Alternative would result in no on-scene assets in the region. Instead, existing assets would have to be mobilized from their normal operating locations (i.e., Kodiak for aviation assets, and surface assets from Kodiak or, if deployed, the Gulf of Alaska or Bering Sea). Therefore, no assets would be positioned for immediate emergency response.

The No Action Alternative would not allow the Coast Guard to fulfill the mission to provide a proactive air, surface, and shoreside presence in the Arctic to meet statutory mission requirements. As such, it is not a viable alternative and does not meet the purpose and need but is included here for comparison of environmental effects with the Proposed Action.

SUMMARY OF POTENTIAL ENVIRONMENTAL CONSEQUENCES

A summary of potential for environmental impact or harm of the Proposed Action is provided in Table 2-2. Potential environmental stressors include acoustic (acoustic transmissions, vessel noise, and aircraft noise), and physical (aircraft and in-water vessel movement). The potential environmental consequences of these stressors have been analyzed in this EA for resources associated with the physical, biological, and socioeconomic environments. Quantitative analysis was performed on those resources, namely marine mammals, for which non-impulsive acoustic thresholds have been established and/or are appropriate. For those resources for which non-impulsive thresholds have not been established and/or appropriate information was not available, a qualitative approach was taken.

The Proposed Action includes guidance documents, operational measures, and best management practices (BMPs) (Chapter 6) developed during federal and state agency permitting and approval processes, or as standard provisions for Coast Guard work. These SOPs and BMPs would be employed to avoid or minimize adverse effects on the environment.

Based on the overall analysis contained herein, the Proposed Action is **not anticipated to have a significant impact** on threatened and endangered species, and their habitat.

The Coast Guard has started informal consultations with the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) and as of the date of this EA, they have not received letters of concurrence. However, once the letters are received, the Coast Guard's obligations under ESA Section 7 to consult with the USFWS will be completed (note that once letters are received, the letters will be placed in Appendix D of this EA). The Coast Guard has determined that the Proposed Action **may affect, but is not likely to adversely affect** ESA-listed species and proposed or designated critical habitat under NMFS's jurisdiction, and the Coast Guard has requested written concurrence and remains in informal consultation with NMFS.

The Coast Guard determined that the Proposed Action **may affect, but is not likely to adversely affect**, ESA-listed species and proposed or designated critical habitat that fall under their jurisdiction. The Marine Mammal Protection Act (MMPA) of 1972, as amended (16 United States Code [U.S.C.] 1361 *et seq*.) prohibits, with certain exceptions, the take of marine mammals in U.S. waters and by U.S. citizens on the high seas along with the importation of marine mammals and marine mammal products. In U.S. Coast Guard Instruction [CGD17INST] 16214.2A (2011), the U.S. Coast Guard outlines procedures for avoiding marine mammals and protected species sightings, strandings, and injuries, as well as enforcing the MMPA and ESA. Therefore, no "take" under the MMPA (defined as Level A or B harassment under the MMPA) is anticipated by Arctic Shield 2024 activities. Section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) requires Federal action agencies to consult with NMFS on all actions or Proposed Actions authorized, funded, or undertaken by the agency that may adversely affect Essential Fish Habitat (EFH). The Coast Guard determined that all activities of the Proposed Action would have no significant adverse effect on designated EFH.

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LIST OF ACRONYMS AND ABBREVIATIONS

° C	degrees Celsius
° F	degrees Fahrenheit
° N	degrees North latitude
° W	degrees West latitude
ABWC	Alaska Beluga Whale Commission
ARPA	Arctic Research and Policy Act
BMP(s)	Best Management Practice(s)
BOEM	Bureau of Ocean Energy Management
CAA	Clean Air Act
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CGD17INST	Coast Guard District 17 Instruction
cm	centimeter(s)
Coast Guard	United States Coast Guard
CWA	Clean Water Act
D17	District 17 (of the Coast Guard)
dB	decibels
dB re 1 µPa at 1 m	decibels referenced to 1 micropascals at 1 meter
DPS	Distinct Population Segment
EA	Environmental Assessment
Eagle Act	The Bald and Golden Eagle Protection Act
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
E.O.	Executive Order
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FMP(s)	Fisheries Management Plan(s)
FOL(s)	Forward Operating Location(s)
FONSI	Finding of No Significant Impact
FR	Federal Register
ft	foot (feet)
ft^2	square feet
HAPC	Habitat Areas of Particular Concern
HF	high-frequency marine mammal hearing group
Hz	hertz
in	inch(es)
kHz	kilohertz
km	kilometer(s)
km^2	square kilometers
km/hr	kilometers per hour
kn	knots

LF	low-frequency marine mammal hearing group
m	meter(s)
m^2	square meters
MF	mid-frequency marine mammal hearing group
mi	mile(s)
mi^2	square miles
μPa	micropascals
mph	miles per hour
ms	millisecond(s)
MBTA	Migratory Bird Treaty Act
MMPA	Marine Mammal Protection Act
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
nm	nautical mile(s)
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPFMC	North Pacific Fisheries Management Council
OPLAN	Operations Plan
OPNAV	Naval Operations
OW	otariid and non-phocid marine carnivore hearing group
PEIS	Programmatic Environmental Impact Statement
PTS	Permanent Threshold Shift
PW	phocid marine mammal hearing group
RHIB	Rigid Hull Inflatable Boat
SAR	Search and Rescue
SIP	State Implementation Plan
SOP(s)	Standard Operating Procedure(s)
TTS	Temporary Threshold Shift
U.S.	United States
USC	United States Code
USCG	U.S. Coast Guard
USFWS	U.S. Fish and Wildlife Service
WHOI	Woods Hole Oceanographic Institution

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CHAPTER 1 PURPOSE AND NEED

1.1 INTRODUCTION

The Arctic Region is dynamic and strategically important to global transportation, resource management, and international cooperation. The United States Coast Guard's (Coast Guard) vision for the Arctic Region is to "ensure safe, secure, and environmentally responsible maritime activity in the Arctic" (U.S. Coast Guard 2013b). This Environmental Assessment (EA) presents the anticipated effects from Coast Guard operations and training exercises related to Arctic Shield that are proposed to occur at sea and over land in the Alaskan Arctic Region from mid-May to mid-November of 2024. In order to accurately capture all areas that may be impacted, both directly and indirectly, as required by 50 C.F.R. §402.02, the Coast Guard has determined that the proposed action area is the "Arctic" as defined by the United States Arctic Research and Policy Act (ARPA) of 1984, Public Law 98-373 §112[2], with the following modification: the southern boundary of the proposed action area runs from the point of intersection of the Maritime Boundary Line and the line of 54° North latitude, and follows the line of 54°N eastward to a point of intersection at longitude 168.00° West and latitude 54.00°N, thence follows a rhumb line in an east/northeast direction to a point of intersection at longitude 160.00° W and the ARPA boundary line, which is near Cape Seniavin on the Alaska Peninsula (Figure 1-1).

The Coast Guard's mission is to protect the public, the environment, and United States (U.S.) economic interests, in the Nation's ports and waterways, along the coast, on international waters, or in any maritime region, as required to support national security. Coast Guard District 17, which has responsibility for the Arctic Region, proposes to conduct Arctic Shield operations and training exercises to fulfill this mission in response to a substantial increase in Arctic maritime activity from mid-May to mid-November of 2024.

This EA was prepared pursuant to the requirements of National Environmental Policy Act (NEPA); regulations issued by the Council on Environmental Quality (CEQ) (40 Code of Federal Regulations [CFR] §1500 *et seq*.); Department of Homeland Security Directive Number 023-01; and Coast Guard Commandant Instruction M16475.1D. The information and analysis contained in this EA will determine whether the Coast Guard presence from mid-May to mid-November of 2024 in the proposed action area, located within the proposed action area (Figure 1-1), would result in a significant impact or harm to the environment. If so, the Coast Guard is required to prepare an environmental impact statement. However, if no significant impacts or harm would occur and a finding of no significant impact (FONSI) is appropriate, then an EIS is not required.

[2] , United States Arctic Research and Policy Act of 1984 defines the Arctic as "all United States and foreign territory north of the Arctic Circle and all United States territory north and west of the boundary formed by the Porcupine, Yukon, and Kuskokwim Rivers; all contiguous seas, including the Arctic Ocean and the Beaufort, Bering and Chukchi Seas; and the Aleutian chain."

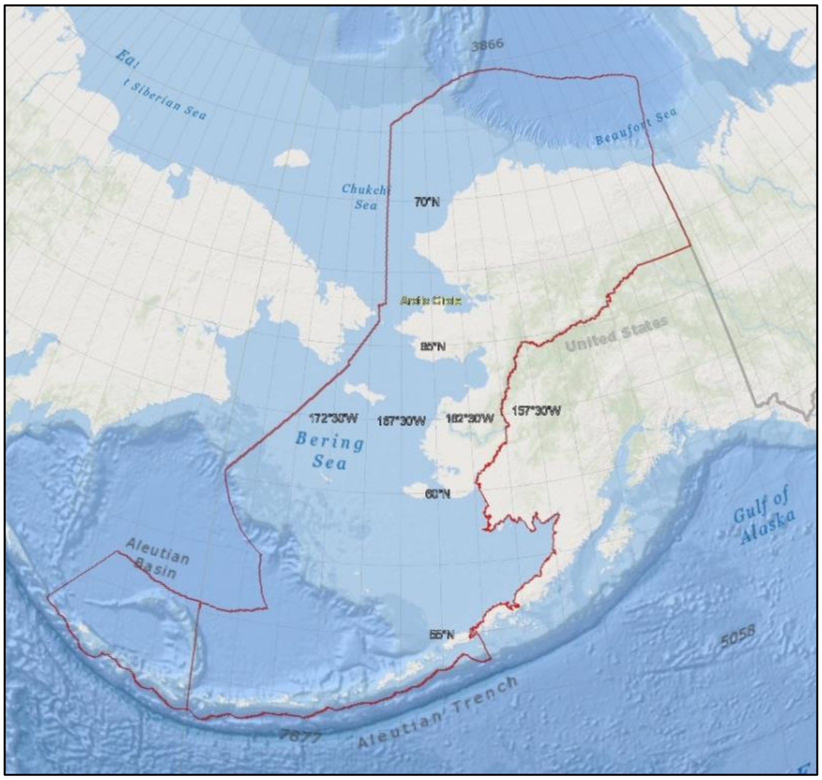

FIGURE 1-1. THE PROPOSED ACTION AREA.

1.2 PURPOSE AND NEED

The Coast Guard District 17 proposes to implement the Arctic Shield Operations Plan (OPLAN) to conduct operations and training events for Coast Guard personnel to be ready to meet statutory mission demands in the U.S. Arctic Region. The purpose of the Proposed Action is to fulfill the Coast Guard's Arctic Strategy (USCG 2013) by providing consistent and reliable Coast Guard presence in the Arctic from mid-May to mid-November. The requirement for the Coast Guard to be present in the Arctic during the ice-free season in the Bering, Chukchi, and Beaufort Seas is so the Coast Guard can react quickly to matters such as safety of life at sea, law enforcement, and collisions at-sea. The Coast Guard response would not have to rely on assets that are at a considerable distance from this area.

The need of the Proposed Action is to meet a seasonal surge of human activity that fall under the umbrella of USCG statutory mission demands in the Arctic. There is a progressive, yearly decline in the thickness and extent of Arctic Sea ice creating navigation routes through the Northwest Passage and Northern Sea Route resulting in an increase of vessel activity in the Arctic U.S. Coast Guard 2016). Expanding commercial ventures in the Arctic have also expanded maritime traffic in the Bering Strait. From 2008 to 2015, traffic through the Bering Strait increased by 145 percent (U.S. Coast Guard 2016). These activities include a broad range of vessels including commercial icebreakers for the opening of sea lanes for cruise ships, oil and gas industry vessels, government and private research vessels, ore carriers, coastal resupply vessels, recreational/adventurer vessels, and commercial fishing boats. With increased traffic comes an increased potential for search and rescue (SAR), water pollution, illegal fishing, and infringement on the U.S. EEZ which requires Coast Guard presence.

Arctic Shield integrates seasonal operations and training events in which the Coast Guard conducts safety and security operations, evaluates its capabilities, and strengthens its relationships with federal and state partners as well as Alaskan communities. These activities have allowed the Coast Guard to better understand and overcome obstacles to communications, logistics, and harsh weather in the Arctic. The lessons learned have informed the

Coast Guard about the specific requirements needed to succeed in the region as rapid changes in climate, activities, and technology continue to present new challenges.

Guided by the Coast Guard's Arctic Strategy Implementation Plan (with direction from the President of the United States; the National Security Strategy; National Military and Maritime Strategies; National Strategy for the Arctic Region; Arctic Region Policy NSPD-66/HSPD-25; National Strategies for Homeland Security; Maritime Domain Awareness; National Ocean Policy; and Executive Order 13580) Arctic Shield operations and training events will allow district D17 to meet the Coast Guard mission responsibilities in the U.S. Arctic Region of operation.

1.3 APPLICABLE LAWS AND DIRECTIVES

1.3.1 NATIONAL ENVIRONMENTAL POLICY ACT

NEPA (42 United States Code [U.S.C] §4321 *et seq.*) was enacted to provide for the consideration of environmental factors in Federal agency planning and decision making, including a series of pertinent alternatives. NEPA requires Federal agencies to analyze the potential impacts of a Proposed Action to the human environment, which includes the physical, biological, and socioeconomic environments and the relationship of people with those environments. The purpose of the NEPA is to ensure that environmental factors are weighted equally when compared to other factors in the decision-making process undertaken by Federal agencies. NEPA also established the President's CEQ which is an executive council that is responsible for writing the regulations implementing agency environmental planning and analysis requirements under NEPA (CEQ regulations, CFR Parts 1500-1508). The CEQ is also responsible for reporting to the President and Congress on the status, condition, and management of the Nation's environment, typically in the annual environmental quality report.

1.3.2 EXECUTIVE ORDER 12114

Executive Order (EO) 12114, Environmental Effects Abroad of Major Federal Actions, directs Federal agencies to be informed of and take account of environmental considerations when making decisions regarding major Federal actions outside the U.S., its territories, and possessions. The EO requires environmental considerations of actions with the potential to significantly harm the global commons, which are the geographic areas outside the jurisdiction of any nation, including the oceans beyond their territorial limits that the U.S. defines as 12 nautical miles (nm; 22 km). The purpose of EO 12114 is to ensure that environmental factors are weighted equally when compared to other factors in the decision-making process undertaken by Federal agencies. Given the absence of any written Coast Guard policy on how field units are to implement EO 12114, the analysis detailed in Section 10-3.19 of OPNAV M-5090.1 has been used to determine whether Arctic Shield operations occurring within the U.S. Territorial Sea will have transboundary effects on the environment. In accordance with EO 12114, applicable regulations, and Coast Guard instructions and directives, this EA evaluates the potential for harm from the Proposed Action.

1.3.3 BALD AND GOLDEN EAGLE PROTECTION ACT

The Bald and Golden Eagle Protection Act (Eagle Act) (16 U.S.C §§668-668d) was enacted in 1940 and prohibits anyone, without a permit issued by the Secretary of the Interior, from "taking" bald eagles, including their parts, nests, or eggs. The Act provides criminal penalties for persons who "take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or any manner, any bald eagle (or any golden eagle), alive or dead, or any part, nest, or egg thereof." The Act further defines "take" as to "pursue, shoot, shoot at, poison, wound, kill capture, trap, collect, molest, or disturb." The Coast Guard determined that the Proposed Action would not result in takes of bald or golden eagles, and, as such, is not required to apply for a permit with the United States Fish and Wildlife Service (USFWS) under the Eagle Act.

1.3.4 CLEAN AIR ACT

The Clean Air Act (CAA) (42 U.S.C §7506[c]) regulates air emissions from area, stationary, and mobile sources and requires Federal actions in nonattainment areas or maintenance areas to conform to an applicable State Implementation Plan (SIP). The SIP is designed to achieve or maintain an attainment designation for air pollutants as defined by the National Ambient Air Quality Standards (NAAQS), which protect public health and the environment. The goal of the CAA was to set and achieve NAAQS in every state by 1975. It was amended in 1977 and 1990. The criteria and procedures to be used to demonstrate conformity are explained in 40 CFR Parts 51 and 93. The Coast Guard determined that the Proposed Action would generate air emissions from aircraft and vessels but is not subject to the General Conformity Rule because the coastal regions of Alaska are in attainment of the NAAQS for criteria pollutants.

1.3.5 CLEAN WATER ACT

The Clean Water Act (CWA) (33 U.S.C §1251 *et seq*.) is the cornerstone of surface water quality protection in the U.S. The statute employs a variety of regulatory and non-regulatory tools to sharply reduce direct pollutant discharges into waterways, finance municipal wastewater treatment facilities, and manage polluted runoff. These tools are employed to achieve the broader goal of restoring and maintaining the physical, chemical, and biological integrity of the nation's waters so that they can support "the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water." Starting in the late 1980s, efforts to address pollution from runoff drastically have increased. For "non- point sources" (i.e., runoff from agricultural areas), voluntary programs are used, whereas regulatory approach is used for "wet weather point sources" (i.e., urban storm sewer systems and construction sites). The Coast Guard determined that beyond the normal operations of the vessel (and if applicable, covered under other regulations), the Proposed Action would not discharge any substances that may pollute the water column.

1.3.6 ENDANGERED SPECIES ACT

The Endangered Species Act (ESA) (16 U.S.C §1531 et seq.) applies to Federal actions in two respects. First, the ESA requires that Federal agencies, in consultation with the responsible wildlife agency, ensure that Proposed Actions are not likely to jeopardize the continued existence of any endangered or threatened species or result in the adverse modification or destruction of critical habitat (16 U.S.C. §1532(19)). Regulations implementing ESA expand the consultation requirement to include those actions that "may affect" a listed species or adversely modify critical habitat. Second, if an agency's Proposed Action would "take" a listed species, then the agency must obtain an incidental take authorization from the responsible wildlife agency. The ESA defined the term "take" to mean "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt any such conduct" (16 U.S.C. §1532(19)). The regulatory definitions of "harm" and "harass" are relevant to the Coast Guard's determination as to whether the Proposed Action would result in adverse effects to listed species.

- Harm is defined by regulation as "an act which actually kills or injures" fish or wildlife (50 CFR §222.102).
- Harass is defined by regulation as an "intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering" (50 CRF §17.3).

U.S. Coast Guard District 17 Instruction [CGD17INST] 16214.2A (2011) outlines procedures for avoiding marine mammals and protected species; reporting whale and protected species sightings, strandings, and injuries; and enforcing the Marine Mammal Protection Act (MMPA) and ESA.

In accordance with the ESA, informal consultations under Section 7 of the ESA were initiated with the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) based on the determination that the Proposed Action will have no effect on candidate species Sunflower Sea Star (*Pycnopodia helianthoides)*, and may affect, but is not likely to adversely affect, Chinook Salmon (*Oncorhynchus tshwytscha*), Chum Salmon (*Oncorhynchus keta*), Coho Salmon (*Oncorhynchus kisutch*), Sockeye Salmon (*Oncorhynchus nerka*), Steelhead (*Oncorhynchus mykiss*), Pacific Eulachon (*Thaleichthys pacificus*), Yelloweye Rockfish (*Sebastes ruberrimus*), Leatherback sea turtle (*Dermochelys coriacea*), bowhead whale (*Balaena mysticetus*), Sei whale (*Balaenoptera borealis*), fin whale (*Balaenoptera physalus*), gray whale (*Eschrichtius robustus*), humpback whale (*Megaptera novaeangliae*), North Pacific right whale (*Eubalaena japonica*), sperm whale (*Physeter macrocephalus*), bearded seal (*Erignathus barbatus*), ringed seal (*Phoca hispida*), Steller sea lion (*Eumetopias jubatus*), northern sea otter (*Enhydra lutris kenyoni*), Polar Bear (*Ursus maritimus*), wood bison (*Bison bison athabascae*), short-tailed albatross (*Phoebastria albatrus*), spectacled eider (*Somateria fischeri*), and Steller's eider (*Polysticta stelleri*). Take of ESA-listed species is not anticipated from the Proposed Action and, therefore, authorization was not warranted or requested. The USFWS indicated that their previous concurrence for Arctic Shield activities that took place in previous years would also to apply to Arctic Shield 2024[3].

The Coast Guard determined that the Proposed Action would have no effect and would not destroy or adversely modify critical habitat because none of the proposed activities are expected to cause direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of the North Pacific right whale, Steller sea lion, or polar bear critical habitat.

1.3.7 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C §1801 et seq.) was enacted to conserve and restore the Nation's fisheries and includes a requirement for NMFS and regional fishery councils to describe and identify Essential Fish Habitat (EFH) for all species that are federally managed. EFH is defined as those waters and substrate necessary for fish to spawn, breed, feed, or grow to maturity. Under the MSA, Federal agencies must consult with the Secretary of Commerce regarding any activity or proposed activity that is authorized, funded or undertaken by the agency that may adversely affect EFH. The MSA was implemented to conserve and manage fisheries resources that occur off the coasts of the U.S. and anadromous species and continental shelf fishery resources of the U.S. In accordance with 62 Federal Register (FR) 66535, the MSA only applies to Federal waters, within the EEZ. The Coast Guard determined that the Proposed Action would not result in a significant adverse effect on EFH and is not required to consult with NMFS under the MSA.

1.3.8 Marine Mammal Protection Act

The Marine Mammals Protection Act (MMPA) (16 U.S.C. §1361 et seq.) established, with limited exceptions, a moratorium on the "taking" of marine mammals in waters or on lands under U.S. jurisdiction. The MMPA further regulates "takes" of marine mammals in U.S. waters and by U.S. citizens on the high seas. The term "take," as defined in Section 3 (16 U.S.C. §1362) of the MMPA, means "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal". The term "harassment" means any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild (Level A Harassment); or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering (Level B Harassment). In the case of a scientific research activity conducted by or on behalf of the Federal Government, consistent with section 1374 (c)(3) of this title, the term "harassment" means (i) any act that injures or has the significant potential to injure a marine mammal or marine mammal stock in the wild (Level A Harassment); or (ii) any act that disturbs or is likely to disturb a marine mammal or marine mammal stock in the

[3] Letter from USFWS to Coast Guard (most recent letter was dated June 2, 2014).

wild by causing disruption of natural behavioral patterns, including, but not limited to, migration, surfacing, nursing, breeding, feeding, or sheltering, to a point where such behavioral patterns are abandoned or significantly altered (Level B Harassment). Coast Guard District 17 Instruction (CGD17INST) 16214.2B (2019) outlines procedures for avoiding marine mammals and protected species; reporting whale and protected species sightings, strandings, and injuries; and enforcing the MMPA and ESA. Based on the analysis contained herein, the Coast Guard has determined that take of marine mammals from the Proposed Action is not reasonably foreseeable. As such, a permit for take of marine mammals was not requested.

1.3.9 MIGRATORY BIRD TREATY ACT AND EXECUTIVE ORDER 13186

The Migratory Bird Treaty Act (MBTA) of 1918 (16 U.S.C. §§703-712 et seq.) was enacted to ensure the protection of shared migratory bird resources. The MBTA prohibits the take, possession, import, export, transport, selling, purchase, barter, or offering for sale, purchase or barter, any migratory bird, their eggs, parts, and nests, except as authorized under a valid permit. The MBTA protects a total of 1,026 bird species; the list of species protected by the MBTA appears in 50 CFR Parts 10 and 21 (November 1, 2013). EO 13186, titled Responsibilities of Federal Agencies to Protect Migratory Birds, directs federal agencies to take certain actions to further implement the MBTA and to conserve migratory birds. The order prohibits the take of migratory birds or their eggs, feathers, or nests. Many waterfowl, songbirds, raptors, and other species are migratory and are protected under the MBTA. The Coast Guard has entered into a Memorandum of Understanding with the USFWS pursuant to Executive Order 13186 (66 FR 3853; January 10, 2001) to strengthen migratory bird conservation through enhanced collaboration between the Coast Guard and the USFWS. Conservation measures, as defined in 50 CFR §21.3, include project designs or mitigation activities that are reasonable from a scientific, technological, and economic standpoint and are necessary to avoid, minimize, or mitigate the take of migratory birds or other potentially adverse effects. A significant adverse effect on population is defined in 50 CFR §21.3 as an effect that could, within a reasonable period of time, diminish the capacity of a population of a migratory bird species to sustain itself at a biologically viable level. The Coast Guard determined that the Proposed Action would not result in a significant adverse effect on a population of migratory bird species and as such, consultation with the USFWS under the MBTA was not required.

CHAPTER 2 PROPOSED ACTION AND ALTERNATIVES

2.1 PROPOSED ACTION

The Proposed Action is to conduct operations and training under or related to Arctic Shield, occurring in the Arctic from mid-May to mid-November of 2024. Arctic Shield operations meet the U.S. Coast Guard mission responsibilities due to the increase of national and international activities in the area. This would provide Coast Guard presence on the shore, air, and sea to meet the seasonal surge mission requirements. These activities support the Arctic Strategy and enable the Coast Guard to fulfill its mission requirements, codified in the Homeland Security Act of 2002.

Coast Guard District 17 has an area of responsibility that encompasses the entire state of Alaska and 44,000 miles (mi; 70,811 kilometers [km]) of coastline. District 17 performs its missions in Alaska with 2,500 active duty, civilian, reservists and auxiliary members. Arctic Shield activities over the next six years (2024–2029) would include the dispatch of two MH-60 helicopters to a FOS in the Arctic, likely from June into October. The Coast Guard would dispatch multiple cutters on a staggered schedule to the region, with typically no more than two Guard Cutters in the region directly supporting Arctic Shield at any given time. The dispatched cutters and aircraft would perform the same humanitarian, law enforcement, and national security duties, functions, and missions of the Coast Guard as are performed in other areas of responsibility year-round in the sub-Arctic Region of Alaska. These include:

1. Searching for either passengers and crew that fall overboard from recreational, commercial, or government vessels in Arctic waters, or victims of crashed aircraft in the water;
2. Rescuing either passengers and crew that fall overboard from recreational, commercial, or government vessels in Arctic waters, or victims of crashed aircraft in the water;
3. Rescuing persons on vessels in Arctic waters in medical scenarios requiring evacuation by Coast Guard helicopter or Coast Guard rescue vessel, sometimes requiring a Coast Guard rescue swimmer to enter the water himself or herself to place the person in a harness or rescue basket to be winched into a hovering helicopter;
4. Freeing a beset vessel which may require towing or escort to safety;
5. Establishing aids-to-navigation in Arctic waters;
6. Enforcing federal law in the U.S. Territorial Sea and the High Seas of Arctic waters;
7. Maintaining awareness of vessel and aircraft activities in the Arctic maritime domain;
8. Broadening Coast Guard partnerships with Alaska Native Villages in the Arctic; and,
9. Enhancing and improving preparedness, prevention, and response capabilities.

Numbers 1, 2, and 3 in the bulleted list above may be considered emergency operations which are not a part of the proposed action but are provided for informational purposes as they are part of the Coast Guard's mission and areas of responsibility. Multiple support vessels, aircraft, and personnel deployed throughout the Arctic would conduct Arctic Shield activities. While operating in the Arctic, the Coast Guard would have the following objectives:

1. Perform Coast Guard missions and activities in the Arctic Region;
2. Advance Arctic maritime domain awareness;
3. Broaden partnerships; and
4. Enhance and improve preparedness, prevention, and response capabilities.

Coast Guard aircraft would be strategically positioned to prepare for potential search and rescue (actual search and rescue is an emergency activity, and is not included in the Proposed Action, but training is a part of the

Proposed Action), environmental protection, law enforcement, and Arctic domain awareness flights. Waterborne assets would typically include cutters and small boats. These assets would operate in the Arctic conducting the Coast Guard's statutory missions. Communications specialists would deploy to ensure fluid communications and connectivity in support of all Coast Guard operations. All Coast Guard operations, including Arctic Shield operations, involve readiness to perform search and rescue; however, this consultation cannot analyze the actual search and rescue missions as timing and location are only determined at the time of those emergencies. NEPA compliance and associated consultations for emergency procedures would be completed immediately before, during, or after the emergency mission.

The Proposed Action consists of the following main elements employed to meet the objectives of Arctic Shield:

1. Land/shore operations;
2. Sea/Surface operations;
3. Air Operations

2.2 PREFERRED ALTERNATIVE

2.2.1 LAND/SHORE OPERATIONS

Land/shore operations would consist of three parts:

1. Establishing FOSs and logistics/staging locations;
2. Conducting inspections and regulatory oversight; and
3. Public outreach, which would include:
   a. Boating safety and/or cold-water survival training;
   b. State, local, and Tribal governmental engagements; and
   c. Commercial Industry stakeholder training and outreach.

2.2.1.1 Forward Operating Sites and Logistics/Staging Locations

Several locations do, or may, serve as temporary Coast Guard home bases for sea and air support during the seasonal surge of Arctic activities. Forward Operating Sites and logistics/staging locations would serve as temporary Coast Guard home bases for sea and air support during the seasonal surge of Arctic activities. The primary FOS for Arctic operations in Alaska is the Army National Guard Hangar in Kotzebue. Two MH-60 Jayhawk helicopters (Figure 2-1) would be based out of this primary FOS to meet mission demand in support of Arctic Shield with occasional deployments into and out of the other FOS locations listed below. The primary FOS would also serve as the primary fueling location for the MH-60 helicopters. Personnel stationed at the FOS would include helicopter flight and maintenance crews. In addition, the landing strip and fueling supply at the FOS may occasionally be used by MH-60 helicopters and C-130J airplanes to support transportation of personnel and supplies. The MH-60 and C-130J aircraft would not be based out of the FOSs but are expected to fly in and out of FOSs a couple of times per month. FOSs and logistics/staging locations would serve as temporary Coast Guard home bases for sea and air support during the seasonal surge of Arctic activities. Up to 16 personnel would be stationed on a seasonal basis at the primary FOS. The primary FOS in the Arctic is expected to remain the Army National Guard Hanger in Kotzebue.

FIGURE 2-1. COAST GUARD MH-60 JAYHAWK HELICOPTER

St. Paul, Utqiagvik, Deadhorse/Prudhoe Bay, and Nome also have the required infrastructure to support an FOS and may be used as primary or temporary FOSs (Figure 2-2) over the next six years. In addition to having the required infrastructure to support personnel and aviation assets (hangers, runways, landing pads, boat launches), Nome has a medium draft port, Utqiagvik has a small boat lagoon, and Deadhorse/Prudhoe Bay has proximity to continental shelf oil and gas endeavors.

Each FOS leverages existing infrastructure to support deployed assets and positions the Coast Guard to conduct standard operations in the Arctic area. Flight and service crews would reside in existing hotels during Arctic Shield. The primary FOS will serve as the hub for all operations with personnel and resources based there temporarily deploying, on an as-needed basis, to the other possible FOSs to better support operations in a particular region. These temporary deployments of personnel and resources would normally include five personnel for a single day but could include up to 12 personnel and last as long as four days. No more than one of these temporary deployments would occur each week.

2.2.1.2 Conducting Inspections and Regulatory Oversight

Law enforcement operations are part of the Coast Guard mission set. The Coast Guard would conduct inspections of vessels in major ports in Alaska to ensure cargos are as claimed, safety standards are intact, and construction or maintenance plans meet established standards. Inspections of both commercial and non-commercial vessels further the missions of drug and migrant interdiction and marine safety. Inspections can take place at any Arctic port wherever a foreign flagged vessel arrives or makes its first U.S. Port-of-Call. These inspections are typically conducted dockside, but if access to the vessel is prevented, the vessel would be accessed via a Coast Guard vessel (small boat). Some inspections would include the use of boat launch areas in and around Arctic communities and hubs such as Utqiagvik, Nome, Kotzebue, and Bethel. Inspections take approximately a half day as the Coast Guard evaluates the safety and vessel operational systems, processes, and documentation. In addition, the Coast Guard would discuss boating safety with recreational boaters during port facility inspections or in a public-school classroom setting.

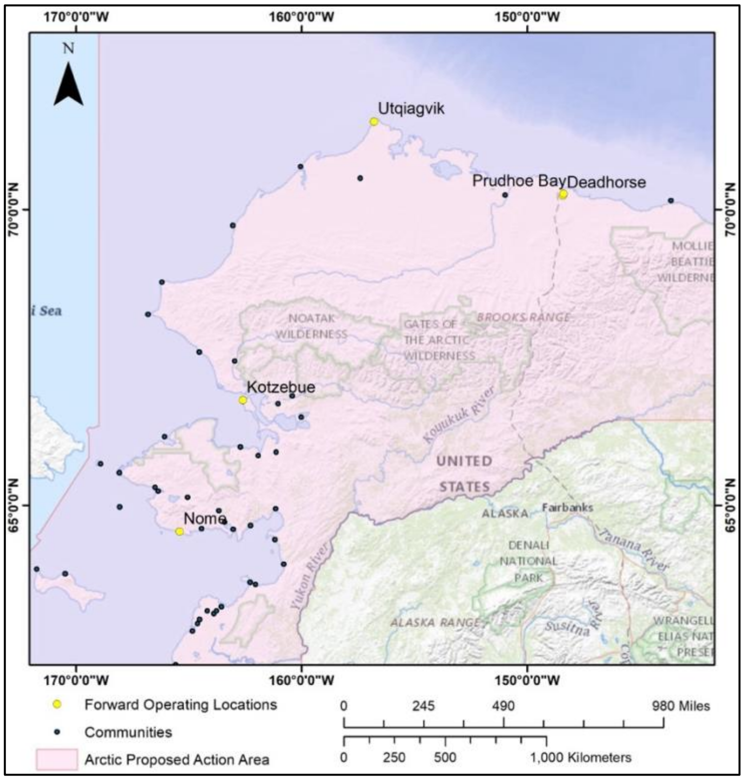

FIGURE 2-2. COAST GUARD FOS'S AND POSSIBLE TEMPORARY HOME BASES FOR SEA AND AIR SUPPORT DURING ARCTIC SHIELD OPERATIONS

The statutory mission described as "living marine resources law enforcement" includes the following elements:

- Project a federal law enforcement presence over the entire U.S. Exclusive Economic Zone, covering nearly 3.4 million square miles of ocean,
- Ensure compliance with fisheries and marine protected species regulations on domestic vessels,
- Prevent over-fishing, reduce mortality of protected species, and protect marine habitats by enforcing domestic fishing laws and regulations, the MMPA, and the ESA.

The statutory mission described as "other law enforcement" includes the following elements:

- Enforce foreign fishing vessel laws,
- Patrol the U.S. Exclusive Economic Zone boundary areas to reduce the threat of foreign poaching of U.S. fish stocks,
- Monitor compliance with international living marine resource regimes and international agreements, and
- Deter and enforce efforts to eliminate fishing using large drift-nets, a method of high seas fishing considered to be one of the main obstacles to sustainable world fisheries and healthy ocean ecosystems.

Law enforcement missions, including any Arctic Shield support of law enforcement activities, are covered under Title 14 U.S.C. and 6 U.S.C. §468 and 14 U.S.C. §522. Arctic Shield support of law enforcement activities is considered part of the Proposed Action (e.g., vessel or helicopter activities), and includes any associated Coast Guard training.

2.2.1.3 Public Outreach

Formal and informal government-to-government and community (with tribes and local community leadership) is vital to all Coast Guard missions. Engagement categories include local government engagement, educational training and outreach, and Tribal and Native community engagement.

2.2.1.4 Engagement with Communities

Building partnerships is an important aspect of Coast Guard activities in the Arctic region. Coast Guard District 17 personnel would share information and communicate by phone, email, and in person with local governments, elected officials, Tribal leadership, mayors, and other leaders in all affected communities prior to and during Coast Guard activities in their local area. Year-round and recurring engagement with these communities would also occur through conferences, meetings, visits from senior Coast Guard leadership, and personal communications allowing the opportunity for community, local governments, and Tribal governments to provide input on Arctic activities. This also allows the Coast Guard to obtain key information from Tribal stakeholders. During Arctic Shield operations, this would involve regular, sometimes daily, communications of Coast Guard actions and how they may interact with local governments or with Tribal activities.

The Coast Guard would contact Tribes and villages to offer classes such as:

- Water Safety - The Coast Guard would educate various community groups on water safety to ensure that they understand proper water safety techniques and fewer lives are put at risk.
- Boating Safety - The Coast Guard would continue the Kids Don't Float boating safety program which maintains and supplies remote communities with proper safety equipment to ensure youths can safely enjoy water and subsistence activities with their families.
- Emergency Responder Training – The Coast Guard would provide ice rescue and response training to local emergency responders. This training would be completed on shore using local training rooms and pools.
- Commercial Fishing Vessel Standards Outreach - The Coast Guard would provide additional outreach efforts, including dock-side exams, town hall meetings, and forums in remote communities to increase knowledge of Commercial Fishing Vessel Standards requirements, including new requirements that would go into place in the next few years.

2.2.1.5 Marine Environmental Response

Oil spill training field exercises would occur onshore (classroom and practical training) or in the nearshore area in the northern Alaskan port such as Utqiagvik (Barrow), Bethel, or in Norton Sound near Nome, Alaska. Training location would change each year, subject to the input and request of local communities to better support their needs. Effective oil spill response would require a coordinated effort by all impacted stakeholders in the region of the event. Classroom training and tabletop exercises, expected to occur annually, provide an opportunity to plan and evaluate effective response management. The Coast Guard would provide classroom-based training and exercises with local governments and the Tribal community to support oil spill response preparedness consistent with the State/Federal Unified (Response) Plan Geographic Response Strategies. Unlike the classroom training, the practical training would be weather dependent and based on requests from local communities; and therefore, may not occur on an annual basis. If there were an actual oil spill in the ocean, however, the response itself is covered under the Interagency Memorandum of Agreement Regarding Oil Spill Planning and Response Activities under the Federal Water Pollution Control Act's National Oil and Hazardous Substances Pollution Contingency Plan and the Endangered Species Act and is not part of the Proposed Action. While marine environmental response would only occur in the event of an emergency, the recovery gear would be tested annually. Once each year and in conjunction with oil response training, the Coast Guard may provide hands-on training on the use and deployment of a containment boom on the water's surface from onshore or nearshore. The location of the hands-on training would be in a port or harbor and away from known biological resources. Any equipment used for this training would be immediately recovered on the day of the deployment. Although the training locations are outside of known ranges where protected species are expected, deployment would be delayed or canceled if dedicated observers identify any protected species in the area. The location of this hands-on training would vary in response to local demand. During an actual emergency, the boom could be used in conjunction with a skimmer and pump and used to corral oil, which would then be pumped into a tank on a vessel. During the equipment training, the boom would be deployed into the water and the skimmer and pump may pump seawater onto the vessel to test the pump's functionality. In addition, marine environmental response training would involve the use of a small support boat that is either stationary or transiting at slow speeds (up to three knots [kn]). This part of the training would only occur in the nearshore area and would occur over a three-to-five hour timeframe.

2.2.2 SEA/SURFACE OPERATIONS

Sea operations in the proposed action area include routine patrols to execute the Coast Guard's statutory missions including search and rescue, marine environmental protection, law enforcement, protection of living marine resources, marine safety, ice operations, ports and waterways security, defense readiness, drug interdiction, migrant interdiction, and aids to navigation.

Coast Guard vessels 65 feet (ft; 20 m) and longer are classified as "cutters". Cutters may be dispatched to the area on staggered schedules, normally resulting in one, but typically no more than two cutters in the Arctic Region during the operational period. Although not supporting Artic Shield, there may also be an additional icebreaking capable cutter deployed to the region for a total of three cutters for certain time frames. Sea operations performed by these cutters would typically include routine patrols throughout the operational area to perform statutory missions, aircraft staging to support air operations, training, at-sea replenishment, and mooring in Nome or other deep-water ports to facilitate port calls. In addition to the shore-based deployment of a boom (previously discussed in Section 2.3.1.5), cutter-based oil recovery training may also occur up to once each year and would involve the deployment and retrieval of skimming equipment. Any equipment used for this training would be recovered immediately following deployment.

Sea/surface operations would be supported by Coast Guard small boats. These boats would operate from existing shore facilities or from the dispatched cutter. Small boat operations would include routine patrols throughout the operational area to perform statutory missions and training. Small boat training would include boat launching and seamanship maneuvers, typically in the vicinity of a shore-based facility or the cutter that they support.

2.2.2.1 Search and Rescue Training

Search and Rescue missions are those that have the goal of preventing the loss of life and property and typically include a combination of Coast Guard aircraft and vessels. Actual Coast Guard SAR missions are considered emergencies, which are not part of the Proposed Action (see Chapter 1). However, crews must be trained for such a response. For example, during an actual SAR mission, helicopters (usually only one at a time) are often sent first to locate a vessel in distress and report its status before a Coast Guard vessel is dispatched for rescue and, as part of aircraft training, Coast Guard would train for such a mission. The helicopter would also transport people to safety, if necessary, and personnel may conduct damage control (e.g., plugging holes, patching pipes, or delivering supplies to aid in repair or control on the damage incurred by a vessel in distress). Coast Guard would train in damage control and how to transport people to safety. In addition to the Arctic Shield vessels, other support boats may be employed to assist in the SAR mission and could travel at speeds up to 30 kn. It is expected that speeds may reach 30 kn during training, but would not be sustained for the entire training exercise. SAR training typically occurs once per year in the proposed action area. During all SAR training, navigation technologies, such as an echosounder, would be used as the vessel would be underway.

2.2.2.2 Cutter Operations

Coast Guard Cutter classes that may be used in support of this operation include: WMSL-418' National Security Cutters, WMEC-Medium Endurance Cutters (various lengths), and WLB-225' Seagoing Buoy Tender. Routine patrols for these cutters include Arctic patrols to perform all Coast Guard statutory missions in the region depending on external demand elements. Routine patrols detect, deter, and disrupt maritime terrorist attacks, sabotage, or subversive acts; detect and investigate violations of the MMPA and the ESA; and reduce the threat of foreign poaching of U.S. natural resources.

The Coast Guard must continually assess the capability of personnel, assets, and resources operating in the Arctic. Training is required for open water ice navigation, small boat operations, aircraft, rescue exercises, and practicing of any Arctic logistics exercises for sea, land, and air. Training is essential for Coast Guard personnel to develop and maintain the skills needed to successfully accomplish mission objectives, and to allow the Coast Guard to accurately assess current capabilities and future needs. The Coast Guard Standard Operating Procedures (SOPs) and Best Management Practices (BMPs) in Chapter 2 minimize potential for impact to biological resources caused by operations or training.

Participating cutters would normally transit from Kodiak or Dutch Harbor, AK to enter the Arctic Shield operational area, and return to one of these ports at least once enroute their return to homeport. Cutters may also briefly stop in one of these locations mid-patrol for logistics, fuel, or other purposes. While vessel operations would be conducted in the area as described in the proposed action area, they would also primarily occur in open water or where other activities are occurring or expected to occur in order to best support the mission objectives of routine patrols described above.

2.2.2.3 Small Vessel Operations

Coast Guard vessels under 65 ft (20 m) are classified as “boats,” which include shore-based and cutter-based boats ranging from 14 to 45 ft (4 to 13.7 m) in length. Small boats, specifically RHIBs, would be deployed from cutters to transport personnel between vessels to support inspections and law enforcement operations, and to transport personnel ashore using local boat ramps or docking facilities to attend meetings with the local communities. Small boat training would include ports where they will operate from shore-based facilities. All small boat sorties would typically occur in the vicinity of the shore-based facility or cutter that they support. An average of two small boat sorties would occur each day during Arctic Shield operations; high-speed maneuvering or intercepts are not typical for routine patrols.

Small support boats may bring passengers from the vessel to shore and from the shore to the vessel. Passengers that are transferred may be crew members or facility and vessel inspectors and their gear. Passenger transfers would typically be completed in under an hour depending on the distance from shore or to the vessel to be inspected. The support boats will be operated at a maximum speed of 15 kn. During these transfers, Coast Guard would use radar communications, including S-band, commercial off-the-shelf, and antenna (radio).

2.2.3 Air Operations

C-130J Hercules airplanes along with MH-60 Jayhawk helicopters would be used to conduct Coast Guard air operations in support of Arctic Shield. As part of Arctic Shield operations these would serve in a non-emergency situation to locate, identify, and assist vessels and persons in distress in the Arctic Region. Helicopters may be used to transfer passengers from cutters to shore-based locations and from shore-based locations to cutters. The flights would also gather and verify data on coastal erosion, ice observation, and other scientific data requests (e.g., carcass surveys, walrus haulout locations, etc.). These scientific data requests typically come from researchers from other federal agencies, such as the USFWS or NMFS, who may be onboard the Coast Guard’s aircraft. The Coast Guard also assists with documentation of the scientific data, and is authorized for this work under the researcher’s scientific research permit or authorization, if applicable. All air operations and training, including operations of unmanned air vehicles (UAVs) would be performed in accordance with the Coast Guard

Standard Operating Procedures described in Chapter 2.

District 17 and Sector Anchorage use UAS to assess the shoreline, map geographic response strategies, and conduct response activities in accordance with the Coast Guard's 11 statutory missions. Certified UAS operators are required to complete standard FAA training courses and pass both a FAA license exam and Coast Guard UAS operator test before receiving command designation to operate throughout the Sector AOR. This test includes understanding and applying strict environmental protocols to include wildlife avoidance, when to ground the UAS, no-fly zones, and required altitudes.

District 17 also engages with the Alaska National Guard and Civil Air Patrol to transport personnel to conduct the prevention missions under Arctic Shield. The Alaska National Guard uses UH-60 Blackhawks, HH-60 Blackhawks, and C-12's, which normally fly at 2,000 ft and below. The Civil Air Patrol uses Cessna 206 and Gippsland Airvan GA-8 for these transport flights. These aircraft normally fly at not less than 1,000ft.

2.2.3.1 Routine Patrols, Arctic Domain Awareness Flights, and Reconnaissance

Routine patrols and Arctic domain awareness flights provide an opportunity for pilot and crew familiarization with the Arctic Region. MH-60 helicopters would be used to conduct an average of three routine patrols and arctic domain awareness flights each week for a total of up to 70 flights each year. C-130J airplanes would be used to conduct up to two routine patrol/arctic domain awareness/logistics support flights each month for a total of up to 10 flights each year. Pilots typically maintain altitudes at or above the minimum altitudes (1,500 or 3,000 ft depending on location) as discussed in detail in Chapter 2.

Additionally, MH-60 helicopters and/or an In-situ Scan Eagle UAS would operate from some of the cutters assigned to operate in the Bering Strait, Chukchi Sea, and Beaufort Sea. These aircraft would conduct daily flights, weather and operations permitting, to support domain awareness and cutter operations. The majority of these flights would be conducted over open water several miles from land or ice. Additionally, because the cutters supporting Arctic Shield are not designed to operate in or around Arctic ice, these aircraft would conduct ice avoidance flights, on an as needed basis, to support safe cutter navigation by identifying areas where the presence of ice may make navigation hazardous. MH-60 pilots conduct these reconnaissance flights at a minimum altitude of 1,500 ft and a speed of 60 kn. When available, the ScanEagle (unmanned) would be flown for up to 12 hours each day in the area of operation. The ScanEagle is not available on every cutter supporting Arctic Shield, but it is possible that up to 70 of these flights would be performed each year. When operating, the ScanEagle would normally be flown at the preferred operating altitude of 3,000 ft, though it may operate anywhere between 1,000 and 6,000 ft. It is subject to the same minimum altitudes required of the MH-60. Dedicated observers would document ice locations and watch for marine mammals to allow pilots and cutters to avoid potential interactions. The frequency of these flights conducted as part of Arctic Shield each year would depend on the presence of ice in the region where the cutters need to operate, but is historically fewer than two flights per week.

2.2.3.2 Routine Flight Crew Training

Flight crews are required to log in-flight hours to meet ongoing training requirements while at their FOS or deployed on cutters. As weather permits, MH-60T and MH-60 helicopters would be flown in the area of the FOS or cutter to meet this requirement. The MH-60T helicopter would be stationed out of the primary FOS while the MH-60 helicopter would be stationed on the medium, high endurance, or homeland security cutter. The ScanEagle would operate from the homeland security cutter. Flight crews would coordinate with local tribes through the USCG D17 External Affairs office to ensure their proposed flight paths do not interfere with subsistence harvest activities. Training would occur as part of normal flights, for situational awareness, area familiarization, and as part of aircraft operational hours. All flight decked equipped cutters have the training and ability to conduct Deck

Landing Qualifications; however, deck landings may or may not occur depending on whether the opportunity arises. Alternatively, deck hoists may be used on those cutters that are not flight deck equipped. Hoist altitude depends on the height of any obstacles in the area, but is anywhere between 25–100 ft (8–30 m) above the surface where the hoist is being conducted. These training evolutions would be conducted in accordance with the policy guidance and Coast Guard SOPs described in Chapter 2 to include the use of lookouts to watch for protected species and adjust operations, as necessary, to avoid take of biological resources. No flight training, other than what has been described above, is expected as part of Arctic Shield. It is expected that up to 70 flight training exercises of up to three hours each for each exercise would occur each year during Arctic Shield operations.

2.2.3.3 Distinction Between Arctic Shield and D17 Operations

D17 executes statutory missions year-round in the proposed action area. During the summer months, the environmental conditions are more conducive to conducting operations across Western Alaska and the U.S. Arctic.

The distinction between Arctic Shield and normal D17 Operations can be illustrated by comparing the additional resources dedicated to Arctic Shield during the summer months (July August, and September), with the resources dedicated to D17 operations for the remaining months of the year.

Specifically, Arctic Shield commits an additional 60 major cutter days, 275 aircraft hours, and 170 small boat hours during the summer surge of July, August, and September. *This is in addition to normal D17 operations which plan for a total of 90 major cutter days, 290 aircraft hours, and 120 small boat hours during the same months.

*Several factors including personnel, casualties, or weather may mean less operations than planned are conducted. For example, in 2023, actual Arctic Shield operations amounted to only 28 major cutter days, 140 aircraft hours, and 150 small boat hours in the proposed action area.

For 2024 and beyond, it is anticipated that planned resource hour commitments will remain largely the same.

During the 9 months without Arctic Shield Operations, D17 averages the following in the Arctic Shield action area:

- Cutter: 30 days per month
- Small Boat: 40 hours per month
- Aircraft: 96.7 hours per month

During Arctic Shield Operations (July, August, September), the average resource commitments above in the action area increase as follows:

- Cutter: 50 days per month
- Small Boat: 96.7 hours per month
- Aircraft: 188.4 hours per month

To truly capture the impact Arctic Shield has on the environment and protected species/habitat, our analysis focuses on those additional Arctic Shield resource commitments in terms of days and hours. Our normal operational tempo is the baseline. To truly garner the impact of Arctic Shield, we focus on the impact those additional resource days and hours have.

Thus, our analysis will be focused on:

- What impact 20 additional cutter days per months has;
- What impact 56.7 additional small boat hours per month has; and
- What impact 91.7 additional flight hours per month has.

Arctic Shield also includes a surge of personnel traveling to the proposed action area to conduct prevention missions which include facility inspections, commercial fishing vessel exams, and training opportunities. Approximately 90 Arctic communities are visited by 120 personnel. The Coast Guard utilizes transportation by the Alaska National Guard and Civil Air Patrol for some of these visits. This use translates on average to approximately 10.2 Alaska National Guard flight hours per month, and 200 Civil Air Patrol flight hours per month. The remaining transportation relies on commercial air providers.

Arctic Shield also includes the FOS that is temporarily activated in Kotzebue as an aircraft staging area annually from 01 July to 31 October. The Air National Guard may provide C17 flight support to the FOS in Kotzebue from Kodiak, which translates to approximately 4 flight hours per trip. While the facility is operational during this time frame, actual flight operations are conducted as mission demand requires. While the facility is operational during this time frame, actual flight operations are conducted as mission demand requires. As explained above, St. Paul, Utqiagvik, Deadhorse/Prudhoe Bay, and Nome also have the required infrastructure to support an FOS and may be used as primary or temporary FOS locations.

2.2.4 ACOUSTIC SOURCES

The Proposed Action would include the introduction of sound in water and air. In-water sources of sound include underwater acoustic transmissions, vessel noise (engine and other operational equipment noises made by the vessel), and helicopter noise (both in-air and the in-air to water surface transfer) from helicopter operations. All Coast Guard vessels are equipped with standard navigational technologies, including high frequency radios, radar, and navigation sonars. Characteristics of acoustic sources associated with sea operations and aircraft operations are given in Table 2-1. These low power sonar devices, which are in use at all times when a vessel is underway, allow ships to operate safely and would be used by all relevant assets during standard operations, training, and other missions. The single-beam echosounder would be commercially and readily available "off-the-shelf" equipment equivalent to many commercially available, high-frequency fish finders.

TABLE 2-1. UNDERWATER ACOUSTIC SOURCES ASSOCIATED WITH PROPOSED ACTION

Source type	Frequency range [kHz]	Source level	Associated Action
Small vessel	1–7	175 dB re 1µPa @ 1m	Small boat training, routine patrols
Large vessel	0.02–0.30	190 dB re 1µPa @ 1m	All sea operations and training
Single-beam echosounder (Fishfinder, Depth Sounder)	3.5–1,000 (24–200)[a]	205[b] dB re 1µPa @ 1m	All sea operations and training, research, and development
Helicopter	0.02-5	in air: 136 dB re 20 µPa	Air support

NOTES

kHz: Kilohertz; dB: Decibel; re 1µPa: referenced to 1 microPascal at 1 meter for underwater sound

[a] Typical frequency range for most devices that are commercially available

[b] Maximum source level is 227 decibels root mean square at 1 meter, but the maximum source level is not expected during operations

References: (NMFS 2012a; Richardson et al. 1995; U.S. Coast Guard 2013a)

2.3 NO ACTION ALTERNATIVE

Under the No Action Alternative, the Coast Guard would not be able to fulfill its mission requirements in the Arctic. The Coast Guard also enforces the MMPA and ESA, and without increased Coast Guard presence in the Arctic, enforcement of these laws would be significantly reduced. The No Action Alternative would result in no on-scene assets in the region, simply using existing assets from their normal operating locations (i.e., Kodiak for aviation assets, and surface assets from Kodiak or, if deployed, the Gulf of Alaska or Bering Sea). Therefore, no assets would be positioned for immediate emergency response.

The No Action Alternative would not meet the Coast Guard's mission to provide a proactive air, surface, and shoreside Coast Guard presence in the Arctic to meet statutory mission requirements. As such, it is not a viable alternative and does not meet the purpose and need but is included here for comparison of environmental effects with the Preferred Alternative.

2.4 ALTERNATIVES ELIMINATED FROM DETAILED CONSIDERATION

The Coast Guard considered several alternatives, but then dismissed from consideration. These alternatives, as well as the rationale for not conducting a detailed evaluation of them are presented below. Each alternative (for an alternative timeframe and location or varying levels of air and surface assets) was dismissed from consideration because they do not meet the purpose and need of the Proposed Action.

2.4.1 ALTERNATE TIME FRAME AND LOCATION

An alternate time frame to conduct Coast Guard Arctic Shield activities does not exist. The mission need for Coast Guard presence in the Arctic is during the ice-free season of 2024. This is the time when increased vessel traffic and other activities would take place, requiring Coast Guard presence in the area. Alternate locations would also not provide a feasible alternative for analysis. The requirement for the Coast Guard to be present in the Arctic during the ice-free season in the Bering, Chukchi, and Beaufort Seas is so the Coast Guard can react quickly to matters such as safety of life at sea, law enforcement, and collisions at-sea; thus, the Coast Guard response would not have to rely on assets that are at a considerable distance from this area. Therefore, considering an alternative time frame or location would not meet the purpose and need of the Proposed Action.

2.4.2 AIR ASSETS

Various levels of air asset support for Arctic Shield activities in the ice-free season of 2024 were considered as an alternative. The Coast Guard has concluded that an alternate level of air asset support for Arctic Shield activities that meets the purpose and need does not exist. There is limited infrastructure available to support Coast Guard Arctic Shield operations and the proposed locations in Alaska are strategically located in an FOL with existing air and ground facilities. This advances the mission of the Coast Guard to support safety of life and SAR for people within the U.S. coastal zone and EEZ. The FOL and Logistics/Staging Location are proposed at the existing Alaska Air National Guard Hangar in Kotzebue, AK and no construction or pile driving is required. No new facilities will be constructed as part of Arctic Shield. Additionally, the Proposed Action seeks a maximum of two helicopters. In this case, reducing the number of assets would equate to a no action alternative, which does not meet the purpose and need of the Proposed Action.

2.4.3 SURFACE ASSETS

Various levels of surface asset support for Arctic Shield activities in the ice-free season of 2024 were considered as an alternative. The Coast Guard has concluded that an alternate level of surface asset support for Arctic Shield that meets the purpose and need does not exist. The proposed locations in the Bering, Chukchi, and Beaufort Seas advance the mission of the Coast Guard to support law enforcement and safety of life and property within the U.S. coastal zone and EEZ. The continued support of Coast Guard cutters and a buoy tender from mid-May to mid-November of 2024 would adequately support Arctic Shield needs while balancing the needs for surface asset support and operational funding throughout the Coast Guard District 17 operational area, including the state of Alaska.

2.5 RESOURCE ANALYSIS

As part of the process to determine the potential impact or harm from the Proposed Action, the Coast Guard identified potential resources and issues to be analyzed (Table 2-2). Some issues typically addressed in planning documents were eliminated from further analysis during this process—these include topics primarily related to actions conducted within terrestrial environments because of the distance from shore that the majority of all proposed activities would occur. Table 2-3 lists the specific resources eliminated from further analysis and provides an explanation for their dismissal.

TABLE 2-2. RESOURCES EVALUATED FOR POTENTIAL IMPACT OR HARM FROM THE PROPOSED ACTION

Resource	Potential Impact or Harm
Biological Environment	
Mammals	Underwater acoustics, aircraft noise, vessel noise, and vessel movement have the potential to impact or harm marine mammals within the proposed action area.
Birds	Underwater acoustics, aircraft noise, vessel noise, vessel movement, and aircraft movement have the potential to impact or harm marine birds within the proposed action area.
Starfish or Sea Stars	Underwater acoustics and vessel movement have the potential to impact or harm fish in the proposed action area.
Fish	Underwater acoustics, vessel noise, and vessel movement have the potential to impact or harm fish in the proposed action area.
Essential Fish Habitats (EFH)	Underwater acoustics, vessel noise, and aircraft noise have the potential to impact or harm EFH.
Reptiles (Sea Turtles)	Underwater acoustics, vessel noise, and vessel movement have the potential to impact reptiles in the proposed action area.
Socioeconomic Environment	
Fishing, Shipping, and Tourism	The Proposed Action would limit illegal fishing activities and provide a law enforcement and safety presence, providing positive impacts to the state of Alaska and these industries off the coast of Alaska.
Cultural Resources	The Proposed Action would not impact the hunting and fishing activities of the Alaska Native communities. The Proposed Action would provide positive impacts by providing at-sea safety and emergency response, as well as educational opportunities, for Alaska Native communities.

TABLE 2-3. RESOURCES ELIMINATED FROM ANALYSIS

Resource	Reason for Elimination
Physical Environment	
Air Quality	The Proposed Action would generate air emissions from aircraft and vessels, but the action is not subject to the General Conformity Rule because the coastal regions of Alaska are in attainment of the NAAQS for criteria pollutants. Air emissions would be minimal and of short-duration, and they would be generated at sea, away from the general public.
Airspace	The majority of aircraft use associated with the Proposed Action would occur over the water or at existing airstrips. Low flying aircraft may be used for a portion of the training and testing but would not interfere with regular public airspace usage given that the offshore locations are within an infrequently used flight corridor. Therefore, the Proposed Action would not impact or harm use of airspace.
Bottom Substrate	No bottom disturbance is expected as a result of vessels or aircraft utilized in the Proposed Action. Therefore, the Proposed Action would not impact or harm bottom substrate within the proposed action area.
Floodplains and Wetlands	The Proposed Action would occur in open water and would not impact or harm the physical attributes of floodplains or wetlands. Therefore, the Proposed Action would not impact or harm floodplains or wetlands.
Geology	No construction or dredging is planned as part of the Proposed Action. Therefore, the Proposed Action would not impact or harm geological resources.
Ice	No icebreaking would occur as part of the Proposed Action and therefore would not impact or harm ice habitat within the proposed action area.
Land Use	There are no ESA-listed invertebrates present in any of the Proposed Action Area.
Terrestrial Environment	The Proposed Action would primarily occur offshore. Onshore portions of the Proposed Action include outreach and educational training only. Therefore, the Proposed Action would not impact or harm the terrestrial environment including parks, forests, and prime and unique farmland.

Resource	Reason for Elimination
Physical Environment	
Water Quality	Coast Guard vessels comply with the CWA. Any discharges from vessels are conducted pursuant to the CWA as well as the Ocean Dumping Act. The Proposed Action would not discharge any superfluous substances that may pollute the water column. Therefore, the Proposed Action would not impact or harm water quality.
Wild and Scenic Rivers	The Proposed Action would occur on or in ocean waters. Therefore, the Proposed Action would not impact or harm wild and scenic rivers.
Biological Environment	
Invertebrates	Vessel noise and aircraft noise have the potential to impact or harm invertebrates within the proposed action area.
Deep Sea Corals and Coral Reefs	No bottom disturbance is expected as part of the Proposed Action; thus, the Proposed Action would not impact or harm deep sea corals or coral reefs.
Marine Vegetation	No bottom disturbance is expected as part of the Proposed Action as vessels are not expected to traverse very shallow coastal areas. Therefore, the Proposed Action is not expected to impact or harm marine vegetation within the proposed action area.
Terrestrial Wildlife	No impact or harm to terrestrial habitat is expected as a result of the Proposed Action. Ambient noise levels are not expected to increase at existing airstrips as a result of the Proposed Action. Therefore, no impact or harm to terrestrial wildlife is anticipated.
Socioeconomic Environment	
Aesthetics	Aircraft movements would be out of the Ralph Wien Memorial Airport in Kotzebue, as well as FOSs located at St. Paul, Utqiagvik, Deadhorse/Prudhoe Bay, and Nome, and would be consistent with the typical flights coming in and out of the airport. Vessel movements would be off shore and would be consistent with other vessels operating within the proposed action area. Therefore, the Proposed Action would not impact aesthetics.
Archaeological and Historical Resources	No archaeological or historical resources are located within the proposed action area. Therefore, the Proposed Action would not impact archaeological and historical resources.
Environmental Justice	The Proposed Action would occur on the water and there would be no disproportionately high or adverse human health or environmental impacts on minority or low-income populations. Therefore, the Proposed Action would not impact environmental justice.
Infrastructure	No modification of infrastructure would occur as a result of the Proposed Action. Therefore, the Proposed Action would not impact infrastructure.
Utilities	The Proposed Action would not occur near any utilities. Therefore, the Proposed Action would not impact utilities.

CHAPTER 3 EXISTING ENVIRONMENT

3.1 PHYSICAL ENVIRONMENT

A description of the proposed action area is detailed below as it relates to the biological resources that will be further analyzed in this EA (Chapter 4). The Proposed Action will occur on the surface of the water within the proposed action area and in the airspace above the proposed action area. No materials will be released into the air or water as part of the Proposed Action, nor will physical habitats be damaged or permanently altered by noise or vessel and aircraft movement within the proposed action area. Therefore, no impact or harm is anticipated to the physical environment as a result of the Proposed Action.

In order to accurately capture all areas that may be impacted, both directly and indirectly, as required by 50 C.F.R. §402.02, the Coast Guard has determined that the proposed action area is the "Arctic" as defined by the ARPA of 1984, Public Law 98-373 §112[4], with the following modification: the southern boundary of the proposed action area runs from the point of intersection of the Maritime Boundary Line and the line of 54° north latitude, and follows the line of 54° north latitude eastward to a point of intersection at longitude 168.00°W and latitude 54.00°N, then follows a rhumb line in an east-northeast direction to a point of intersection at longitude 160.00° W and the ARPA boundary line, which is near Cape Seniavin on the Alaska Peninsula (Figure 1-1).

The Earth's temperature has risen by an average of 0.11 degrees Fahrenheit (°F; 0.06 degrees Celsius [°C]) per decade since 1850 or about 2°F in total with the rate of warming since 1982 being more than three times as fast (0.36°F [0.20°C] per decade) (Lindsey et al. 2024). In recent decades, the warming in the Arctic has been much faster than in the rest of the world, a phenomenon known as Arctic amplification. Numerous studies report that the Arctic is warming either twice, more than twice, or even three times as fast as the globe on average (Rantanen et al. 2022). Sea ice extent fluctuates annually and is influenced by natural variations in atmospheric pressure and wind patterns, but clear linkages have also been made to decreased Arctic sea ice extent and rising greenhouse gas concentrations dating back to the early 1990s (Karl et al. 2007).

Arctic sea ice reaches its minimum extent each September and maximum extent in March (Richter-Menge and Overland 2010). The September minimum ice is now shrinking at a rate of 12.2% per decade (NASA 2024). The average ice extent for March 2024 is 14.87 million square kilometers (5.74 million square miles), fifteenth lowest in the passive microwave satellite record (Figure 3-2), and as of the beginning of April 2024, Arctic sea ice extent had dropped by about 278,000 square kilometers (107,000 square miles) below the March 14 maximum (Figure 3-3) (NSIDC 2024). The rapid loss of sea ice causes large temperature changes inland, and can in turn trigger permafrost degradation, increases coastal erosion and flooding, and alter the timing and location of plankton blooms (Karl et al. 2007). Sea ice reduction may also provide access opportunities for increased shipping and transportation as well as increased resource extraction (Karl et al. 2007).

[4] United States Arctic Research and Policy Act of 1984 defines the Arctic as "all United States and foreign territory north of the Arctic Circle and all United States territory north and west of the boundary formed by the Porcupine, Yukon, and Kuskokwim Rivers; all contiguous seas, including the Arctic Ocean and the Beaufort, Bering and Chukchi Seas; and the Aleutian chain."

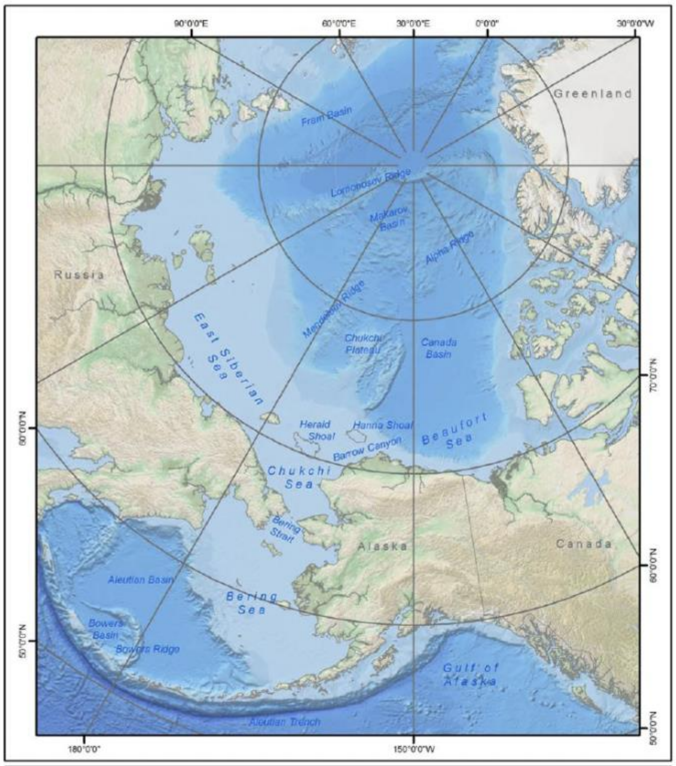

FIGURE 3-1. TOPOGRAPHIC AND BATHYMETRIC FEATURES IN THE PROPOSED ACTION AREA

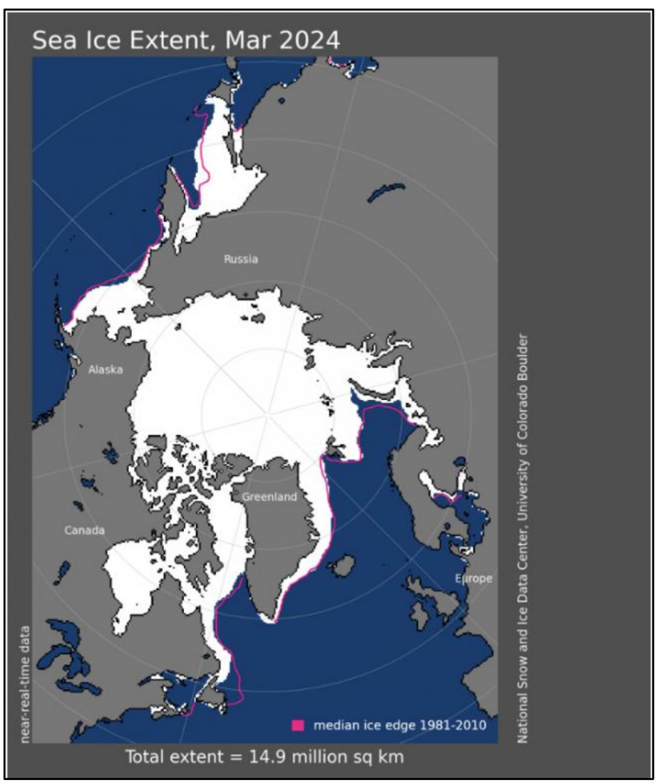

FIGURE 3-2. THE AVERAGE ICE EXTENT FOR MARCH 2024

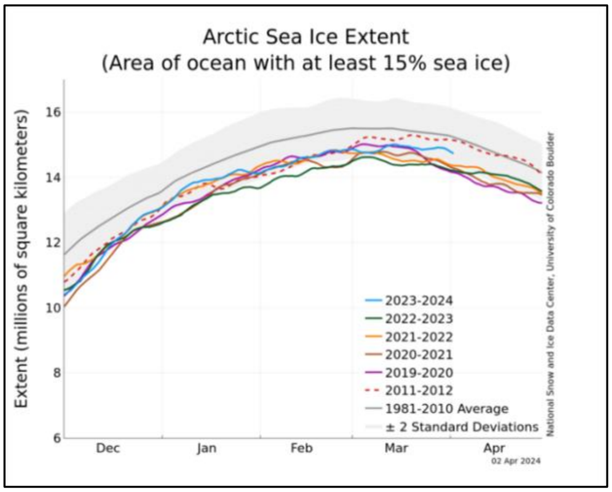

FIGURE 3-3. ARTIC ICE EXTENT AS OF APRIL 2, 2024

3.2 BIOLOGICAL ENVIRONMENT

3.2.1 ESA-LISTED SPECIES

Twenty-six species listed under the ESA occur within the proposed Operation Artic Shield Action Area (Table 3-1). These species fall under the jurisdiction of the National Marine and Fisheries Service and United States Fish and Wildlife Service. Only a single species, the Aleutian shield fern (*Polystichum aleuticum*), is excluded from analysis. Detailed information about these species us located in Appendix E.

TABLE 3-1. ESA-LISTED SPECIES UNDER THE JURISDICTION OF USFWS THAT OCCUR WITHIN THE PROPOSED OPERATION ARCTIC SHIELD ACTION AREA.

Species	Listing Status	Critical Habitat
Starfish or Sea Stars		
Sunflower Sea Star (*Pycnopodia helianthoides*)	P 3/16/2023; 88 FR 16212	none
Fish		
Chinook Salmon *(Oncorhynchus tshwytscha)*		
Sacramento River Winter-run	E 1/4/94; 59 FR 440	6/16/93; 58 FR 33212
Upper Columbia River Spring-run	E 6/28/05; 70 FR 37160	9/2/05; 70 FR 52630
Snake River Spring/Sumer-run	T 6/28/05; 70 FR 37160	10/25/99; 64 FR 57399
Snake River Fall-run	T 6/28/05; 70 FR 37160	12/28/93; 58 FR 68543
Central valley Spring-run	T 9/16/99; 64 FR 50394	9/2/05; 70 FR 52629
California Coastal	T 9/16/99; 64 FR 50394	9/2/05; 70 FR 52629
Puget Sound	T 3/24/99l 64 FR 14308	9/2/05; 70 FR 52629
Lower Columbia River	T 6/28/05; 70 FR 37160	9/2/05; 70 FR 52630
Upper Willamette River	T 6/28/05; 70 FR 37160	9/2/05; 70 FR 52630
Chum Salmon *(Oncorhynchus keta)*		
Hood Summer-run	T 3/25/99 64 FR 14508	9/2/05; 70 FR 52629
Columbia River	T 6/28/05; 70 FR 37160	9/2/05; 70 FR 52630
Coho Salmon *(Oncorhynchus kisutch)*		
Central California Coast	E 6/28/05; 70 FR 37159	5/5/99; 64 FR 24049
Southern Oregon/Northern California Coasts	T 5/6/97; 62 FR 24588	5/5/99; 64 FR 24049
Lower Columbia River	T 6/28/05; 70 FR 37160	2/24/16; 81 FR 9252
Oregon Coast	T 8/10/98; 63 FR 42587	2/11/08; 73 FR 7815
Sockeye Salmon *(Oncorhynchus nerka)*		
Snake River	E 8/15/11; 70 FR 37160	12/28/93; 58 FR 68543
Ozette Lake	T 3/25/99 64 FR 14528	9/2/05; 70 FR 52629
Steelhead *(Oncorhynchus mykiss)*		
Southern California	E 8/18/97; 62 FR 43937	9/02/05; 70 FR 52487
Upper Columbia River	T 1/5/06; 71 FR 834	9/02/05; 70 FR 52629
Snake River Basin	T 1/5/06; 71 FR 834	9/02/05; 70 FR 52629
Middle Columbia River	T 1/5/06; 71 FR 834	9/02/05; 70 FR 52630

Species	Listing Status	Critical Habitat
Lower Columbia River	T 1/5/06; 71 FR 834	9/02/05; 70 FR 52630
Upper Willamette River	T 1/5/06; 71 FR 834	9/02/05; 70 FR 52630
South-Central California Coast	T 8/18/97; 62 FR 43937	9/02/05; 70 FR 52487
Central California Coast	T 8/18/97; 62 FR 43937	9/02/05; 70 FR 52487
Northern California	T 6/7/00; 65 FR 36074	9/02/05; 70 FR 52629
California Central Valley	T 3/19/98; 63 FR 13347	9/02/05; 70 FR 52629
Puget Sound	T 3/11/07; 72 FR 26722	2/24/16; 81 FR 9252
Pacific Eulachon *(Thaleichthys pacificus)*		
Southern DPS	T 3/18/10; 75 FR 13012	10/20/11; 76 FR 65324
Yelloweye Rockfish *(Sebastes ruberrimus)*	T 4/28/10; 75 FR 22276	11/13/14; 79 FR 68041
Reptiles		
Leatherback sea turtle (*Dermochelys coriacea*)	E 6/2/70; 35 FR 8491	
Mammals		
Bowhead whale *(Balaena mysticetus)*		
Western Arctic stock	E 12/2/70; 35 FR 18319	none
Sei whale (*Balaenoptera borealis*)	E 6/2/70; 35 FR 8491	
Fin whale (*Balaenoptera physalus)*		
Northeast Pacific stock	E 12/2/70; 35 FR 18319	none
Gray whale (*Eschrichtius robustus)*		
Western North Pacific (WNP) DPS	E 12/2/70; 35 FR 18319	none
Humpback whale *(Megaptera novaeangliae)*		
WNP DPS	E 9/8/16; 81 FR 62259	4/21/21; 86 FR 21082
Central America DPS	E 9/8/16; 81 FR 62259	4/21/21; 86 FR 21082
Mexico DPS	T 9/8/16; 81 FR 62259	4/21/21; 86 FR 21082
North Pacific right whale *(Eubalaena japonica)*		
Eastern North Pacific stock	E 3/6/08; 73 FR 12024	4/8/2008; 73 FR 19000
Sperm whale (*Physeter microcephalus)* Bearded seal (*Erignathus barbatus)*	E 12/2/70; 35 FR 18319	
(*E.b. nauticus*) Beringia DPS	T 12/28/12; 77 FR 76739	4/1/22; 87 FR 19180
Ringed seal (*Phoca hispida)*		
(P.h. hispida) Arctic DPS	T 12/28/12; 77 FR 76706	4/1/22; 87 FR 19180
Steller sea lion (*Eumetopias jubatus)*		
Western DPS	E 05/05/97; 62 FR 24345	8/27/93; 58 FR 45269
Northern Sea Otter (*Enhydra lutris kenyoni*)		
Southwest Alaska (DPS)	T 8/5/05; 74 FR 52010	12/16/08; 73 FR 76454
Polar Bear (*Ursus maritimus*)	T 5/15/08; 73 FR 28212	12/7/10; 75 FR 76086
Wood Bison (Bison *bison athabascae*)	T 6/4/12; 77 FR 26191	none
Birds		
Short-tailed albatross (*Phoebastria albatrus*)	E 8/30/00; 65 FR 46643	none
Spectacled eider (*Somateria fischeri*)	T 5/10/93; 58 FR 27474	3/8/01; 66 FR 9146
Steller's eider (*Polysticta stelleri*)	T 7/11/97; 62 FR 31748	3/5/01; 66 FR 8850

3.2.2 Essential Fish Habitat

To protect fisheries resources, NMFS works with regional fishery management councils to identify EFH for every life stage of each federally managed species using the best available scientific information. According to NOAA, EFH has been described for approximately 1,000 managed species to date. EFH includes all types of aquatic habitat including wetlands, coral reefs, seagrasses, and rivers: all locations where fish spawn, breed, feed, or grow to maturity. EFH is included in Fishery Management Plans (FMPs). NMFS is responsible for approving and implementing FMPs under the MSA.

TABLE 3-2. ESSENTIAL FISH HABITAT (ESH) PRESENT IN THE PROPOSED OPERATION ARTIC SHIELD ACTION AREA

Common Name	Scientific Name	Location	For
Scallops			
Weathervane scallop	*Patinopecten caurinus*	S. Bering Sea, Aleutian Islands	all (eggs, immature, juveniles, adults)
Salmon			
Chinook salmon	*Oncorhynchus tshawytscha*	Bering Strait south to Aleutians	all
Chum salmon	*Oncorhynchus keta*	Bering Strait south to Aleutians	all
Chum salmon	*Oncorhynchus keta*	Bering Strait south to Aleutians	all
Coho salmon	*Oncorhynchus kisutch*	Bering Strait south to Aleutians	all
Pink salmon	*Oncorhynchus gorbuscha*	Bering Strait south to Aleutians	all
Sockeye salmon	*Oncorhynchus nerka*	Bering Strait south to Aleutians	all
Crab			
Blue king crab	*Paralithodes platypus*	Bering Sea	all
Golden king crab	*Lithodes aequispinus*	Bering Sea, Aleutians	all
Grooved tanner crab	*Chionoecetes tanneri*	Bering Sea	all
Red king crab	*Paralithodes camtschaticus*	Norton Sound, Bering Sea, Bristol Bay	all
Snow crab	*Chionoecetes opilio*	Bering Sea, Bering Strait, Chukchi Sea	all
Tanner crab	*Chionoecetes bairdi*	Bering Sea	all
Triangle tanner crab	*Chionoecetes angulatus*	Bering Sea	all
Groundfish			
Alaska plaice	*Pleuronectes quadrituberculatus*	Bering Sea	all
Arctic cod	*Arctogadus glacialis*	Bering Strait, Chukchi Sea, Beaufort Sea	all
Arrowtooth flounder	*Atheresthes stomias*	Bering Sea	all
Atka mackerel	*Pleurogrammus azonus*	Bering Sea, Aleutians	all
Dover sole	*Solea solea*	Aleutians, Bering Sea	all
Dusty rockfish	*Sebastes ciliatus*	Aleutians, Bering Sea	all
Flathead sole	*Hippoglossoides elassodon*	Aleutians, Bering Sea	all
Greenland turbot	*Reinhardtius hippoglossoides*	Aleutians, Bering Sea	all
Northern rockfish	*Sebastes polyspinis*	Aleutians, Bering Sea	all
Pacific cod	*Gadus macrocephalus*	Aleutians, Bering Sea	all
Pacific Ocean perch	*Sebastes alutus*	Aleutians, Bering Sea	all
Rex sole	*Glyptocephalus zachirus*	Aleutians, Bering Sea	all
Rock sole	*Lepidopsetta bilineata*	Aleutians, Bering Sea	all
Saffron cod	*Eleginus gracilis*	Bering Strait, Chukchi Sea	all
Sablefish	*Anoplopoma fimbria*	Aleutians, Bering Sea	all
Sculpin	*Cottus sp.*	Aleutians, Bering Sea	all
Shortraker	*Sebastes borealis*	Aleutians, Bering Sea	all
Rougheye rockfish	*Sebastes aleutianus*	Aleutians, Bering Sea	all
Skate	*Raja sp.* and *Bathyraja sp.*	Aleutians, Bering Sea	all
Squid		Aleutians, Bering Sea	all
Thornyhead rockfish	*Sebastolobus macrochir*	Aleutians, Bering Sea	all
Walleye pollock	*Gadus chalcogrammus*	Aleutians, Bering Sea	all
Yelloweye rockfish	*Sebastes ruberrimus*	Aleutians, Bering Sea	all
Yellowfin sole	*Limanda aspera*	Aleutians, Bering Sea	all

Habitat Areas of Particular Concern (HAPC) are a subset of EFH. Fishery management councils designate HAPCs under the MSA. HAPCs are identified based on habitat level considerations rather than species life stages which are associated with EFH designations. Several habitat types, identified as an HAPC, focus on specific habitat locations such as seamounts and hard corals. In the proposed action area, amendments to the FMP for salmon fisheries, scallop fisheries, and groundfish fisheries have established the following Habitat Conservation Areas and Habitat Protection Areas: one Alaska Seamount Habitat Protection Area (Bowers Seamount), Gulf of Alaska Slope Habitat Conservation Area, two areas within the Bowers Ridge Habitat Conservation Zone (Bowers Ridge and Ulm Plateau) (North Pacific Fishery Management Council 2005), and six skate nursery areas within the Bering Sea (North Pacific Fishery Management Council 2012b). More information on the specific FMPs and HAPCs are located in Appendix F.

3.3 SOCIOECONOMIC ENVIRONMENT

Socioeconomics are the basic attributes and resources associated with the human environment, particularly characteristics of population and economic activity. Examples of economic activity typically include employment, personal income, and industrial or commercial growth. Impacts on these fundamental socioeconomic components influence other issues such as housing availability and provision of public services. Socioeconomic resources include: land use; population and housing; transportation; demographics; regional economy; cultural resources; recreation; and environmental justice.

Socioeconomic data shown in this section are presented to characterize baseline socioeconomic conditions in the context of regional, state, and national trends. Data have been collected from previously published documents issued by federal, state, and local agencies and from state and national databases (e.g., U.S. Bureau of Economic Analysis' Regional Economic Information System).

3.3.1 FISHING, SHIPPING, AND TOURISM

3.3.1.1 Commercial and Recreational Fishing

The Arctic-Yukon-Kuskokwim Region encompasses the coastal waters of Alaska and includes the rivers and streams that drain into the Bering, Chukchi, and Beaufort Seas (Alaska Department of Fish and Game 2024a). The Yukon River and Kuskokwim River lie within this management region (Alaska Department of Fish and Game 2024a). Salmon and herring are the most important fisheries resources in this region (Alaska Department of Fish and Game 2024a). Large numbers of salmon are taken for subsistence and subsistence harvests can equal or surpass the numbers of fish harvested in commercial fisheries, especially Chinook salmon. King crab is harvested near Nome in both commercial and subsistence fisheries. Whitefish are also important to the residents of this region (Alaska Department of Fish and Game 2024a). More information on the Yukon, Arctic, Norton Sound and Kotzebue, Kuskokwin Management Areas can be found in Appendix G.

3.3.1.2 Shipping

Marine vessels transiting Arctic waters generally fall into one of five categories: (1) vessels that re-supply Arctic communities, (2) vessels that transport ore, oil, and gas in bulk, (3) fishing vessels, (4) passenger or tourism vessels, and (5) icebreakers, government vessels, or research vessels (Arctic Council 2009). The greatest amount of vessel traffic occurs in the proposed action area between the Alaskan Archipelago and the Bering Strait (Arctic Council 2009). Community re-supply and coastal Arctic shipping involve a range of ship types, including tankers, general cargo and container ships, and, in some areas, tug/barge combinations. Community re-supply is expected to expand in the coming years due to both population increases in Arctic communities and increasing development in the region. Ship activity involving bulk transport of ore, oil, and gas, is likely in areas of experiencing growth such as the North Slope Borough and Seward Peninsula (Arctic Council 2009). Nearly all passenger vessel activity in the Arctic takes place in ice-free waters in the summer season; primarily for marine tourism. Icebreakers, government, and research vessels represent a relatively small proportion of the total vessel traffic. Within the proposed action area, the western Alaskan coast is the area in which fishing vessels also spend the greatest number of days at sea (Arctic Council 2009). As governments look to capitalize on new resources and sea routes in the melting Arctic Ocean, the number transits throughout the Action Area have increased dramatically (Nuka Research and Planning Group and Pearson Consulting 2014).

3.3.1.3 Tourism

There is limited ship-based tourism to Alaska within the proposed action area. While ferries and cruises visit many of the cities in the southeast, they rarely, if ever, reach areas of Alaska north of the Aleutians. In 2016, Nome hosted the Crystal Serenity cruise ship and its 1,700 passengers and crew (City of Nome Alaska 2016). Some smaller cruise ships sail regularly between Nome, Greenland, Russia, Norway, and other global destinations. Most travel by tourists or business travelers is done by air. Nome, Kotzebue, and Utqiagvik (Barrow) can be reached through Anchorage. Kivalina can be reached only from Kotzebue by plane, small boat, and snow machine (NANA Regional Corporation 2016a).

3.3.2 SUBSISTENCE RESOURCES

Subsistence hunting is defined as the customary and traditional uses of wild resources for food, clothing, fuel, transportation, construction, arts, crafts, sharing and customary trade. Subsistence use and activities are key pieces of the culture and cultural identity of Alaska Native people. Native communities along the Bering, Chukchi, and Beaufort Seas subsist largely on fish, land mammals, and marine mammals. The top species that are fished or hunted as subsistence foods include marine mammals such as ringed seals, bearded seals, walruses, and bowhead whales; fish such as Dolly Varden, Arctic char, sheefish, cod, whitefish, salmon, herring, and halibut; and land mammals such as caribou, moose, and Dall sheep (Wolfe 2004). Species of waterfowl (and their eggs) are also caught for subsistence. Statewide, fish compose most of the subsistence food (about 53 percent by weight), followed by land mammals (22 percent), marine mammals (14.2 percent), and birds and eggs (2.9 percent). Wild plants make up 4.2 percent and shellfish make up 3.2 percent of subsistence food. In total, subsistence harvest represents 0.9 percent of the fish and game harvested annually in the state of Alaska (while 98.5 percent is taken as part of commercial fishing) (Fall 2016).

Many of these species migrate, so the hunting or fishing season would depend on the species presence near the Native community. For example, in Kotzebue, typically seasonal hunting and fishing begins in spring, hunting marine mammals such as bearded seals, ringed seals, and, rarely, walruses (Georgette and Loon 1993). In Utqiagvik (Barrow) use of the offshore environment occurs year-round, but primarily during the open lead and open water season, which is April through October (Stephen R. Braund Associates 2012). These offshore use areas extend nearly 90 miles offshore to the north and up to approximately 60 miles offshore from the Chukchi and Beaufort Sea coasts (Stephen R. Braund Associates 2012). During the summer and fall months, Native residents set nets for various species of fish at coastal locations and harvest clams. Subsistence fishermen operate gillnets or seines in the main rivers and to a lesser extent in coastal marine waters to harvest salmon and other species of fish.

CHAPTER 4 ENVIRONMENTAL CONSEQUENCES

This chapter discusses potential environmental consequences of the Proposed Action to the physical, biological, and socioeconomic environments described in Chapter 3. Components of the Proposed Action that may potentially impact or harm the environment include:

- Acoustic stressors: underwater acoustic transmissions, vessel, and helicopter noise,
- Physical stressors: vessel and helicopter movements.

The potential impact or harm of the Proposed Action on each resource and critical habitat is analyzed by stressor. This section evaluates the likelihood that a resource would be exposed to, or encounter, a stressor and identifies the impact or harm associated with that exposure or encounter. The likelihood of an exposure or encounter is based on the stressor, location, and timing relative to the spatial and temporal distribution each biological resource or critical habitat. Under the No Action Alternative, the stressors from the Proposed Action would not be present; therefore, there would be no impact or harm to the physical, biological, or socioeconomic environments. No further analysis of the No Action Alternative will be presented. A table summarizing the analysis is presented below in Table 4-1.

TABLE 4-1. SUMMARY OF POTENTIAL EFFECTS FOR EACH RESOURCE

Resource	No Action	Proposed Action Conclusion of Analysis
Physical Environment		
Physical Resources	No change to baseline	No significant impact or harm
Biological Environment		
Mammals	No change to baseline	May affect, but is not likely to adversely affect
Birds (ESA and Migratory)	No change to baseline	May affect, but is not likely to adversely affect
Starfish or Sea Stars	No change to baseline	May affect, but is not likely to adversely affect
Fish	No change to baseline	May affect, but is not likely to adversely affect
Essential Fish Habitats (EFH)	No change to baseline	May affect, but is not likely to adversely affect
Reptiles (Sea Turtles)	No change to baseline	May affect, but is not likely to adversely affect
Socioeconomic Environment		
Socioeconomic Resources	No change to baseline	No significant impact

4.1 ACOUSTIC STRESSORS

The acoustic stressors from the Proposed Action include underwater acoustic transmissions, vessel noise, and aircraft noise (e.g., MH-60, C-130J). All Coast Guard vessels are equipped with standard navigational technologies, including radar and navigational sonar (Table 2-1). In general, the Coast Guard would use high endurance or medium endurance cutters and a buoy tender during Arctic Shield that would operate navigational sonar while underway. Aircraft used would typically be a MH-60 Jayhawk helicopter and C-130J fixed wing aircraft.

Flights for routine patrols can occur at altitudes of 400—1,500 ft (122—457 m), but typically aircraft stay at or above 1,000 ft (305 m). Aircraft will not operate at an altitude lower than 1,500 ft (457 m) within 0.5 mi (805 m) of marine mammals observed on ice or land. Helicopters may also not hover or circle above such areas. Aircraft would also avoid any biologically sensitive areas, but if deemed necessary to pass over such areas, aircraft would stay above 3,000 ft (914 m). SAR missions would operate at an altitude below 500 ft (152 m) in order to be effective, particularly if loading a rescued person.

<u>Hearing Thresholds</u>

The most familiar effect of exposure to high intensity sound is hearing loss, meaning a shift in the hearing threshold. The distinction between PTS and TTS is based on whether there is complete recovery of a threshold shift following a sound exposure. If the threshold shift eventually returns to zero (the threshold returns to the pre-exposure value), the threshold shift is considered a TTS. The recovery to pre-exposure threshold from studies of marine mammals is usually on the order of minutes to hours for the small amounts of TTS induced (Finneran et al. 2005; 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; Mooney et al. 2009). If the threshold shift does not return to zero but leaves some finite amount of threshold shift, then that remaining threshold shift is a PTS.

Studies of marine mammals have been designed to determine relationships between TTS and exposure parameters such as level, duration, and frequency. In these studies, hearing thresholds were measured in trained marine mammals before and after exposure to intense sounds (Schlundt et al. 2000). Although there have been no marine mammal studies designed to measure PTS, the potential for PTS in marine mammals can be estimated based on known similarities between the inner ears of marine and terrestrial mammals.

<u>Behavioral Responses</u>

The response of an animal to an anthropogenic sound will depend on the frequency, duration, temporal pattern, and amplitude of the sound as well as the animal’s prior experience with the sound and the context in which the sound is encountered (i.e., what the animal is doing at the time of the exposure). Other variables such as the animal’s gender, age, the activity it is engaged in during a sound exposure, the distance from the sound source, and whether it is perceived as approaching or moving away can also affect the way an animal responds to a sound (Wartzok et al. 2003). For marine mammals, a review of responses to anthropogenic sound was first conducted by Richardson et al. (Richardson et al. 1995). More recent reviews (Nowacek et al. 2007; Southall et al. 2007) address studies conducted since 1995 and focus on observations where the received sound level of the exposed marine mammal(s) was known or could be estimated.

Southall et al. (2007) synthesized data from many past behavioral studies and observations to determine the likelihood of behavioral reactions at specific sound levels. While in general the louder the sound source the more intense the behavioral response, it was clear that 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 all the available data, the authors felt 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.

4.1.1 ACOUSTIC TRANSMISSIONS (IN WATER)

4.1.1.1 De minimis

The Coast Guard proposes to adopt the U.S. Navy’s definition of acoustic sources, defined as de minimis (U.S. Navy 2013), as any in-water active acoustic source with: narrow beam widths; downward directed transmissions; short pulse lengths; frequencies outside known hearing ranges (e.g., marine mammals); low source levels; or a combination of any of these factors. A de minimis acoustic source is not expected to result in the take of protected species. These de minimis sources are qualitatively analyzed to determine the appropriate determinations under the ESA. When used during routine activities, and in a typical environment, de minimis sources fall into one or more of the following categories:

Transmit primarily above 200 kHz: Sources above 200 kHz are above the hearing range of the most sensitive marine mammals and far above the hearing range of any other animals in the proposed action areas. Source levels of 160 dB re 1 μPa or less: Low-powered sources with source levels less than 160 dB re 1 μPa are typically handheld sonars, range pingers, transponders, and acoustic communication devices. Assuming spherical spreading for a 160 dB re 1 μPa source, the sound will attenuate to less than 140 dB within 10 meters (m; 33 ft) and less than 120 dB within 100 m (328 ft) of the source. Ranges would be even shorter for a source less than 160 dB re 1 μPa source level. Sources with operational characteristics, such as short pulse length, narrow beam width, downward-directed beam, and low energy release, or manner of system operation, which exclude the possibility of any significant impact to a protected species. Even if there is a possibility that some species may be exposed to and detect some of these sources, any response is expected to be short-term and inconsequential. Based on the short pulse length, narrow beam width, downward-directed beam, and manner of system operation, and the de minimis criteria, the navigational system (i.e. fathometer/single beam echosounder) could be considered de minimis. However, for some biological resources, the frequency range (50-200 kHz) does overlap with the hearing range of certain species, and the potential impact of that overlap with hearing is discussed in greater detail in Section 4.1.5.4.

In general, marine species are expected to exhibit no more than short-term and inconsequential responses to the navigational technologies given their characteristics (e.g., narrow, downward-directed beam), which is focused directly beneath the platform. Such reactions are not considered to constitute "take" and, therefore, no additional quantitative modeling is required for marine species that might encounter these sound sources. A qualitative discussion is provided for certain species below, focusing only on those species' whose hearing range overlaps with the frequency range of these sources, since the other characteristics suggest that these sound sources would be considered de minimis. Active acoustic in water transmissions associated with the Proposed Action include the single beam echosounder.

4.1.1.2 Fish

Most fish species can hear sounds between 50 and 1,000 Hertz (Hz). Fish without hearing specialization (generalists) are not expected to detect signals emitted by the single-beam echosounder associated with the Proposed Action, as the operating frequency range of these devices is about 3.5–1000 kHz, which is well outside the hearing range of these fish. The ESA-listed fish species expected to come in contact with underwater acoustic transmissions are generally regarded as hearing non-specialists (Hastings and Popper 2005). Salmon can respond to sounds up to 380 Hz, and the related rainbow trout (the landlocked version of the steelhead trout) has similar hearing sensitivity (Hastings and Popper 2005; Hawkins and Johnstone 1978). There is a lack of reliable hearing data on rockfish.

4.1.1.3 Sea Turtles

Most turtle species can hear sounds between low frequencies from 30 to 2,000 Hz, with a range of maximum sensitivity between 100 and 800 Hz (Bartol 1994; Bartol and Ketten 2006; Lenhardt 2002; Ridgway et al. 1969). ESA-listed sea turtles are not expected to detect signals emitted by the single-beam echosounder associated with the Proposed Action, as the operating frequency range of these devices is about 3.5–1000 kHz, which is well outside the hearing range of sea turtles.

4.1.1.4 Marine Mammals

The potential effect from acoustic transmissions to marine mammals could include PTS, TTS, or a behavioral response. The Coast Guard analyzed the data and conducted an analysis of the species distribution and likely responses to the acoustic transmissions based on available scientific literature.

In 2016, NMFS published technical guidance that identifies the received levels, or acoustic thresholds, at which individual marine mammals are predicted to experience changes in their hearing sensitivity (either temporary or permanent) for acute, incidental exposure to underwater anthropogenic sound sources (Table 6). The guidance included a protocol for estimating PTS onset acoustic thresholds for impulsive (e.g., airguns, impact pile drivers) and non-impulsive (e.g., tactical sonar, vibratory pile drivers) sound sources for the following marine mammal hearing groups: low- (LF), mid- (MF), and high- (HF) frequency cetaceans, and otariid and non-phocid marine carnivores (OW) and phocid (PW) pinnipeds. NMFS' acoustic guidelines (NMFS 2016b) only address effects of noise on marine mammal hearing and do not provide guidance on behavioral disturbance. Thus, the guidance does not represent the entirety of the comprehensive analysis included here but serves as a tool to help evaluate the effect during the Proposed Action on marine mammals and to make findings required by the National Oceanic and Atmospheric Administration's various statutes, such as the MMPA. Table 4-2 provides the resultant TTS onset auditory acoustic thresholds for non-impulsive sounds4 from NMFS' technical guidance (NMFS 2016b). Impulsive sources are not listed since no impulsive sources would be produced by any of the underwater acoustic transmissions. In addition, Table 6 provides PTS onset auditory thresholds derived from TTS for non-impulsive sounds, utilizing NMFS' technical guidance (NMFS 2016b).

The source level associated with the single-beam echosounder is not expected to cause any injury to ESA-listed mysticetes (bowhead whale, fin whale, gray whale, humpback whale, or North Pacific right whale), odontocetes (sperm whale), pinnipeds (bearded seal and ringed seal), or otariids (Steller sea lion) that may be within the proposed action area because any received levels would be below onset of TTS and PTS for each hearing group. Non-auditory physiological effects or injuries that can theoretically occur in marine mammals exposed to strong underwater noise are stress, neurological effects, bubble formation, resonance effects and other types of organ or tissue damage. These effects would be considered injurious, but the source levels associated with the Proposed Action would not be expected to cause any non-auditory physiological effects or injuries to mysticetes, odontocetes, or pinnipeds that may be within the proposed action area. In addition, SOPs, which are detailed in Section 2, would minimize the effects of the Proposed Action. By monitoring the presence of marine mammals and initiating adaptive mitigation responses to marine mammals including reducing vessel speed, posting additional dedicated lookouts to assist in monitoring location of the marine mammals, avoiding sudden changes in speed and direction, avoiding crossing the path of a marine mammal, and avoiding approach of marine mammals head-on or directly from behind.

TABLE 4-2. ONSET OF PTS AND TTS THRESHOLDS FOR MARINE MAMMALS FOR UNDERWATER NON-IMPULSIVE SOUNDS

Hearing Group	Species	Physiological Criteria (24 hours)	
		Weighted Onset TTS[1]	Onset PTS (received level)
Low-Frequency (LF) Cetaceans	All mysticetes	179 dB SEL_{cum} [2]	199 dB SEL
Mid-Frequency (MF)Cetaceans	Most delphinids, beaked whales, medium and large toothed whales	178 dB SEL_{cum}	198 dB SEL
High-Frequency (HF)Cetaceans	Porpoises, River dolphins, *Cephalorynchus* spp., some *Lagenorhynchus* species *Kogia* spp.	153 dB SEL_{cum}	173 dB SEL
Phocidae (PW) (in water)	Harbor, Bearded, Hooded, Common, Spotted, Ringed, Baikal, Caspian, Harp, Ribbon, Gray, Monk, Elephant, Ross, Crabeater, Leopard, and Weddell seals	181 dB SEL_{cum}	201 dB SEL
Otariidae (OW) (in water)	Guadalupe fur seal, Northern fur seal, California sea lion, Steller sea lion	199 dB SEL_{cum}	219 dB SEL

NOTES

[1] Determined from minimum value of exposure function and the weighting function at its peak

[2] The SELcum metric accounts for the accumulated exposure (i.e., sound exposure level cumulative exposure over the duration of the activity within a 24-hour period)

Reference: NMFS Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (National Marine Fisheries Service 2016b)

The echosounder's system operates at a wide range of frequencies (between 24 and 200 kHz, but typically between 50 and 200 kHz). Although there is a lack of audiometry data, based on anatomical studies and analysis of sounds that they produce, most baleen whales hear best at low frequencies, from seven Hz to 35 kHz (National Marine Fisheries Service 2016b; Southall et al. 2007). Watkins (1986) stated that humpback whales often react to frequencies from 15 Hz to 28kHz but did not react to frequencies above 36 kHz. Fin and right whales also often react to frequencies from 15 Hz to 28 kHz but did not react to frequencies above 36 kHz (Watkins 1986). Similarly, ESA-listed sea lions hear best between 60 Hz to 39 kHz (Kastak and Schusterman 1998; Moore and Schusterman 1987; Schusterman et al. 1972; Southall 2005) and are unlikely to detect any frequency used by Coast Guard single-beam echosounder.

Most phocids can hear frequencies between 50 Hz and 86 kHz (National Marine Fisheries Service 2016b; Southall et al. 2007) but can detect sounds up to 140 kHz although sensitivity is low (Cunningham and Reichmuth 2016). Thus, it is possible that the ESA-listed bearded seal and ringed seal could detect or react to an echosounder if it was swimming within or near the vertical beam, but only if it was operating at a frequency within their hearing range. The overlap between the echosounder's frequency and the phocid best hearing range is limited to 50 and 86 kHz, which would be at the echosounder's lower operational frequencies. Although phocids can hear frequencies between 50 Hz and 86 kHz, sensitivity to noise decreases at the low and high ends of this range (Perrin and Wursig 2009). Sills et al. (2015) determined that hearing abilities for ringed seals are better than what Terhune and Ronald (1975) previously reported (from 2—50 kHz) with best sensitivity at 49 dB re 1 μPa (12.8 kHz in water) and critical ratio measurements ranging from 14 dB at 0.1 kHz to 31 dB at 25.6 kHz. Since the lowest operational frequency for the echosounder only overlaps with the high end of the phocid's best hearing range, the sensitivity to the echosounder is expected to be poor because of the ear's decreased sensitivity to extreme low and high frequency noise. Data suggest that exposures of pinnipeds to sources between 90 and 140 dB re 1 μPa at 1 m do not elicit strong behavioral responses (Southall et al. 2007). In contrast, data on grey (Halichoerus grypus) and harbor seals indicate avoidance response at received levels of 135–144 dB re 1 μPa at 1 m (Götz and Janik 2010). Wartzok et al. (1992a; 1992b) investigated the under-ice movements and sensory cues associated with under-ice navigation of ringed seals by attaching acoustic transmitters (60–69 kHz at 159 dB re 1 μPa at 1 m).

Although the frequencies used in the Wartzok et al. (1992a; 1992b) studies were at the upper limit of ringed seal hearing, the ringed seals exhibited normal behavior (e.g., finding breathing holes). Because it is unknown at what exact decibel level a phocid, such as the bearded or ringed seals may elicit a response, it is expected that bearded or ringed seals may elicit similar behavioral responses as the other phocid seals described above if exposed to source levels higher than 140 dB re 1 μPa at 1 m. Pinnipeds are expected to exhibit no more than short-term and inconsequential responses to the echosounder given the device's characteristics (e.g., narrow downward-directed beam), which is focused directly beneath the vessel. However, any response to the echosounder, although unlikely, is expected to be short-term, any disturbance is expected to be temporary, and any individual that did respond is expected to return to its normal behavior.

The maximum potential effect is expected for odontocetes, since their frequencies of best hearing range from 150 Hz to 160 kHz, which could overlap with low- and medium-frequency echosounder signals Table 4-2. Beluga whales have been found to have quite sensitive hearing for odontocetes, from 32—80 kHz with thresholds below 60 dB re 1 μPa and from 11.2—90 kHz with thresholds below 70 dB re 1 μPa (Mooney et al. 2008). While harbor porpoise have a range of best hearing from 16—140 kHz, with reduced sensitivity around 64 kHz and maximum sensitivity from 100—140 kHz (Kastelein et al. 2002a).

There is some evidence of disruptions of sperm whale clicking and behavior from exposure to pingers in Watkins and Schevill (1975), the Heard Island Feasibility Test (Bowles et al. 1994), and the Acoustic Thermometry of Ocean Climate at Pioneer Seamount off Half Moon Bay, California (Costa et al. 1998). Sperm whales have been observed to frequently stop echolocating in the presence of underwater pulses made by echosounders (emitting about 1 pulse per second at 6–13 kHz); however, sperm whales did not show a prolonged reaction to continuous pulsing from echosounders (Watkins and Schevill 1975). Goold (1999) reported that six sperm whales were driven through a narrow channel using ship noise, echosounder, and fish finder emissions from a flotilla of 10 vessels. Although echosounders are expected to be operational the entire time any vessel is underway, Coast Guard assets would follow SOPs (Appendix B) to minimize the effects of the Proposed Action to marine mammals. Specifically, Coast Guard vessels would not create a flotilla, like the one described in Goold (1999) and would not drive animals into a narrow channel. The sperm whale is the only ESA-listed odontocete that may be present in open ocean areas and overlaps with the proposed action area. The northernmost boundary of the sperm whale's range is near the Pribilof Islands. In the unlikely event that a sperm whale is within the proposed action area and within a range to detect the echosounder, sperm whales are expected to exhibit no more than short-term and inconsequential responses to the echosounder given the device's characteristics (e.g., narrow, downward-directed beam), which is focused directly beneath the vessel.

As stated in the Coast Guard SOPs, crew members will be trained as PSOs in marine mammal and protected species identification and will alert the Command of the presence of marine mammals or protected species. In response to sightings, operators will initiate adaptive mitigation responses including reducing vessel speed, posting additional PSOs to assist in monitoring location of the animals, avoiding sudden changes in speed and direction, or if a swimming whale is spotted, attempting to parallel the course and speed of the moving whale so as to avoid crossing its path, and avoiding approach of sighted whales head-on, or directly from behind (COMDTINST M16247.1H).

Coast Guard vessels would support the recovery of protected living marine resources through internal compliance with laws designed to preserve marine protected species, including planning passage around marine sanctuaries, such as federally-designated critical habitat. These actions would minimize the effects of acoustic transmissions from vessels to marine mammals and federally-designated critical habitat. As described above, the acoustic transmissions associated with the Proposed Action may result in minor to moderate avoidance responses of odontocetes, over short and intermittent periods of time. The Proposed Action is not expected to cause significant disruptions such as mass haul outs, or abandonment of breeding, that would result in significantly altered or abandoned behavior patterns.

4.1.1.5 Vessel Noise

Marine species within the proposed action area may be exposed to vessel noise associated with Coast Guard assets during the Proposed Action. It is difficult to differentiate between behavioral responses to vessel sound and visual cues associated with the presence of a vessel (Hazel et al. 2007); thus, it is assumed both could play a role in prompting reactions from animals. The potential effect from vessel noise is from masking of other biologically relevant sounds as well as behavioral reactions, such as an alerting or avoidance response.

Underwater sound from vessels is generally at relatively low frequencies, usually between 5 and 500 Hz (Hildebrand 2009; NRC 2003; Southall et al. 2017; Urick 1983; Wenz 1962). However, high levels of vessel traffic are known to elevate background levels of noise in the marine environment (Andrew et al. 2011; Chapman and Price 2011; Frisk 2012; Miksis-Olds et al. 2013; Redfern et al. 2017; Southall 2005). Anthropogenic sources of sound in the proposed action areas includes smaller vessels such as skiffs, larger vessels for pulling barges to deliver supplies to communities or industry work sites, icebreakers, and vessels for tourism and scientific research which all produce varying noise levels and frequency ranges. Commercial ships radiate noise underwater with peak spectral power at 20–200 Hz (Ross 1976). The dominant noise source is usually propeller cavitation which has peak power near 50–150 Hz (at blade rates and their harmonics), but also radiates broadband power at higher frequencies, at least up to 100,000 Hz (Arveson and Vendittis 2000; Gray and Greeley 1980; Ross 1976). While propeller singing is caused by blades resonating at vortex shedding frequencies and emits strong tones between 100 and 1,000 Hz, propulsion noise is caused by shafts, gears, engines, and other machinery and has peak power below 50 Hz (Richardson et al. 1995). Overall, larger vessels generate more noise at low frequencies (<1,000 Hz) because of their relatively high power, deep draft, and slower turning (<250 rotations per minute) engines and propellers (Richardson et al. 1995).

Low frequency ship noise sources include propeller noise (cavitation, cavitation modulation at blade passage frequency and harmonics, unsteady propeller blade passage forces), propulsion machinery such as diesel engines, gears, and major auxiliaries such as diesel generators (Ross 1976). Globally, commercial shipping is not uniformly distributed (NRC 2003). Other vessels may be found widely distributed outside of ports and shipping lanes. These include military vessels participating in training exercises, fishing vessels, and recreational vessels. The vessels participating in the Proposed Action may be in the proposed action areas at any given time for any given amount of time and would overlap spatially and temporally with other vessels described above.

Vessel operations associated with the Proposed Action could create a zone of masking in the water for marine species. The potential effect from vessel noise from auditory masking is missing biologically relevant sounds that species may rely on, as well as eliciting behavioral reactions such as an alert, avoidance, or other behavioral reaction (NRC 2003, 2005; Williams et al. 2015). The effects of masking can vary depending on the ambient noise level within the environment, the received level, frequency of the vessel noise, and the received level and frequency of the sound of biological interest (Clark et al. 2009; Foote et al. 2004; Parks et al. 2010; Southall et al. 2000). In the open ocean, ambient noise levels are between about 60 and 80 dB re 1 μPa, especially at lower frequencies (below 100 Hz) (NRC 2003). When the noise level is above the sound of interest, and in a similar frequency band, auditory masking could occur (Clark et al. 2009). Any sound that is above ambient noise levels and within an animal's hearing range needs to be considered in the analysis; however, the degree of masking increases with the increasing noise levels; a noise that is just detectable over ambient levels is unlikely to actually cause any substantial masking above that which is already caused by ambient noise levels (NRC 2003, 2005).

Vessel presence, particularly for activities such as shipping, is diffuse and spread throughout the world's oceans (Hildebrand 2009). Vessel noise associated with the Proposed Action would not contribute meaningfully to these ambient sound levels in areas experiencing higher vessel traffic, such as frequently used transit routes. In the more remote regions of the Arctic, the additional vessel noise would still be minimal compared to the noise of the ambient environment. As observed by Worcester et al. (2015), the median noise level at 98 m depth during the first two weeks of May not far from the North Pole had a maximum between 10 and 20 Hz of approximately 75 dB re 1 μPa2/Hz. Dziak et al. (2015) recorded tens of "icequakes" per day in Antarctica with underwater sound levels ranging between 190–247 dB RMS re 1μPa @ 1 m. Veirs et al. (2016) measured ship noise in Puget Sound, WA and determined that median received spectrum levels of noise from 2,809 isolated transits are elevated relative to median background levels not only at low frequencies (20-30 dB re 1 mPa2/Hz from 100 to 1,000 Hz), but also at high frequencies (5-13 dB from 10 to 96 kHz). Under the Proposed Action, the frequency of the vessel noise could overlap with the hearing range of ESA-listed fish, sea turtles, and marine mammals.

4.1.1.5.1 Fish

Vessel noise has the potential to expose fish to both sound and disturbance from particle motion, which could result in short-term behavioral or physiological responses (e.g., avoidance, stress, increased respiration rate).

Vessel noise from transiting, operations, or training activities associated with the Proposed Action is not expected to affect fish, as available evidence does not suggest that ship noise can injure or kill a fish (Popper 2014). Misund (1997) found that fish ahead of a ship showed avoidance reactions at ranges of 49 to 149 m. When the vessel passed over them, some species of fish exhibited sudden escape responses that included lateral avoidance or downward compression of the school of fish; though it is unclear if this avoidance behavior is to the physical presence of the vessel, particle motion, or actual detection of the sound. Avoidance behavior of vessels, vertically or horizontally in the water column, has been reported for cod and herring, and was attributed to vessel noise. Vessel activity can also alter schooling behavior and swimming speed of fish (UNEP 2012).

It is not anticipated that temporary behavioral reactions (e.g., temporary cessation of feeding or avoidance response) would affect the individual fitness of a fish, as individuals are expected to resume feeding upon cessation of the sound exposure and unconsumed prey would still be available in the environment. Furthermore, while vessel sounds may influence the behavior of some fish species (ex., startle response, masking), other fish species can be equally unresponsive (Becker et al. 2013). Shipping is diffuse and spread throughout the world's oceans, raising the ambient levels of sound (Hildebrand 2009). It is expected that vessels associated with the Proposed Action, similar to other ships in the area, would also contribute to ambient levels of sound in the proposed action areas, but are not expected to increase the current ambient sound levels. In the unlikely event that an ESA-listed fish was present in the proposed action area, vessel noise associated with the Proposed Action may affect individual fish; however, responses to vessel noise would be short-term and insignificant behavioral reactions, and thus, would not be expected to have any population level impacts.

4.1.1.5.2 Sea Turtles

Little is known about how sea turtles use sound in their environment. They may use sound for navigation, locating prey, avoiding predators, and general environmental awareness. However, sea turtles do not appear to use sound for communication. When presented with acoustic stimuli at 430 Hz and 1.5 dB re 1 μPa, sea turtles placed in 50-gallon tanks responded with abrupt body movements, such as blinking, head retraction, and flipper movement, all of which were interpreted as startle responses (Lenhardt et al. 1996). Higher level responses, such as changes in swimming patterns and orientation, were noted when sea turtles, located in a confined canal (300 m long, 45 m wide, and up to 10 m deep), suspended at 2-m depth and positioned 33 m inward from one side of the tank, and exposed to high-pressure air gun pulses (120 dB re 1 mbar at 1 m) with frequencies ranging from 25 to 750 Hz (O'Hara and Wilcox 1990). Vessel noise in the open ocean may cause a startle response in sea turtles. However, any response is expected to be short term and temporary in nature. Overlap between the proposed action area and the range of the leatherback sea turtle is very small (e.g., only a far north as the Aleutian Island chain); however, in the unlikely event that a leatherback sea turtle was present in the proposed action area, vessel noise associated with the Proposed Action may affect individual sea turtles. Any responses to vessel noise would be short-term and insignificant behavioral reactions, and thus, would not be expected to have any population level impacts. Furthermore, given the concentration of offshore vessel traffic in the proposed action area, the vessel noise from the Proposed Action would have no significant changes to ambient noise levels nor create any additional masking impacts, and therefore would not impact a sea turtle's ability to perceive other biologically relevant sounds.

4.1.1.5.3 Marine Mammals

Since many marine mammals rely on sound to find prey, moderate social interactions, and facilitate mating (Tyack 2008), noise from anthropogenic sound sources like ships can interfere with these functions, but only if the noise spectrum overlaps with the hearing sensitivity of the marine mammal (Clark et al. 2009; Hatch et al. 2012; Southall et al. 2007). It is difficult to differentiate between behavioral responses to just a vessel sound or just the visual cues associated with the presence of a vessel; thus, it is assumed that both play a role in prompting reactions from animals (Richardson et al. 1995).

As mentioned previously, hearing sensitivity isn't yet characterized in mysticetes, but based on their signals they are likely most sensitive at frequencies 10-10,000 Hz and therefore constitute a low-frequency functional hearing group (Southall et al. 2007). They typically emit signals with fundamental frequencies well below 1,000 Hz (Au et al. 2006; Cerchio et al. 2001; Munger et al. 2008) although non-song humpback signals have peak power near 800 and 1,700 Hz (Stimpert 2010) and humpback song harmonics extend up to 24,000 Hz (Au et al. 2006). While most mysticetes hear best at low frequencies, blue whales (B. musculus) have been observed reacting to mid-frequency sound in the range of 3.5-3.6 kHz (Goldbogen et al. 2013). However, the responses varied across individuals and the responses themselves were strongly affected by the whale's behavioral state at the time of exposure, with surface feeding animals typically showing no change in behavior. By contrast, deep feeding and non-feeding whales' responses ranged from termination of deep foraging dives to prolonged mid-water dives. The potential effects of ship noise can be assessed more confidently in odontocetes because they constitute midfrequency or high-frequency functional hearing groups (Southall et al. 2007) in which auditory response curves have been obtained for many species. These curves show maximum auditory sensitivity near the frequencies where toothed whale signals have peak power (Mooney et al. 2012; Tougaard et al. 2014) at about 1-20 kHz for social sounds and 10-100 kHz or higher for echolocation.

Marine mammals have been recorded in several instances altering and modifying their vocalizations to compensate for the masking noise from vessels, or other similar sounds (Holt et al. 2011; Parks et al. 2011). Vocal changes in response to anthropogenic noise can occur across the repertoire of sound production modes used by marine mammals, such as whistling, echolocation click production, calling, and singing. Changes to vocal behavior and call structure may result from a need to compensate for an increase in background noise. In cetaceans, vocalization changes have been reported from exposure to anthropogenic sources such as sonar, vessel noise, and seismic surveying. Behavioral responses to boat (as opposed to ship) noise have been documented in toothed whales. Bottlenose dolphins whistle (at 4-20 kHz) less when exposed to boat noise at 500-12,000 Hz (Buckstaff 2004), and Indo-Pacific bottlenose dolphins lower their 5-10 kHz whistle frequencies when noise is increased by boats in a band from 5,000 to 18,000 Hz (Morisaka et al. 2005).

Vessel noise also has the potential to disturb marine mammals and elicit an alerting, avoidance, or other behavioral reaction (Huntington et al. 2015; Pirotta et al. 2015; Williams et al. 2014). Most studies have reported that marine mammals react to vessel sounds and traffic with short term interruption of feeding, resting, or social interactions (Huntington et al. 2015; Magalhães et al. 2002; Merchant et al. 2014; Pirotta et al. 2015; Richardson et al. 1995; Williams et al. 2014). In cases where vessels actively approached marine mammals (e.g., whale watching), scientists have documented that animals exhibit altered behavior such as increased swimming speed, erratic movement, and active avoidance behavior (Acevedo 1991; Baker and MacGibbon 1991; Bursk 1983; Constantine et al. 2003; New et al. 2015; Parsons 2012; Pirotta et al. 2015; Trites and Bain 2000; Williams et al. 2002), reduced blow interval (Richter et al. 2003b), disruption of normal social behaviors (Lusseau 2003; Lusseau 2006; Pirotta et al. 2015), and the shift of behavioral activities which may increase energetic costs (Constantine et al. 2003; Constantine et al. 2004). These reactions could be caused by vessel noise or the presence of the vessel itself. Some species respond negatively by retreating or responding to the vessel antagonistically, while other animals seem to ignore vessel noises altogether (Watkins 1986). Marine mammals are frequently exposed to vessels due to research, ecotourism, commercial and private vessel traffic, and government activities. Veirs et al. (2016) measured ship noise in Puget Sound, WA and determined that median received spectrum levels of noise from 2,809 isolated transits are elevated relative to median background levels not only at low frequencies (20-30 dB re 1 mPa2/Hz from 100 to 1,000 Hz), but also at high frequencies (5-13 dB from 10,000 to 96,000 Hz). Based on these results, noise received from ships at ranges less than 3 km could extend to frequencies used by odontocetes.

Studies showed that bowhead whales avoided encroaching vessels by as much as 2.5 mi (4 km) but returned to the displaced area within a day (Koski and Johnson 1987; Richardson et al. 1985). If vessels were not moving towards bowhead whales, bowhead whales did not demonstrate avoidance behaviors such as those described previously. Bowhead whales located more than 1,640 ft (500 m) behind the moving vessel did not demonstrate avoidance behavior and approached vessels to within 328 to 1,640 ft (100 to 500 m) (Wartzok et al. 1989). Therefore, it would appear that directionality and vessel speed could influence behavioral reactions of bowhead whales.

Other baleen whales, like the humpback whale have exhibited varied responses to vessels, ranging from approaching to avoiding (Au and Green 2000; Baker and Herman 1989; Bauer and Herman 1986; Stamation et al. 2009). Vertical avoidance was observed within 1 mi (2 km), while horizontal avoidance occurred from 1-2 mi (2-4 km) away (Baker and Herman 1989; Baker et al. 1983). Humpback whales are less likely to react if actively engaged in feeding (Krieger and Wing 1984, 1986) although Blair et al. (2016) reported that humpback whales significantly changed foraging behavior in response to high levels of ship noise in the North Atlantic. Although vessels could cause some short-term changes in behavior, any disturbance is expected to be temporary, and any whales are expected to return to their normal behavior.

Sperm whales have also exhibited varied responses to outboard vessels up to 1 mi (2 km) away (Cawthorn 1992). However, many individual sperm whales remained in areas with regular boat presence (Gordon et al. 1992). Smaller odontocetes, including some dolphins and porpoises and other smaller toothed whales (and occasionally sea lions and fur seals), interact with vessels by bow riding when a vessel is moving. Bow-riding is when the animals position themselves in such a manner as to be lifted up and pushed forward by the circulating water generated to form a bow pressure wave of an advancing vessel (Hertel 1969; Lang 1966).

Based on these studies, whales are not expected to be disturbed by vessels that maintain a reasonable distance from them, though this varies with vessel size, geographic location, frequency of exposure, and tolerance levels of individuals. As stated in the Coast Guard SOPs in Section 2, crew members would be trained as PSOs in marine mammal and protected species identification and will alert the Command of the presence of marine mammals or protected species. In response to sightings, operators will initiate adaptive mitigation responses including reducing vessel speed, posting additional PSOs to assist in monitoring location of the animals, avoiding sudden changes in speed and direction, or if a swimming whale is spotted, attempting to parallel the course and speed of the moving whale so as to avoid crossing its path, and avoiding approach of sighted whales head-on, or directly from behind (see COMDTINST M16247.1H).

Pinnipeds could react to vessels when hauled out, and thus react to both the in-air sound of a vessel as well as to the visual cue from the vessel itself. In 1997, Henry and Hammill (2001) conducted a study to measure the effects of small boats (i.e., kayaks, canoes, motorboats and sailboats) on harbor seal haulout behavior in Metis Bay, Quebec, Canada and noted that the most frequent disturbances were caused by lower speed, lingering kayaks, and canoes as opposed to motorboats conducting high speed passes. The study concluded that boat traffic at current levels had only a temporary effect on the haulout behavior of harbor seals in the Metis Bay area because once the animals were disturbed, there did not appear to be any significant lingering effect on the recovery of numbers to their pre-disturbance levels.

Pinnipeds may also react to vessels while they are in the water, from hearing just the in-water vessel noise or hearing the in-water vessel noise and the sight of the vessel approaching (only likely if the pinniped's head is above water). Richardson et al. (1995) stated that for in-water vessel reactions only, pinnipeds are much less likely to react to vessels if in water and not hauled out. While in water pinnipeds show a high tolerance to vessels, though it is not known if these incidents cause them stress, despite their tolerance (Richardson et al. 1995). Johnson and Acevedo-Gutierrez (2007) evaluated the efficacy of buffer zones for watercraft around harbor seal haulout sites on Yellow Island, Washington. The authors estimated the minimum distance between the vessels and the haulout sites, categorized the vessel types, and evaluated seal responses to the disturbances. During the seven-weekend study, the authors recorded 14 human-related disturbances, which were associated with stopped powerboats and kayaks. During these events, hauled out seals became noticeably active and moved into the water. The flushing occurred when stopped kayaks and powerboats were at distances as far as 453 and 1,217 ft (138 and 371 m) respectively. The authors note that the seals were unaffected by passing powerboats, even those approaching as close as 128 ft (39 m), possibly indicating that the animals had become tolerant of the brief presence of the vessels and ignored them. The authors reported that on average, the seals quickly recovered from the disturbances and returned to the haulout site in less than or equal to 60 minutes. Seal numbers did not return to predisturbance levels within 180 minutes of the disturbance less than one quarter of the time observed. The study concluded that the return of seal numbers to pre-disturbance levels and the relatively regular seasonal cycle in abundance throughout the area counter the idea that disturbances from powerboats may result in site abandonment (Johnson and Acevedo-Gutiérrez 2007). Frequent and close disturbances may cause abandonment of a haulout site (Allen et al. 1984) but are not likely to occur from infrequent exposure to boats passing by the haulout. In general, from the available information, pinnipeds exposed to intense (approximately 110 to 120 dB re 20 μPa at 1 m) non-pulsed sounds often leave haulout areas and seek refuge temporarily (minutes to a few hours) in the water (Southall et al. 2007).

The received levels from sources and associated source levels (Table 7) for the Proposed Action are expected to be below the onset of TTS and PTS (Table 6) for all marine mammal groups, including mysticetes, odontocetes, or pinnipeds, that may be within the proposed action area. Underwater noise from all vessels could overlap with the same low-frequency sounds that many whales use for communication for feeding and mating, and therefore, could cause masking. Auditory response curves for odontocetes show maximum auditory sensitivity near where toothed whale signals have peak power (Mooney et al. 2012; Tougaard et al. 2014) at about 1,000—2,000 Hz for social sounds and 10,000—100,000 Hz or higher for echolocation. NMFS (2016) considers sperm whales to be Mid-frequency (MF) cetaceans, with a generalized hearing range from 150 Hz to 160 kHz and pinnipeds as phocids (PW) with a generalized hearing range from 50 Hz to 86 kHz or OW with a generalized hearing range from 60 Hz to 39 kHz. Commercial ships radiate noise underwater with peak spectral power at 20–200 Hz (Ross 1976). The dominant noise source is usually propeller cavitation which has peak power near 50–150 Hz (at blade rates and their harmonics), but also radiates broadband power at higher frequencies, at least up to 100,000 Hz (Arveson and Vendittis 2000; Gray and Greeley 1980; Ross 1976). While propeller singing is caused by blades resonating at vortex shedding frequencies and emits strong tones between 100 and 1,000 Hz, propulsion noise is caused by shafts, gears, engines, and other machinery and has peak power below 50 Hz (Richardson et al. 1995). Overall, larger vessels generate more noise at low frequencies (<1,000 Hz) because of their relatively high power, deep draft, and slower turning (<250 rotations per minute) engines and propellers (Richardson et al. 1995). It is expected that vessels associated with the Proposed Action, similar to other ships in the area, would also contribute to ambient levels of sound in the proposed action area, but are not expected to change current ambient sound levels.

The effect to marine mammals from masking is expected to be temporary due to the Coast Guard's SOPs. Odontocetes and pinnipeds are not expected to be affected by the low-frequency noise produced by ships because the noise produced is outside of the typical hearing range for odontocetes and pinnipeds. However, Veirs et al.

(2016) noted that median received spectrum levels of noise from 2,809 isolated transits were elevated relative to median background levels including high frequencies (5-13 dB from 10,000 to 96,000 Hz). Thus, noise received from ships at ranges less than 3 km extends to frequencies used by odontocetes. As these ships enter shallow waters and traverse the estuarine habitat typically occupied by major ports, the noise they radiate may impact coastal marine life. In addition, the Coast Guard vessels would not purposefully approach marine mammals and noise generated by these vessels are not expected to elicit significant behavioral responses. Such reactions are not expected to significantly disrupt behavioral patterns such as migration, breathing, nursing, breeding, feeding and sheltering to a point where the behavior pattern is abandoned or significantly altered or result in reasonably foreseeable takes of marine mammals.

4.1.1.5.4 Essential Fish Habitat

Vessel noise could impact or harm EFH due to the temporary increase in ambient sound level during the transmissions. It is expected that vessels associated with the Proposed Action, similar to other ships in the area, would also contribute to ambient levels of sound in the proposed action area, but are not expected to change current ambient sound levels overall. However, this potential reduction in the quality of the acoustic habitat would be localized to the area of the Proposed Action and temporary in duration, due to the movement of the vessels throughout the proposed action area. The quality of the water column environment as EFH would be restored to normal levels immediately following the departure of vessels.

4.1.2 Aircraft Noise

The primary aircraft expected to be used during the Proposed Action are the MH-60 Jayhawk helicopter and C-130J Hercules; however, the Coast Guard may also use unmanned air vehicles (UAVs) in place of the helicopter.

The MH-60 Jayhawk is an all-weather, medium-range helicopter (specialized for search and rescue). Helicopter flights associated with the Proposed Action would occur in both the Arctic and Antarctic proposed action areas and would be used for transport of personnel and equipment and for conducting training (e.g., qualifications). The C-130J provides heavy air transport and long-range maritime patrol capability and is capable of serving as an on-scene command and control platform or as a surveillance platform with the means to detect, classify and identify objects and share that information with operational forces. The C-130J airplanes associated with the Proposed Action would serve in a non-emergency situation to locate, identify, and assist vessels and persons in distress in the Arctic Region.

Aircraft would not operate at an altitude lower than 1,500 ft (457 m) within 0.5 mi (805 m) of marine mammals observed on ice or land. Helicopters would also not hover or circle above such areas. Aircraft would avoid any identified environmentally sensitive areas, to include, but not be limited to, critical habitat designated under the ESA, and marine mammal haulouts and rookeries, but if deemed necessary (e.g., personnel safety) to pass over such areas, aircraft would stay above 3,000 ft (914 m).

Search and Rescue air searches for persons in the water or a vessel in distress, may require that the helicopter fly at an altitude below 500 ft (152 m). Emergency recovery of persons in the water and transfer of rescue equipment would also require that the helicopter hover below 500 ft (152 m). Any Coast Guard response during a SAR mission is considered an emergency and is not a part of the Proposed Action. However, normal operations and training for a SAR is part of the Proposed Action. As stated previously, environmentally sensitive areas would be avoided, and flights would be expected to stay above 1,500 ft. Any SAR training that may require helicopters to fly below 1,500 ft, would avoid environmentally sensitive areas and areas where ESA-listed species are known to occur due to the Coast Guard's SOPs (Section 2).

Helicopters produce low-frequency sound and vibration (Pepper et al. 2003; Richardson et al. 1995). Noise generated from helicopters is transient in nature and variable in intensity. Helicopter sounds contain dominant tones from the rotors that are generally below 500 Hz. MH-60 noise levels at the helicopter average approximately 136 dB re 20 μPa in air with frequencies between 20 Hz and 5 kHz. More low frequency components (<1 kHz) are contained in this broad band signal primarily from rotor noise (i.e., helicopter blade rotation).

Helicopters often radiate more sound forward than aft. Sound levels generated by UAVs have not been well-documented. However, two multi-rotor UAVs were measured to produce broad-band in-air source levels of 80 decibels referenced at 20 μPa with frequencies centered at 60 to 150 Hz. When flying at altitudes of 16 to 33 ft (5 to 10 m) above the water's surface, the received levels of these UAVs were considered to be close to ambient noise levels in many shallow water habitats and below the hearing thresholds of most marine mammals (Christiansen et al., 2016). A fixed-wing UAV is expected to be quieter than quadcopters and would operate at a minimum altitude of 3,000 ft (914 m) above the water's surface. Similar to helicopters, UAVs would avoid any identified environmentally sensitive areas, to include, but not be limited to, critical habitat designated under the ESA, and marine mammal haulouts and rookeries.

4.1.2.1.1 In Air

Most of the acoustic energy from an aircraft arrives through a relatively narrow cone extending vertically downward from the aircraft (Figure 4-1) (Eller and Cavanagh 2000; Richardson et al. 1995). This cone creates a "footprint" directly beneath the flight path, with the width of the footprint (at the water's surface) being a function of aircraft altitude. Furthermore, in air noise decreases with distance, with a decrease in sound level from any single noise source following the "inverse-square law." In other words, the Sound Pressure Level (SPL) changes in inverse proportion to the square of the distance from the sound source. Therefore, aircraft sound levels at the air-water interface (i.e., sea surface) are a function of how high above the surface the aircraft is flying or hovering. Thus, the higher the aircraft, the less sound reaches the sea surface (Eller and Cavanagh 2000; Richardson et al. 1995). Any sound produced by the UAV is expected to be less than that produced by the helicopter.

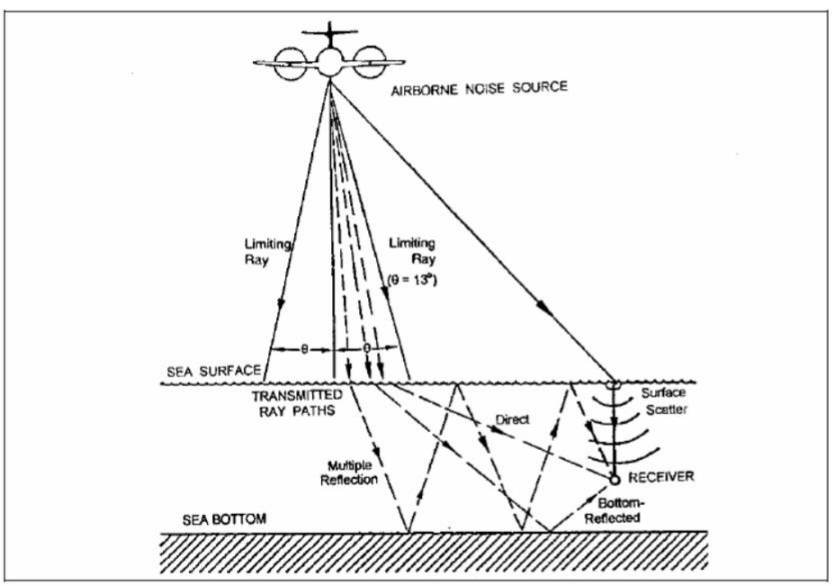

FIGURE 4-1. CHARACTERISTICS OF SOUND TRANSMISSION THROUGH THE AIR-WATER INTERFACE (RICHARDSON ET AL. 1995)

4.1.2.1.2 Sea Surface (Air-Water Interface)

As stated above, aircraft sound levels present at the air-water interface (i.e., sea surface) is a function of how high above the surface the aircraft is flying or hovering. Thus, the higher the aircraft, the less sound reaches the sea surface. Given in air transmission loss with distance via the previous discussion of the inverse-square law, it would be estimated that a 136 dB re 20 µPa helicopter source level at an altitude of 100 ft (30.5 m) would measure an SPL of approximately 106 dB re 20 µPa at the air-water interface (i.e., sea surface), while the same source level at 10 ft (3 m) would measure an SPL of approximately 126 dB re 20 µPa at the air-water interface. Aircraft associated with the Proposed Action would not operate at altitudes under 1,500 ft (457 m). Therefore, the received level estimated above would be significantly less than 106 dB re 20 µPa when measured at the surface if the helicopter were at an altitude of 1,500 ft (457 m). Any sound produced by the UAV is expected to be less than that produced by the helicopter.

4.1.2.1.3 In Water

Helicopter overflights produce airborne noise and some of this energy is transmitted into the water. Transmission of sound from a moving airborne source to a receptor underwater is influenced by numerous factors and has been addressed Urick (1983), Young (1973), Richardson et al. (1995), and Eller and Cavanagh (2000). Sound is transmitted from an airborne source to a receptor underwater by four principal means: (1) a direct path, refracted upon passing through the air-water interface; (2) direct-refracted paths reflected from the bottom in shallow water; (3) evanescent transmission in which sound travels laterally close to the water surface; and (4) scattering from interface roughness due to wave motion.

Aircraft sound is refracted upon transmission into water because sound waves move faster through water than through air (a ratio of about 0.23:1). Based on this difference, the direct sound path is reflected if the sound reaches the surface at an angle more than 13 degrees from vertical. As a result, most of the acoustic energy transmitted into the water from an aircraft arrives through a relatively narrow cone extending vertically downward from the aircraft.

Traveling beyond the sea surface, the sound values in air and in water are not directly comparable due to the reference units used and must be converted. The result is that sound waves with the same intensities in water and air have relative intensities that differ by 26 dB. This amount (26 dB) must be added to sound levels in air referenced to 20 µPa to obtain the sound level in water referenced to 1 µPa. In consideration of the air-water interface, another 6 dB would have to be added (doubling of pressure across interface), such that 26 dB + 6dB or 32 dB would have to be added to any in air value to estimate its corresponding in water transition value (ex., 100 dB re 20 µPa in air + 26 dB +6 dB= 132 dB re 1 µPa in water)

Therefore, for a helicopter at an altitude of 100 ft, the in-water sound just beneath the surface would be approximately 138 dB re 1 µPa. For a helicopter at 10 ft (30.5 m), the in-water sound just beneath the sea surface would be approximately 168 dB re 1 µPa. Helicopter sounds that do enter the water would be subject to further transmission loss with distance. The underwater noise produced is generally brief when compared with the duration of audibility in the air. Due to the relatively small area over which aircraft noise would radiate outward, the noise would be transient. Any sound produced by the UAV is expected to be less than that produced by the helicopter and would also be transient.

4.1.2.1.4 Under Ice

The inhomogeneous nature of sea ice does not necessarily allow for attenuation of noise from the air through an ice layer and into the water. When aircraft noise passes from air to water, there is a limiting ray of 13 degrees, where the noise will be reflected off the surface of the water instead of passing through (Richardson et al. 1995). At frequencies less than 500 Hz, the ice layer is acoustically thin and causes little attenuation of sound (Richardson et al. 1991). This implies that noise travelling through sea ice would only be slightly lower than that same noise travelling directly from the air to the water. It is expected that transmission of low-frequency sound through ice would be only slightly lower than that of low-transmission sound travelling directly from the air into the water (Richardson et al. 1995). Use of the air-water transmission model would provide slight overestimates of underwater sound levels from aircraft overflights, but this is the best model currently available to analyze airborne sound transmission through ice (Richardson et al. 1995).

If ice is present beneath aircraft operations, noise levels would be lowered by the time they reach the ice from an overhead flight and would still have to attenuate through the ice and the resulting underwater noise would be generally brief in nature. Any sound produced by the UAV is expected to be less than that produced by the helicopter. No effect to ESA-listed fish is expected from aircraft noise, as there is a lack of sufficient sound transmission across the air/water interface, to a depth where fish are expected, and the likelihood that ESA-listed species would be present in the proposed action area where overflights may occur is extremely low. The potential effect of aircraft noise to sea turtles and marine mammals is provided below.

4.1.2.1.5 Sea Turtles

Sea turtles may use sound for navigation, locating prey, avoiding predators, and general environmental awareness. However, they do not appear to use sound for communication. Piniak et al. (2012) notes that leatherback sea turtle hatchlings are able to detect sounds between 50 and 1600 Hz in air, with maximum sensitivity between 50 and 400 Hz (62 dB re: 20 μPa-rms at 300 Hz). This is within the range of sound typically produced by helicopters. Sea turtles may respond to both the physical presence and to the noise generated by the helicopter, particularly when it is flying at a low altitude and when they are directly underneath it.

4.1.2.1.6 Marine Mammals

Potential effects to species from aircraft could involve acoustic and non-acoustic effects and it is unclear if reactions are due to sound or the physical presence of the aircraft flying overhead. Aircraft noise would include noise generated by the MH-60 Jayhawk helicopter during flights associated with the Proposed Action and from the UAVs. Behavioral responses by marine mammals could include quick dives or turns, change in course, or flushing and stampeding from a haulout site. There are few well-documented studies of the effect of aircraft overflight over pinniped haulout sites or rookeries, and many of those that exist are specific to military activities (Efroymson et al. 2001). There are even fewer documented studies of the effect of aircraft overflights to marine mammals at the water's surface and for UAVs. Potential effects to marine mammals from aircraft noise may occur due to auditory fatigue, TTS, PTS, or behavioral reactions.

The reactions of cetaceans to aircraft noise are varied and often dependent on what the animal is doing at the time (e.g., migrating, feeding, mating, etc.). In general, a behavioral response by mysticetes could include a decrease in swim speed, change in direction of travel, or a cessation of feeding or mating in response to broadcast sounds. Mysticetes may exhibit various behavioral reactions to aircraft overflights such as diving underwater, slapping the water's surface with their flukes or flippers, or swimming away from the aircraft track (Richardson et al. 1995). Belugas, for example, may swim away, dive abruptly, look upwards, or turn sharply away from low altitude overflights (Richardson et al. 1995). They have also been recorded to have no visual behavioral reaction to aircraft flights within 100 to 200 m (Richardson et al. 1995).

Bowhead whales, however, react to overflight aircraft in various ways as well such as diving underwater, turning away from the aircraft, and dispersing away from the area exposed to the aircraft. Bowhead whales frequently reacted to a circling piston-engine aircraft at less than 1,000 ft (305 m) in altitude. Infrequent reactions occurred at 1,499 ft (457 m) of altitude and rare reactions occurred at greater than 2,001 ft (610 m) (Richardson et al. 1995). Reactions seem more pronounced when bowhead whales are in shallow water. Repeated overflights did not seem to displace many (if any) bowheads from feeding areas. Watkins and Moore (1983) found that, when below 492 ft (150 m) in altitude, some disturbance to right whales may occur. (Payne et al. 1983) saw rare reactions to a circling aircraft between 16 and 492 ft (5 and 150 m) in altitude. Bowheads appear to be more susceptible to aircraft overflights while resting and less so when actively feeding, mating, or socializing. Patenuade et al. (2002) observed 63 bowhead whale groups and 40 groups of beluga whales. Fourteen percent of bowhead whales and 38 percent of Beluga whales responded to the sound of a Bell 212 helicopter passing overhead repeatedly at an altitude of 492 ft (150 m) and a distance of 820 ft (250 m). Responses included short surfacing, immediate dives or turns, vigorous swimming, and breaching.

Meanwhile, gray whale reactions to aircraft are variable and mothers with calves seem to be particularly sensitive (Clarke et al. 1989; Ljungblad and Moore 1983). Malme et al. (1983; 1984) observed the behavioral reactions of gray whales from underwater playbacks of a Bell 212 helicopter and noted that there were changes to their swim speed and direction of travel. Clarke (1956) observed that some sperm whales showed no reaction to a helicopter at a low altitude unless they were in its downwash. At an altitude of 492–755 ft (150–230 m), some sperm whales remained at the surface while others dove immediately (Mullin et al. 1991). Therefore, as described above, behavioral reactions of cetaceans to aircraft noise associated with the Proposed Action are expected to be, at most, minor to moderate avoidance responses of a few animals, over short and intermittent periods.

Pinnipeds, more so than cetaceans, have the potential to be disturbed by both airborne and underwater noise generated by the engine of the aircraft (Born et al. 1999; Richardson et al. 1995) because they spend part of their life on land and not exclusively in the water. In 2004, researchers measured auditory fatigue to airborne sound in harbor seals, California sea lions, and northern elephant seals after exposure to non-pulse noise for 25 minutes (Holt et al. 2004; Kastak et al. 2004; Kastak et al. 2005). In the study, the harbor seal experienced approximately 6 dB of TTS at 99 dB re 20 μPa. The authors identified onset of TTS in the California sea lion at 122 dB re 20 μPa. The northern elephant seal experienced TTS-onset at 121 dB re 20 μPa (Kastak et al. 2004). There is a dearth of information on acoustic effects of helicopter overflights on pinniped hearing and communication (Richardson et al. 1995) and to the Coast Guard's knowledge, there has been no specific documentation of TTS or PTS in free-ranging pinnipeds exposed to helicopter operations during realistic field conditions. Therefore, as described above, physical effects to pinnipeds from aircraft noise associated with the Proposed Action are not expected. While noise from aircraft would not be expected to cause direct physical effects, aircraft noise has the potential to affect behavior.

Behaviorally, reactions of hauled out pinnipeds to aircraft flying overhead, such as looking up at the aircraft, moving on the ice or land, entering a breathing hole or crack in the ice, or entering the water have been observed (Blackwell et al. 2004; Born et al. 1999). Reactions depend on several factors, including the animal's behavioral state, activity, group size, habitat, age or experience, and the flight pattern of the aircraft (Richardson et al. 1995). Spotted seals hauled out on sea ice react at considerable distances to aircraft by moving swiftly across ice floes and diving off into the water (Richardson et al. 1995). Spotted seals on beaches move into the water when a survey aircraft flies over at altitudes up to 305 to 760 m or more and at lateral distances up to 1 km. This fleeing behavior persists despite frequent exposure to aircraft overflights, but the seals return to their haul out sites shortly after exposure (Richardson et al. 1995). Reactions to helicopter disturbance are difficult to predict, though helicopters have been recorded to elicit a stronger behavioral response (e.g., diving, increase in surfacing) by bearded and ringed seals (Born et al. 1999). Observations of ringed seals within the water column showed some ringed seals surfaced 66–98 ft (20–30 m) from the edge of an ice pan only a few minutes after a helicopter had landed and shut down near the ice edge (Richardson et al. 1995). Additionally, a study found that wind chill was also a factor in level of response of ringed seals hauled out on ice (higher wind chill increases probability of leaving the ice), as well as time of day and relative wind direction (Born et al. 1999). Overall, there has been no indication that single or occasional aircraft flying above pinnipeds in water cause long term displacement of these animals (Richardson et al. 1995). The Lowest Observed Adverse Effects Levels are rather variable for pinnipeds on land, ranging from just over 492 ft (150 m) to about 6,563 ft (2,000 m) (Efroymson et al. 2001). A conservative (90th percentile) distance effects level is 3,773 ft (1,150 m). Most thresholds represent movement away from the overflight. Bowles and Stewart (1980) estimated a Lowest Observed Adverse Effects Level of 1,000 ft (305 m) for helicopters (low and landing) in California sea lions and harbor seals observed on San Miguel Island, CA; animals responded to some degree by moving within the haulout and entering into the water, stampeding into the water, or clearing the haulout completely. Both species always responded with the raising of their heads. California sea lions appeared to react more to the visual cue of the helicopter than the noise. Coast Guard aircraft would maintain a minimum altitude of 1,500 ft (457 m) (Appendix B). Aircraft would also stay at or above 3,000 ft (914 m) within an environmentally sensitive area in order to avoid disturbances.

As a case for reference, in 2008, NMFS issued an Authorization to the USFWS for the take of small numbers of Steller sea lions and Pacific harbor seals, incidental to rodent eradication activities on an islet offshore of Rat Island, AK (USFWS 2009). This rodent eradication would be conducted by helicopter; the 15-minute aerial treatment consisted of the helicopter slowly approaching the islet at an elevation of over 1,000 ft (304.8 m), gradually decreasing altitude in slow circles, and applying the rodenticide in a single pass then returning to Rat Island. The gradual and deliberate approach to the islet resulted in the sea lions present initially becoming aware of the helicopter and calmly moving into the water. Further, the USFWS reported that all responses fell well within the range of Level B harassment, as defined under the MMPA, (i.e., limited, short-term displacement resulting from aircraft noise due to helicopter overflights) (USFWS 2009).

As a general statement from the available information, pinnipeds exposed to intense (approximately 110 to 120 dB re 20 μPa) non-pulse sounds often leave haulout areas and seek refuge temporarily (minutes to a few hours) in the water (Southall et al. 2007). Per Richardson et al. (1995), approaching aircraft generally flush animals into the water and noise from a helicopter is typically directed down in a ‘‘cone’’ underneath the aircraft. In these cases, the helicopter was deliberately approaching areas where pinnipeds were expected. The Coast Guard would not approach known areas where pinnipeds are expected, therefore, no impacts to pinnipeds are expected as a result of proposed action’s activities.

Behavioral reactions of ringed seals to aircraft have been recorded. Ringed seal pups are born in lairs from mid-March through April, and mothers nurse their pups in the lairs for 5 to 8 weeks (Hammill et al. 1991; Lydersen and Hammill 1993; Smith et al. 1973). Sea ice habitat that is suitable for the formation and maintenance of subnivean birth lairs (used for sheltering pups during whelping and nursing), is typically seasonal landfast (shorefast) ice, except for any bottom-fast ice extending seaward from the coastline in waters less than 2 m deep, or dense, stable pack ice that has undergone deformation and contains snowdrifts at least 54 centimeters deep. From mid-May through early June, ringed seals also frequently haulout on the exposed ice surface. Ringed seals were shown to leave their subnivean lairs and enter the water when a helicopter was at an altitude of less than 1,000 ft (305 m) and within 1.2 mi (2 km) lateral distance (Richardson et al. 1995). Ringed seal vocalizations in water were similar between areas subject to low-flying aircraft and areas that were less disturbed (Calvert and Stirling 1985). These data suggest that although a ringed seal may leave a subnivean lair (Burns et al. 1982), aircraft disturbance was temporary and did not cause the animals to leave the general area. Williams et al. (2006) investigated whether ringed seals use of breathing holes and lairs during winter and spring was affected by the construction and drilling on Northstar Island, built in the nearshore Alaskan Beaufort Sea, and determined that activities did not negatively affect the seals’ use of their lairs. Williams et al. (2006) further determined that given the turnover and creation of new structures (lairs) during the ice-covered season, it was unlikely that the loss of a breathing hole or resting structure over the course of the winter, from natural or anthropogenic causes, would significantly affect an individual seal. Structures used by ringed seals are not distributed randomly and are usually concentrated along pressure ridges, cracks, leads, or other surface deformations (Furgal et al. 1996; Hammill and Smith 1989; Lydersen and Smith 1989; Nichols 1999; Smith and Stirling 1975). It is expected that should the Coast Guard land on the ice with a helicopter during personnel transport, these landings would be considered extremely rare (e.g., emergency) and would not occur in the same location (e.g., consecutive repetitive landings in the same spot on the ice). Thus, effects from landing a helicopter on the ice would be short-term. Although lairs are often cryptic and likely difficult to identify from air, they are rarely occupied for long periods and as mentioned previously, ringed seals tend to use structures for shorter periods in areas of higher ice deformation. In all likelihood, most of the personnel transport to any ice location would occur outside of the pupping season, so effects to ringed seals associated with lairs would be extremely low. In addition, the Coast Guard would follow SOPs (Appendix B) to avoid effects to hauled out pinnipeds. Therefore, the Coast Guard does not anticipate any effect from aircraft activities to ringed seals in subnivean lairs during the Proposed Action.

Coast Guard aircraft would support the recovery of protected living marine resources through internal compliance with laws designed to preserve marine protected species, including planning passage around marine sanctuaries, such as federally-designated critical habitat. These actions would minimize the effect of aircraft noise to marine mammals and federally designated critical habitat. As stated in the Coast Guard SOPs in Appendix B, the Coast Guard expects to avoid any aircraft close approaches of marine mammals in the water or any known haulout areas that may be within the proposed action area. The Coast Guard would post PSOs and train crew members so that when a marine mammal is sighted, the bridge or pilot would be alerted, so avoidance measures can be taken. Weather conditions are often a factor in the proposed action area and therefore, an unexpected situation could occur where a helicopter needs to divert from its planned route, or the helicopter needs to fly lower than originally anticipated. The Coast Guard would continue to post PSOs to sight marine mammals, although sighting conditions may be compromised due to the weather conditions and could alter a PSO’s ability to detect marine mammals. As long as navigational safety is not compromised, the Coast Guard would follow SOPs to avoid marine mammals. If an unexpected (emergency) situation with regard to flight patterns and weather occurs, and in the unlikely event that pinnipeds are hauled out in area that is not a known haulout site or rookery that is actively being avoided, it is possible that a low-flying helicopter could cause some disturbance to an unknown number of pinnipeds. While the number of pinnipeds is unknown, it is assumed that the total number would be considerably less than what would be expected at a known rookery or haulout site. The initial helicopter approach to these hauled out animals could cause a subset, or all of the marine mammals hauled out, to depart and move into the water. Thus, some animals may be temporarily displaced from the haulout and either raft in the water, relocate to other haulouts, or immediately return to the haulout where they were just displaced. The likelihood of the temporary presence of Coast Guard assets in one area due to unplanned events caused by weather is extremely rare. Therefore, the long-term effect of Proposed Action’s activities on hauled out animals is expected to be negligible because any response is expected to be temporary and any animal that did exhibit a behavioral response would be expected to return to its normal behavior once the stimulus is gone. There would be no effect to breeding, feeding, migrating, or sheltering and thus, to the health and fitness of that individual(s). In the unlikely event that a Coast Guard aircraft diverted from its planned course and may have impacted pinniped(s), the Coast Guard would immediately notify NMFS as soon as possible regarding this event.

Any noise generated by the UAV is expected to be minimal and below the hearing threshold of marine mammals, both in-air and under-water (where noise would attenuate even further).

4.1.2.1.7 Marine Birds

Altitudes at which migrating birds fly can vary greatly based on the type of bird, where they are flying (over water or over land), and other factors such as weather. Approximately 95 percent of bird flight during migrations occurs below 42,808 ft (3,048 m) with the majority below 2,999 ft (914 m) (Lincoln et al. 1998). The ESA-listed marine bird species that may be encountered during the proposed overflights tend to fly directly above sea level to about 328 ft (100 m) above sea level. In a Day et al. (2004) study done near Utqiagvik (Barrow), Eiders had a mean flight altitude of 40.0 ± 2.6 ft (12.1 ± 0.8 m) above ground or sea level. Short-tailed albatross have been recorded at altitudes between 13 and 26 ft (4 and 8 m) (Pennycuick 1982). Helicopters associated with the Proposed Action are taking off and landing either at sea or from an existing airstrip.

While marine birds may fly below the altitude of helicopter flights associated with the Proposed Action, if a bird is close to an intense sound source, it could suffer auditory fatigue or a threshold shift. Studies have examined hearing loss and recovery in only a few species of birds, and none studied hearing loss in marine birds (Hashino et al. 1988; Ryals et al. 1999; Ryals et al. 1995; Saunders et al. 1974). A bird may experience PTS if exposed to a continuous sound pressure level over 110 dBA re 20 µPa in air. Continuous noise exposure at levels above 90 to 95 dBA re 20 µPa can cause TTS (Dooling and Therrien 2012). Unlike many other species, birds have the ability to regenerate hair cells in the ear, usually resulting in considerable anatomical, physiological, and behavioral recovery within several weeks. Still, intense exposures are not always fully recoverable, even over periods up to a year after exposure, and damage and subsequent recovery vary significantly by species (Ryals et al. 1999). Birds may be able to protect themselves against damage from sustained sound exposures by regulating inner ear pressure, an ability that may protect ears while in flight (Ryals et al. 1999).

Chronic stress due to disturbance may compromise the general health and reproductive success of birds (Kight et al. 2012), but a physiological stress response is not necessarily indicative of negative consequences to individual birds or to populations (Bowles et al. 1991; National Parks Service 1994). It is possible that individuals would return to normal almost immediately after exposure, and the individual’s metabolism and energy budget would not be affected long-term. Studies have also shown that birds can habituate to noise following frequent exposure and cease to respond behaviorally to the noise (Larkin et al. 1996; National Parks Service 1994). However, the likelihood of habituation is dependent upon a number of factors, including species of bird (Bowles et al. 1991), and frequency of and proximity to exposure. A study by Komenda-Zehnder et al. (2003) examined the stressed behavioral shifts during aircraft overflights at different altitudes. They observed that flights operating at lower altitudes elicited a greater behavioral response, and that larger, slower moving aircraft also lead to greater stressed response. However, this study also concluded that the stressed behaviors exhibited were decreased to a normal level around five minutes after the overflight occurred; thus the behavioral responses were temporary.

Responses by birds to helicopter overflights include flying, swimming, and displaying alert behaviors (Conomy et al. 1998; Ward et al. 1999). Even if a behavioral response is not observed, studies have shown that birds physiologically may be affected based on increased heart rates during aircraft overflights (Wooley Jr. and Owen Jr. 1978). However, an occasional startle or alert reaction to aircraft is not likely to disrupt major behavior patterns (such as migrating) or to result in serious injury to any marine bird (U.S. Navy 2011).

Coast Guard aircraft would follow SOPs and BMPs (as outlined in Section 2) to minimize the impact or harm of the Proposed Action. Specifically, Coast Guard vessels would support the recovery of protected living marine resources through internal compliance with laws designed to preserve protected species, including ESA-listed marine birds, marine birds protected by the MBTA, and federally-designated critical habitat for marine bird species.

4.1.3 SOCIOECONOMIC RESOURCES

Section 4.1.1 and Section 4.1.2 have determined that there is no impact to marine birds, fish, EFH, or marine mammals as a result of acoustic transmissions associated with the Proposed Action. As socioeconomic resources in this region (Section 3.3) consist of commercial and recreational fishing resources, shipping, tourism, and subsistence resources, no negative impact is expected to socioeconomic resources as a result of the Proposed Action. Additionally, the Proposed Action would discourage illegal activity from occurring at sea within the proposed action area and enforce regulations set forth by NMFS and the USFWS. Because the Proposed Action would provide a Coast Guard presence in the case of an emergency to the community at sea, the Coast Guard would have a positive impact on fishing, shipping and tourism within the proposed action area. Outreach and educational programs conducted for the communities within the proposed action area would also be beneficial. In regards to subsistence resources, as stated in the SOPs and BMPs (Chapter 6), all Coast Guard vessels will avoid areas of active or anticipated subsistence hunting activities (for species such as whale, walrus, bird, seal, caribou, muskox, moose, sheep, and bear) as determined through community engagement and information. Coast Guard will also coordinate with tribal representatives about planned hunts. Thus, in accordance with NEPA, acoustic transmissions from the Proposed Action are not likely to significantly impact socioeconomic resources.

4.2 PHYSICAL STRESSORS

Potential effects on ESA-listed species considered in this analysis include vessel strikes, aircraft strikes, auditory or visual disturbance, entanglement, pollutants and discharges, and cumulative effects.

4.2.1 VESSEL STRIKE

Marine species within the proposed action areas may be exposed to vessel movement associated with Coast Guard assets during the Proposed Action. It is difficult to differentiate between behavioral responses to vessel sound and visual cues associated with the presence of a vessel (Hazel et al. 2007); thus, it is assumed both could play a role in prompting reactions from animals. Vessels have the potential to affect ESA-listed species by altering their behavior patterns or causing mortality or serious injury from collisions. Reactions to vessels often include changes in general activity (e.g., from resting or feeding to active avoidance), changes in surfacing-respiration-dive cycles (marine mammals), and changes in speed and direction of movement. Past experiences of the animals with vessels are important in determining the degree and type of response elicited from an animal-vessel encounter. Some species have been noted to tolerate slow-moving vessels within several hundred meters, especially when the vessel is not directed toward the animal and when there are no sudden changes in direction or engine speed (Richardson et al. 1995).

Interactions between surface vessels and marine mammals have demonstrated that surface vessels represent a source of acute and chronic disturbance for marine mammals (Au and Green 2000; Bejder et al. 2006; Hewitt 1985; Jefferson et al. 2009; Kraus et al. 1986; Magalhães et al. 2002; Nowacek et al. 2004; Richter et al. 2008; Richter et al. 2003a; Williams et al. 2009). In some circumstances, marine mammals respond to vessels with the same behavioral repertoire and tactics they employ when they encounter predators, although it is not clear what environmental cues marine mammals might respond to–the sound of water being displaced by the ships, the sound of the ships' engines, or a combination of environmental cues surface vessels produce while they transit.

Vessel collisions are a well-known source of mortality in marine mammals and can be a significant factor affecting some large whale populations (Berman-Kowalewski et al. 2010; Jensen and Silber 2003; Knowlton and Kraus 2001; Laist et al. 2001; Neilson et al. 2012; Redfern et al. 2013; Van Waerebeek et al. 2007; Vanderlaan et al. 2009; Vanderlaan et al. 2008). During a review of data on the subject, Laist et al. (2001) compiled historical records of ship strikes, which contained 58 anecdotal accounts. It was noted that in the majority of cases, the whale was either not observed or seen too late to maneuver in an attempt to avoid collision. The most vulnerable marine mammals to collision are thought to be those that spend extended periods at the surface or species whose unresponsiveness to vessel sound makes them more susceptible to vessel collisions (Gerstein 2002; Laist and Shaw 2006; Nowacek et al. 2004).

Vessels transiting the marine environment have the potential to collide with, or strike, marine mammals (Laist et al. 2001, Jensen and Silber 2003). Vessel collisions with marine mammals can either result in blunt-force impacts from contact of the animal with some non-rotating component of the vessel, or sharp-force injuries from a chopping or cutting wound typically resulting from contact of the animal with the propeller or skeg of a vessel (Moore et al. 2013). The probability of strike events depends on the frequency, speed, and route of the marine vessels, as well as distribution of marine mammals in the area. Large whales are especially susceptible to ship strike injury and mortality in narrow bottleneck passages (Williams and O'Hara 2010). Laist et al. (2001) noted that most severe and fatal injuries to marine mammals occurred when the vessel was traveling in excess of 14 kn (16 miles per hour [mph]; 26 kilometers per hour [km/hr]); meanwhile Vanderlaan and Taggart (2007) found that the greatest risk of a lethal strike was when the vessel reached speeds of 8.6 to 15 kn (10 mph; 16 km/hr). However, while slow speed does decrease the chance of a fatal collision, it will not eliminate the chance that a collision results in serious injury or mortality. Vanderlaan and Taggart (2007) concluded that at speeds below 8 kn (9 mph; 15 km/hr), there was still a 20 percent risk of death from blunt trauma. It is likely that small support boats would travel at or below a speed of 15 kn (17 mph; 28 km/hr).

Vessel strike of large, endangered whales in Alaska is a great concern, particularly for eastern North Pacific right whales. Large numbers of cargo, fishing, cruise, and other ships transit the action area each year, and strikes occur through these waters. From 2012 to 2016 there were 31 incidents of vessel strike reported in the NMFS Alaska Region stranding database. While this averages to just over six strikes reported a year, 2012 saw 10 reported strikes. From 1978-2011, 108 whale-vessel collisions were reported within 200 miles of Alaska’s coastline (Neilson et al. 2012). Most of these (86%) were humpback whales, and most of the collisions occurred in Southeast Alaska. Other species included fin whale, gray whale, and sperm whale (Neilson et al. 2012).

Several vessel strikes resulting in mortality to large whales in the action area in recent years have been well documented; two strikes to large whales by the Alaska Marine Highway System ships near Kodiak, and one strike to a sperm whale by a USCG cutter in Samalga Pass in the Aleutian Islands. The USCG cutter that struck the sperm whale was not engaged in Arctic Shield activities, and vessels engaged in previous Arctic Shield activities have not reported vessel collisions with whales. While vessel strike is a potential stressor, the likelihood of an Arctic Shield vessel striking a whale is relatively small. Mitigation measures such as avoidance of whales and slowing of vessels when whales are sighted will further reduce the likelihood of a vessel engaged in Arctic Shield activities striking a whale.

Marine mammals such as dolphins, porpoises, and pinnipeds do not appear to be as susceptible to vessel strikes as large whales are, though the risk of a strike still exists for these species. Since 1998, the Coast Guard has reported 12 collisions with whales in the waters of the U.S. EEZ. In the past ten years (2006-2016 and into 2017), Coast Guard vessels have reported eight collisions with whales in the waters of the U.S. EEZ. Specifically in the proposed action area off the U.S. West Coast (California to Alaska), collisions with seven whales were reported during that same period. However, none of these strikes were due to Coast Guard icebreaker or similar class vessels, even though several Coast Guard icebreakers have been operating in the action area for roughly half a century. The Coast Guard has also improved watchstander training, placing an emphasis on marine protected species awareness. The improved training would likely decrease marine-mammal-vessel strike probabilities from historic data. Included in this estimate was a collision with a sperm whale in 2017 near Samalga Pass, Alaska

(NMFS Marine Mammal Health and Stranding Database5). As a federal agency and co-investigator with NMFS, the Coast Guard is required to report all whale strikes to NMFS.

Few authors have specifically described the responses of pinnipeds to vessels, and most of the available information on reactions to boats concerns pinnipeds hauled out on land or ice. Brueggeman et al. (1992) stated ringed seals hauled out on the ice showed short-term escape reactions when they were within 820 to 1640 ft (0.25 to 0.5 km) of a vessel. From the limited data available, it appears that pinnipeds are not as susceptible to vessel strikes as other marine mammal species. This may be due, at least in part, to the large amount of time they spend on land or ice (especially when resting and breeding) and their high maneuverability in the water. However, pinniped carcasses do not typically wash up in an area where they can be reported to the local stranding network, or a necropsy is unable to be performed to determine cause of death, so incidents of reporting a vessel strike as cause of death are low.

Although risk of vessel strike has not been identified as a significant concern for Steller sea lions (Loughlin and York 2000), the Recovery Plan for this species states that Steller sea lions may be more susceptible to ship strike mortality or injury in harbors or in areas where animals are concentrated (e.g., near rookeries or haulouts) (NMFS 2008). From 2000 to June 2018, there have been at least five vessel strikes of Steller sea lions in Alaska reported to the NMFS Alaska Region Stranding Database. We anticipate that the risk of vessel strike to ringed and bearded seals is relatively similar to Steller sea lions.

Boat strike is considered a recurring potential cause of mortality and serious injury across all three stocks of northern sea otter (Burek Huntington et al. 2021). In Kachemak Bay, boat strikes have been the most commonly encountered human-inflicted injury (Burek Huntington et al. 2021). Necropsies of boat-struck sea otters have revealed that although trauma was the ultimate cause of death, disease or biotoxin exposure likely incapacitated the animal and made it more vulnerable to boat strike (Lefebvre et al. 2016, Burek Huntington et al. 2021).

Although strikes to marine mammals are regularly reported, the number that are fatal to listed species in Alaska appears to be low. There is no clear evidence that vessel strikes are having a population level impact on the listed marine mammal species considered, and no evidence that vessel strike is a stressor to salmonids. In addition, the mitigation measures included in the standard operating procedures of Arctic Shield make a ship strike extremely unlikely. Therefore, effects from ship strikes as a result of implementing the proposed action are discountable.

4.2.2 AIRCRAFT STRIKE

The aircraft utilized during the Proposed Action would be the MH-60 Jayhawk helicopter and the C-130J Long Range Surveillance Aircraft. Normal cruising speed of the MH-60 Jayhawk is 135 to 140 kn (155 to 161 mph; 249 to 259 km/hr) and the aircraft is capable of reaching 180 kn (207 mph; 333 km/hr) for short durations. Normal cruising speed of the C-130J is 320 kn (approximately 368 mph; 593 km/hr).

Helicopter flights associated with the Proposed Action would be used for transport of personnel and equipment and for conducting training (e.g., qualifications). In general, flights can occur at 400–1,500 ft (122–457 m) in altitude, but typically aircraft stay at or above 1,000 ft (305 m), when possible. Air searches for persons in the water must be performed at an altitude below 500 ft (152 m) to be effective. Recovering persons in the water and dropping rescue equipment must also be done while the helicopter is hovering below 500 ft (152 m). While the location of a SAR mission is unknown, Coast Guard personnel will avoid biological resources to the best of their ability providing navigational safety is not compromised. As the Coast Guard does not expect to land on the ice with a helicopter during Arctic Shield 2017, only marine birds could potentially be exposed, and therefore struck by, a helicopter.

The C-130J provides heavy air transport and long-range maritime patrol capability and is capable of serving as an on-scene command and control platform or as a surveillance platform with the means to detect, classify and identify objects and share that information with operational forces. C-130J airplanes associated with the Proposed Action would serve in a non-emergency situation to locate, identify, and assist vessels and persons in distress in the Arctic Region. C-130J airplanes would be used to conduct up to two routine patrol/arctic domain awareness/logistics support flights each month for a total of up to 10 flights each year. While operating the C-130J, Coast Guard personnel will avoid biological resources to the best of their ability providing navigational safety is not compromised.

The potential for aircraft strike is dependent upon the type of aircraft, altitude of flight, and speed of travel. The majority of bird flight is below 2,999 ft (914 m) and approximately 95 percent of bird flight during migration occurs below 10,000 ft (3,048 m) (U.S. Department of the Interior 2006). As stated in Section 4.1.3.1, marine birds in the proposed action area prefer flight altitudes just at the water's surface to 328 ft (100 m), but can be found as high as 19, 685 ft (6,000 m) above the surface. Bird and aircraft encounters are more likely to occur during aircraft takeoffs and landings than when the aircraft is engaged in level, low-altitude flight.

Approximately 97 percent of aircraft-wildlife collisions occur at or near airports when aircraft are operating at or below 1, 969 ft (600 m). In a study that examined 38,961 bird and aircraft collisions, Dobson (2010) found that the majority (74 percent) of collisions occurred below 492 ft (150 m). Bird strike potential is greatest in foraging or resting areas, in migration corridors, and at low altitudes. About 90 percent of wildlife/aircraft collisions involve large birds or large flocks of smaller birds (Federal Aviation Administration 2003), and more than 70 percent involve gulls, waterfowl, or raptors. From 2000 to 2009, the Navy Bird Aircraft Strike Hazard program recorded 5,436 bird strikes with the majority occurring during the fall period from September to November. Though bird strikes can occur anywhere aircraft are operated, this data indicate they occur more often over land or close to shore.

Strike of an aircraft associated with the Proposed Action with a marine bird is possible, though not likely. Although marine birds are likely to hear and see approaching aircraft, they are unlikely to avoid all collisions. Birds are known to be attracted to aircraft lights, which can lead to collisions (Gehring et al. 2009; Poot et al. 2008). Coast Guard aircraft would not participate in flight near large groups of birds as this may endanger both their aircraft and protected species. Coast Guard aircraft would follow SOPs and BMPs (as outlined in Chapter 6) to minimize the impact or harm of the Proposed Action. In this context, the loss of a large number of birds due to aircraft movement is unlikely. The loss of several or even dozens of birds due to physical strikes may not constitute a population-level impact. Some bird strikes and associated bird mortalities or injuries could occur as a result of aircraft use; however, population-level impact or harm to marine birds would not likely result from aircraft strikes due to the limited time of operation, the potential flight response of marine birds to in-air noise and general aerial disturbance, and that marine birds are not likely to approach the helicopter.

Marine bird presence in the proposed action area during the Proposed Action would be mainly those individuals feeding offshore in open waters. Large flocks of marine birds are not anticipated to cross through the proposed action area during the timeframe of the Proposed Action, and therefore the potential for strike with an aircraft would be limited to a small number of individuals. Coast Guard aircraft would follow SOPs and BMPs (as outlined in Chapter 6) to minimize the impact or harm of the Proposed Action. Specifically, Coast Guard aircraft would support the recovery of protected living marine resources through internal compliance with laws designed to preserve protected species, including ESA-listed marine birds, marine birds protected by the MBTA, and federally-designated critical habitat for marine bird species.

Although unlikely, aircraft strike with an individual marine bird is possible. However, pursuant to the MBTA, aircraft movement associated with the Proposed Action would not result in a significant adverse effect on migratory bird populations. In accordance with NEPA, aircraft movement associated with the Proposed Action would not result in significant impacts to marine birds. In accordance with E.O. 12114, aircraft movement associated with the Proposed Action would not result in significant harm to marine birds. Under the ESA, aircraft strike associated with the Proposed Action may affect, but is not likely to adversely affect the ESA-listed short-tailed albatross, spectacled eider, or Steller's eider. The Proposed Action would not result in the destruction or adverse modification of federally-designated critical habitat for spectacled or Steller's eider.

4.2.3 ENTANGLEMENT

Entanglement of pinnipeds and cetaceans in fishing gear and other human-made material is a significant threat to their survival worldwide. Other materials also pose entanglement risks including marine debris, mooring lines, anchor lines, and underwater cables. While in many instances, marine mammals may be able to disentangle themselves (Neilson et al. 2009), other entanglements result in lethal and sublethal trauma to marine mammals including drowning, injury, reduced foraging, reduced fitness, and increased energy expenditure (van der Hoop et al. 2016, van der Hoop et al. 2017). Entangled marine mammals may drown or starve due to being restricted by gear, suffer physical trauma and systemic infections, and/or be hit by vessels due to an inability to avoid them. Entanglement can include many different gear interaction scenarios, but the following have occurred with listed species covered in this analysis:

- Ingestion of gear and/or hooks can cause serious injury depending on whether the gear works its way into the gastrointestinal (GI) tract, whether the gear penetrates the GI lining, and the location of the hooking (e.g., embedded in the animal's stomach or other internal body parts) (Andersen et al. 2008).
- Gear loosely wrapped around the marine mammal's body that moves or shifts freely with the marine mammal's movement and does not indent the skin can result in disfigurement.
- Gear that encircles any body part and has sufficient tension to either indent the skin or to not shift with marine mammal's movement can cause lacerations, partial or complete fin amputation, organ damage, or muscle damage and interfere with mobility, feeding, and breathing. Chronic tissue damage from line under pressure can compromise a whale's physiology. Fecal samples from entangled whales had extremely high levels of cortisols (Hunt et al. 2006), an immune system hormone. Extended periods of pituitary release of cortisols can exhaust the immune system, making a whale susceptible to disease and infection.

The NMFS Alaska Marine Mammal Stranding Network database has records of 199 large whale entanglements between 1990 and 2016. Of these, 67% were humpback whales. Gray, beluga, bowhead, fin, and sperm whales have also been reported as entangled in Alaska waters over the past decade. Most humpbacks get entangled with gear between the beginning of June and the beginning of September, when they are on their nearshore foraging grounds in Alaska waters. Between 1990 and 2016, 29% of humpback entanglements were with pot gear and 37% with gillnet gear. Entanglement of pinnipeds in marine debris is common worldwide, and as of 1997, 79% or Otariid species (sea lions) and 42% of Phocid species (seals) had been reported entangled (Laist 1997). The most common entanglement material was plastic packing bands and most entanglement materials appeared to originate from fishery activities.

4.2.4 POLLUTANTS AND DISCHARGES

While transport and storage of hydrocarbons or other hazardous materials is not part of the proposed action, aircraft and vessels operating as part of Arctic Shield will have fuel tanks laden with hydrocarbons, and other lubes and oils will be used. However, hazardous materials spills and other pollutants and discharges are not anticipated as part of the proposed action. While oil and other hazardous materials can be toxic to biological organisms, including fish and marine mammals, discharges are not an authorized or expected component of Arctic

Shield. NMFS conducted Section 7 consultation on the effects of response activities as directed by the Alaska Federal/State Preparedness Plan for Response to Oil & Hazardous Substance Discharge/Releases (Unified Plan) (NMFS 2015b). Any emergency response necessary for incidental/accidental discharges from aircraft or marine vessels engaged in Arctic Shield operations would be subject to an emergency ESA Section 7 consultation as detailed in the Unified Plan Biological Opinion (NMFS 2015b).

In addition, the Unified Plan provides a detailed description of the potential effects of oil and other hazardous materials to marine mammals and fish exposed to a spill. We anticipate that no spills, or only very small accidental spills will occur incidental to Arctic Shield operations. Any adverse effects to listed species would be too small to detect or measure. We therefore conclude that any effects are insignificant.

4.2.5 Socioeconomic Resources

Section 4.2.1 through Section 4.2.4 determined that there may be effects to marine birds or marine mammals as a result of vessel noise associated with the Proposed Action, but these effects are not likely to adversely affect . marine birds or marine mammals

As socioeconomic resources in this region (see Section 3.3) consist of commercial and recreational fishing resources, shipping, tourism, and subsistence resources, no negative impact is expected to socioeconomic resources as a result of the Proposed Action. Additionally, the Proposed Action would discourage illegal activity from occurring at sea within the proposed action area and enforce regulations set forth by NMFS and the USFWS. Because the Proposed Action would provide a Coast Guard presence in the case of an emergency to the community at sea, the Coast Guard would have a positive impact on fishing, shipping, and tourism within the proposed action area. Outreach and educational programs conducted for the communities within the proposed action area would also be beneficial. In regard to subsistence resources, as stated in the SOPs and BMPs (Chapter 6) all Coast Guard aircraft will avoid areas of active or anticipated subsistence hunting activities (for species such as whale, walrus, bird, seal, caribou, muskox, moose, sheep, and bear) as determined through community engagement and information. Coast Guard will also coordinate with tribal representatives about planned hunts. Thus, in accordance with NEPA, aircraft movement from the Proposed Action is not likely to significantly impact socioeconomic resources.

CHAPTER 5 CUMULATIVE IMPACTS

This section 1) defines cumulative impacts, 2) describes past, present, and reasonably foreseeable future actions relevant to cumulative impacts, 3) analyzes the incremental interaction the Proposed Action may have with other actions, and 4) evaluates cumulative impacts potentially resulting from these interactions.

5.1 DEFINITION OF CUMULATIVE IMPACTS

The approach taken in the analysis of cumulative impacts follows the objectives of NEPA, CEQ regulations, and CEQ guidance. Cumulative impacts are defined in 40 CFR Section 1508.7. The CEQ regulations define cumulative impacts as the impacts on the environment that result from the incremental impacts of the action when added to the other past, present, and reasonably foreseeable future actions regardless of what group or agency (Federal or non-Federal) undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

To determine the scope of environmental impact statements, agencies shall consider cumulative actions, which when viewed with other proposed actions have cumulatively significant impacts and should therefore be discussed in the same impact statement. In addition, CEQ and the U.S. Environmental Protection Agency (USEPA) have published guidance addressing implementation of cumulative impact analyses—Guidance on the Consideration of Past Actions in Cumulative Effects Analysis (Council on Environmental Quality 2005) and Consideration of Cumulative Impacts in EPA Review of NEPA Documents (United States Environmental Protection Agency 1999). CEQ guidance entitled Considering Cumulative Impacts Under NEPA (1997) states that cumulative impact analyses should: "…determine the magnitude and significance of the environmental consequences of the proposed action in the context of the cumulative impacts of other past, present, and future actions...identify significant cumulative impacts…[and]…focus on truly meaningful impacts."

Cumulative impacts are most likely to arise when a relationship or synergism exists between a Proposed Action and other actions expected to occur in a similar location or during a similar time period. Actions overlapping with or in close proximity to the proposed action would be expected to have more potential for a relationship than those more geographically separated. Similarly, relatively concurrent actions would tend to offer a higher potential for cumulative impacts. To identify cumulative impacts, the analysis needs to address the following three fundamental questions:

- Does a relationship exist such that affected resource areas of the Proposed Action might interact with the affected resource areas of past, present, or reasonably foreseeable actions?
- If one or more of the affected resource areas of the Proposed Action and another action could be expected to interact, would the Proposed Action affect or be affected by impacts of the other action?
- If one or both of the above are true, then does an assessment reveal any potentially significant impacts not identified when the Proposed Action is considered alone?

5.2 CUMULATIVE IMPACTS ANALYSIS

This section focuses on past, present, and reasonably foreseeable future projects at and near the proposed action area outlined in Section 1.2. Multiple databases (i.e., the Naval Operations [OPNAV] 45 Environmental Library, the FR) and the websites of federal (e.g., United States [U.S.] Army Corps of Engineers, Federal Aviation Administration [FAA], U.S. Navy, United States Coast Guard [USCG]), state (e.g., Alaska Department of Transportation), local (e.g., City of Kotzebue), and private (e.g., oil rig operators) entities were used to collect information on these projects. Additionally, the cumulative impacts sections of prior NEPA documents (e.g., Ice Exercise 2018, Bureau of Ocean Energy Management [BOEM] Outer Continental Shelf Oil and Gas Leasing Proposed Final Program) were reviewed for actions that might intersect in time, space, or resource with Arctic

Shield 2024 activities. Only those projects that had a relationship with the Proposed Action (such that the affected resource areas of the Proposed Action might interact with the affected resource area of the project) were considered. If no such potential relationship exists, the project was not carried forward into the cumulative impacts analysis. In accordance with CEQ guidance (CEQ 2005), those actions considered but excluded from further cumulative effects analysis are not catalogued here as the intent is to focus on the meaningful actions relevant to decision-making.

Previous activities in the basin of the Beaufort Sea have been limited, primarily due to ice cover. The primary federal activity off the North Slope of Alaska is oil and gas exploration and extraction. BOEM has multiple projects in the region, utilizing large swaths of the federal waters and potential leasing sites for oil and gas developers. The BOEM Beaufort Sea Planning Area extends out to over 100 nm (185 km) from shore and into the proposed action area, though those areas related to oil and gas exploration are typically close to shore. The majority of the BOEM leasing sites used by Shell are in water depths of less than 100 ft (30.5 m) (USDOI 2013), which is likely of most other lease sites as well, due to their presence primarily on the Outer Continental Shelf. The Chukchi Sea is no less heavily used for oil and gas exploration and extraction, with federal lease sites extending out towards the U.S.-Russia Maritime Boundary. However, the Proposed Final Program for 2017-2022 Outer Continental Shelf Oil and Gas Leasing by BOEM has removed the Chukchi Sea and Beaufort Sea Programs due to ecological conditions, environmental risks, and recent changes in industry interest (BOEM 2016). Despite a temporary stay on drilling for oil in the Arctic (Executive Order 13754), oil and gas presence may increase over time as needs for fossil fuels continue to rise.

With decreasing first-year and multi-year ice, the Arctic is becoming increasingly accessible. After the Northwest Passage opened in 2007, it paved the way for an increase in maritime traffic through the region, including recent tourism cruises through the region. This increase in accessibility is likely to lead to even more activities as vessels of different sizes and icebreaking capacity are able to enter the region and leading to increases in tourism, industry, research, and military. Presently, the U.S. Navy, Coast Guard, Army, and Air Force operate in the Beaufort Sea. Activities through these agencies can be national defense based, as is the case for the Arctic Shield 2024 mission, or research-based. Any aircraft or vessel activities in the proposed action area would increase air emissions; any incremental greenhouse gas contributions by these activities are likely to cumulatively contribute to climate change and decreased overall air quality.

The Bering Sea is currently home to fisheries that represent half of the marine harvest in waters of the United States. The Coast Guard presence in the proposed action area would discourage illegal activity from occurring at sea, as well as enforce regulations set forth by NMFS and the USFWS. The cumulative impact of fishing combined with a law enforcement presence would be an economic benefit to law-abiding fishermen as well as the resources of the State of Alaska. Coast Guard presence would also be a benefit to the at-sea community of fishermen and seafarers in the case of an emergency. The presence of a minimal number of vessels would not contribute greatly to the increase in vessel traffic.

The U.S. Arctic Research Commission publishes a bi-annual report about the various entities that participate in different science directives in the Arctic (USARC 2017). Programs operated by the National Aeronautics and Space Administration, the Office of Naval Research, the National Science Foundation, the North Pacific Research Board, the Department of Energy, and NOAA have plans for Arctic research in the upcoming years. These research projects should provide valuable information to the USCG regarding changes in the Arctic environment and provide insight into how these changes would possibly impact the ability of the USCG to achieve its operating missions.

One of the most concerning issues associated with the Arctic is climate change and the disappearing of sea ice in the region. The National Aeronautics and Space Administration Earth Observatory has determined via satellite imagery that multi-year sea ice is persistently declining in the Arctic. This directly relates to Arctic Shield 2024 because a decline in sea ice means an increase in human presence, whether via cruise ship, container ship, fishing vessel, or recreational vehicle. An increase in human presence will require the presence of the USCG, both for law enforcement and human safety purposes. Law enforcement will also be necessary as waters from foreign ports open up as well. Foreign and domestic vessels would also need to be monitored to enforce regulations put in place by NMFS and the USFWS. Additionally, declining ice would lead to an increase in stress to threatened and endangered species, for which the USCG also enforces regulations.

Based on the past, present, and reasonably foreseeable future actions within the proposed action area, Arctic Shield 2024 would not be expected to considerably contribute to any cumulative impacts from all other actions and activities in the Beaufort, Chukchi, or Bering Seas.

CHAPTER 6 CONCLUSIONS

The Proposed Action is to conduct increased operations and training exercises in the Arctic to meet Coast Guard mission responsibilities due to the increase of national and international activities in the area. This would provide a shore, air, and sea Coast Guard presence to meet the seasonal surge mission requirements. These activities support the Arctic Strategy and enable the Coast Guard to fulfill its requirements.

The Proposed Action consists of five main elements: shore, air, and sea operations; training exercises; and tribal and local government engagement.

This EA evaluated acoustic stressors (acoustic sources, vessel noise, and aircraft noise) and physical stressors of the Proposed Action, including vessel and aircraft movement. In the analysis of stressors, it was concluded that activities may affect but will not adversely affect the physical, biological, or socioeconomic environment, including mammals, birds, starfish or sea stars, fish, essential fish habitats (EFH) or reptiles (sea turtles), and socioeconomic resources.

Based on the analysis contained herein, the Proposed Action **is not anticipated to have a significant impact on** the physical, biological, or socioeconomic environment. As such, an Environmental Impact Statement (EIS) is not required and promulgation of a FONSI is recommended.

TABLE 6-1. SUMMARY OF ENVIRONMENTAL IMPACTS

Environmental Resource (with subcategory as identified)		**Potential Impact (Classification and Duration of the Proposed Action**
Noise	Airborne Noise	Short term, Limited Long term, No Impacts
	Underwater Noise	See Biological Resources
Water Resources	Surface Water and Marine Waters	Short term, Negligible Long term, Negligible
Biological Resources	Terrestrial	Short term, Limited Long term, No Impacts
	Underwater Noise	Short term, Limited Long term, No Impacts
	Habitat	Short term, Limited Long term, No Impacts
	Fish and Essential Fish	Short term, Limited Long term, No Impacts
	Special Status Species	Negligible
	Marine Mammals	Limited
	Invasive Species	No Impacts
Cultural Resources	Historic Resources	No Impacts
	Archaeological Resources	No Impacts

CHAPTER 7 PREPARERS OF THE DOCUMENT

Table 8-1 lists the persons who helped prepare this Environmental Assessment.

TABLE 7-1. LIST OF DOCUMENT PREPARERS

Name	Organization	Qualifications
Charles Britt	EGC	BS in Biology, MS in Wildlife Science; 21 years of NEPA experience
Michael Bradle	EGC	BA in Anthropology, MA in Anthropology/Archaeology, PhD Candidate; 35 years of environmental planning experience
Scott Quint	EGC	BS in Chemical Engineering. 20 years of environmental planning experience; 10 years of NEPA experience

CHAPTER 8 AGENCIES CONSULTED

Table 9-1 lists persons and agencies consulted during the preparation of this Environmental Assessment.

[To be completed after consultation on BA, Tribal letters]

TABLE 8-1. LIST OF PERSONS AND AGENCIES CONSULTED

Name	Agency

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APPENDIX A. REFERENCES

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Appendix B: Guidance, Operational Measures, and Best Management Practices

COAST GUARD GUIDANCE

The following Coast Guard directives have been promulgated by the Commandant of the Coast Guard or the D17 Commander for the purpose of insuring that actions carried out by Coast Guard vessels and aircraft are not likely to jeopardize the continued existence of, or taking of, or harassment of, any animal subject to the protection of the MMPA and any species listed as endangered or threatened under the ESA.

The negligent or intentional disregard of any one of the following directives would place the Commanding Officer or Officer-in-Charge of the Coast Guard vessel or aircraft operating in the field in jeopardy of disciplinary action or even criminal prosecution under the Uniform Code of Military Justice.

- The Protected Living Marine Resource Program (CGD17INST 16214.2B) outlines procedures for operations IVO protected species; reporting requirements for sightings, strandings, and injuries; and enforcement of the MMPA and ESA.
- Chapter 11 of the Vessel Environmental Manual (Command Instruction [COMDTINST] M16455.1A) describes measures for protection of marine wildlife applicable to all waterborne Coast Guard assets. In accordance with this instruction, all Commanding Officers and Officers in Charge must plan and act to protect marine mammals during operations and planning. Whale avoidance measures are prescribed, including requiring that vessels be especially alert for activity, and proceed with caution, in areas of known whale migration routes or high animal density, and that vessels do not approach whales head on during non-emergency maneuvering.
- Chapter 10 of the Vessel Environmental Manual states ballasting and de-ballasting shall be conducted in a manner to minimize the introduction of non-native species and reduce their impact.
  - Ballast water taken on board from a location more than 200 nm from any shore and in water of a depth greater than 200 meters may be discharged without restriction. Ballast water taken on board within 200 nm from any shore or in water less than 200 meters deep, must be managed through stepwise protocol that ranges from ballast water exchange in waters more than 200 nm from any shore and more than 200 meters deep, to discharge at an approved receiving facility.
  - In all cases, the minimum distance for de-ballasting shall be 12 nm from land. Any ballast water taken on board would likely be released (ballast tanks cycled) in the Bering Sea, prior to entering any port (e.g., Dutch Harbor, Nome) for refueling.
  - Should any invasive species be in the ballast water, these species would be released in the open ocean to minimize the potential for introduction into another area. It is recognized that ship hulls can also be vectors for alien species, but at this time, only ballasting and de-ballasting is restricted.
  - The Coast Guard Air Operations Manual (COMDTINST M3710.1I) prescribes measures for the protection of wildlife applicable to all Coast Guard air assets. In accordance with this instruction, Commanding officers shall implement standard operating procedures to prevent unnecessary over-

flight of sensitive environmental habitat areas, to include, but not be limited to, critical habitat designated under the endangered species act, migratory bird sanctuaries, and marine mammal haul-outs and rookeries. Environmentally sensitive areas will be properly annotated on pilot's charts as required. When it is necessary to fly over such areas, an altitude of 3,000 feet above ground level shall be maintained, except in a situation defined by 50 CFR 402.05 as an emergency: situations involving acts of God, disasters, casualties, national defense of security emergencies. The amount of time spent at low altitudes should be limited to what is necessary to accomplish the particular emergency.

- The Maritime Law Enforcement Manual (COMDTINST 16247.1H) states that during all maritime law enforcement activities the Coast Guard shall seek to avoid collision with a whale during the course of normal operations, operators of Coast Guard vessels transiting critical habitat, migratory routes, and high-use areas use caution, remain alert, and reduce speeds, as appropriate. Additional reductions in speed are considered when a whale is sighted 30 or known to be in the vicinity or within five nautical miles of the vessel.

STANDARD OPERATING PROCEDURES AND BEST MANAGEMENT PRACTICES

Standard operating procedures and best management practices (BMPs), along with conservation measures that are part of the Proposed Action, are described for each resource, as applicable, below. These measures may not apply in a situation defined by 50 CFR 402.05 as an emergency: situations involving acts of God, disasters, casualties, national defense of security emergencies. The Coast Guard also maintains an active marine mammal sighting and reporting program in cooperation with NMFS and the USFWS.

BIOLOGICAL RESOURCES

Personnel involved in the Proposed Action would be made aware of these operating guidelines through the 2017 Operation OPLAN, Annex L, Environmental Considerations, guiding Coast Guard participation in activities in the Arctic. Training that amplifies these guidelines will be given by D17 personnel, and State and federal agency personnel in support of D17. Coast Guard aviation and vessel crews will be instructed to use the most conservative altitudes and distance setbacks identified in Coast Guard instructions. The following measures, developed by the Coast Guard in consultation with Alaska Natives, USFWS, and NMFS, are included to avoid significant adverse effects on biological resources. As stated previously, the Coast Guard may not be able to implement all of the measures below during an emergency.

- Crew members will be trained in marine mammal identification and will alert the Command of the presence of marine mammals and initiate adaptive mitigation responses including reducing vessel speed, posting additional dedicated lookouts to assist in monitoring whales' location, avoiding sudden changes in speed and direction, or if a swimming whale is spotted, attempting to parallel the course and speed of the moving whale so as to avoid crossing its path, and avoiding approach of sighted whales head-on, or directly from behind (see COMDTINST M16247.1H Section D.11 of Chapter 9). Vessels will maintain greater than a 0.5 mi (805 m) radius from polar bears and there would be no cooking on the deck of the vessel.
- Reductions in speed for whales and other marine mammals, and a dedicated lookout is recommended

upon sighting marine mammals in operating area.

- Coast Guard vessels will not discharge sewage black water when within 3 nautical miles of known or reported marine mammals (to the extent that operating constraints permit). The Coast Guard will coordinate with NMFS, USFWS, and local sources to learn of confirmed haul-out locations and communicate them to all field units in the Arctic operating environment.
- Aircraft will not operate at an altitude lower than 1,500 ft (457 m) within 0.5 mi (805 m) of marine mammals observed on ice or land. Helicopters may not hover or circle above such areas or within 0.5 mi of such areas. When weather conditions do not allow a 1,500 ft flying altitude, such as during severe storms or when cloud cover is low, aircraft may be operated below the 1,500 ft altitude stipulated above. However, when aircraft are operated at altitudes below 1,500 ft because of weather conditions, the operator will try and avoid areas of known marine mammal concentrations and will take precautions to avoid flying directly over or within 0.5 mi (805 m) of these areas. Specific to polar bears, aircraft will not hover or cast shadows greater than 2,000 ft (620 m) elevation and will maintain greater than 0.5 mi (805 m) radius. Aircraft will also not hover or cast shadows greater than a 2,000 ft (610 m) radius from ice seals.
- Fixed-wing aircraft will not operate at an altitude lower than 3,000 ft (610 m) within 0.5 mi (805 m) of marine mammals observed on ice or land. When weather conditions do not allow these minimum flying altitudes, such as during severe storms or when cloud cover is low, aircraft may be operated below the altitude stipulated above. However, when aircraft are operated at altitudes below 2,000 ft (610 m) because of weather conditions, the operator try and avoid known marine mammal concentrations and will take precautions to avoid flying directly over these areas.
- Reductions in vessel speed will be considered when a whale is sighted or known to have been sighted within 5 nautical miles (nm) of the intended vessel track. Vessels will use navigationally prudent courses to avoid striking the whale and, if necessary, reduce speed to bare steerageway or come to a stop. A dedicated marine mammal lookout after the initial sighting will be recommended.
- All vessels and aircraft will avoid areas of active or anticipated subsistence hunting activities (whale, walrus, bird, seal, caribou, muskox, moose, sheep, and bear) as determined through community engagement and information. The Coast Guard will coordinate with tribal representatives about planned hunts.
- Coast Guard flight crews will coordinate with tribal representatives to ensure proposed flight paths will not interfere with planned land mammal hunts (caribou, muskox, sheep, moose, and bear). Areas of known land mammal congregations will be avoided to the maximum extent practicable during flight operations through coordination with local and tribal governments.
- Vessels will avoid active subsistence whale hunting areas during spring and fall migrations of bowhead whales.
- Trained crewmembers will be posted during operations to look specifically for marine mammals. If a marine mammal is spotted, the vessel will avoid them by changing course unless there is a threat to safety. In addition, unless the vessel’s mission involves specifically investigating an endangered species, the vessel or aircraft will plan its passage to avoid any known sanctuaries or feeding grounds.

PROTECTIVE MEASURES

Protected marine resource program managers in D17 use a variety of guidance and employ proactive operational measures to help minimize the environmental impacts of Coast Guard vessels and aircraft on MPS and MPAs and they are as follows:

- Coast Guard Headquarters (HQ), Area, and district operating procedures and directives for Coast Guard vessels and aircraft designed to minimize negative interactions with MPS and within MPAs, including formalized speed and approach guidance around protected species.
- Enforcement of the ESA, MMPA, National Marine Sanctuaries Act (NMSA), and other pertinent environmental statutes designed to protect MPS and MPAs.
- Participation in regional multiagency working groups, recovery teams, implementation teams, take reduction teams, sanctuary advisory councils, and task forces.
- Properly training lookouts on marine protected species detection and identification and maintaining those lookouts aboard vessels at all times.
- Establishment of Memoranda of Agreement (MOA) with the National Marine Sanctuaries (NMS) outlining procedures for coordinating enforcement activities.
- Providing routine surveillance of the NMS concurrently with other Coast Guard operations and providing specific targeted or dedicated law enforcement as appropriate. NMS surveillance and enforcement is incorporated into routine patrol orders where feasible.
- Subject to availability of resources, providing other agencies with platforms to conduct critical MPS research and recovery efforts during stranding and recovery operations.
- Regional Fisheries Training Centers (RFTCs) provide applicable ESA, MMPA, and NMSA enforcement training to Coast Guard personnel supporting the MPS mission.
- Formal guidelines for appropriate disposal of animal carcasses.
- Critical habitat areas are provided to units for awareness, compliance, and monitoring.
- An ESA expenditure report is produced yearly to account for the monetary value of CG time spent on Protected Living Marine Resource assistance and compliance regulation.
- District guidance is promulgated through the D17 Protected Living Marine Resource Program in which units are directed on conduct regarding protected species.
- Units document all sightings of marine mammals and endangered species. Polar Bear and Short-tailed Albatross sightings are included in an MPR SITREP and passed to USFWS as needed. All MPR SITREPS are forwarded to CG Pacific Area and then combined to a report at CG Headquarters which is distributed to other government agencies.
- Training is given to any units operating in the Arctic on approach limits and conduct around protected species. This ensures CG compliance and improves enforcement and outreach during law enforcement patrols.
- Contact information for the USFWS and guidance is provided to units who sight or respond to injured, entangled, stranded, or dead polar bears, walruses, sea otters or sea birds.
- Several Pulse operations are directed each year. These protected resource pulse operations are focused on Enforcement of Laws and Regulations, Conservation on Resources or Compliance Outreach and may involve species managed by the USFWS.

TRIBAL AND LOCAL GOVERNMENT ENGAGEMENT

Tribal and local government engagement is vital to all of U.S. Coast Guard missions. Tribal and community engagement will occur on a regular and sometimes daily basis as follows:

- Arctic Shield includes the assignment and forward deployment of an Arctic Liaison Officer (ALO) who, working for D17 external affairs, serves as the primary point of contact supporting interactions with tribal and local government.
- Arctic Shield includes the assignment and forward deployment of an ALO who, working for D17 external affairs, serves as the primary point of contact supporting interactions with tribal and local government.
- Flight crews will coordinate with D17 external affairs personnel to ensure their proposed flight paths will not interfere with subsistence harvest activities.
- Boat crews will check with D17 external affairs personnel /local tribes to ensure boating activities will not interfere with subsistence harvest activities.
- Flight crews will coordinate with D17 external affairs personnel to ensure their proposed flight paths will not interfere with subsistence harvest activities.
- Boat crews will check with D17 external affairs personnel /local tribes to ensure boating activities will not interfere with subsistence harvest activities.

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Appendix C. Sound Levels

The level received by an animal present inside the ensonified volume is expressed as:

$$RL = SL - TL$$

Where,

RL = the received level in dB re 1 µPa

SL = the source level (which depends on transmission angle), expressed in re 1 µPa at 1 m.

TL = the transmission loss in dB as:

$$TL = 20\log\left(\frac{R}{1m}\right) + \alpha R$$

Where,

R = the oblique sonar-receiver range, and α the absorption coefficient in water in dB/m.

Table A-1 gives the typical values for α as a function of frequency.

Table A-1. Absorption coefficient values (in dB/km) as a function of frequency (in kHz) computed at a depth of 10 m

F (kHz)	24	32	50	100	120	200
A (dB/km)	4.3	7.1	14.9	36	42	61

For instance, considering a 50 kHz single beam transmitting at a SL of 205 dB re 1 µPa, the received level at a range of 1 km is RL= 205-20log(1000)-14.9 = 130.1 re dB 1 µPa.

The sound exposure level (SEL) is calculated as:

$$SEL = RL + 10\log(T_\tau) = SL - TL + 10\log T_\tau$$

Where,

T_τ = the total exposure time (in seconds) to consider

Thus, considering a case of an animal present for 10 minutes in the beam sending a 10 ms pulse once every 20 seconds:

$$T_\tau = {}^{600}/_{10}\ x\ 0.01 = 0.6s$$

At a range of 1 km:

$$SEL = 205 - 10\log(1000) - 14.9 + 10\log(0.6) = 127.9\ dB\ re\ 1\ \mu Pa^{2*}s$$

This does not include any information on animal-group-specific frequency weighting, as is reported in Table 3 which provides TTS onset and PTS onset for auditory acoustic thresholds for non-impulsive sounds for an accumulated 24-hour period. The weighting will sometimes decrease the effective SEL of a particular source but would not be expected to increase it.

Appendix D. Letter of Concurrence from USFWS

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Appendix E. Additional ESA-listed Species Information

MAMMALS

USFWS-managed Mammals

Northern Sea Otter

Sea otters (Enhydra lutris) occur in nearshore coastal waters of the North Pacific Rim from the northern end of Japan to California. The northern sea otter sub-species (E. lutris kenyoni) extends from Alaska's Aleutian Islands through British Columbia (Canada) and Washington. Southwest Alaska stock includes Western Cook Inlet, the Alaska Peninsula and Bristol Bay coasts, and the Aleutian, Barren, Kodiak, and Pribilof Islands.

In August of 2005, the Northern Sea Otter Southwest Alaska Distinct Populations Segment (DPS) was designated as a threatened species under the ESA due to its separation from other populations of the same taxon as a consequence of morphological and genetic differences. As part of the ESA listing decision, the Service designated 15,164 km2 (5,855 mi2) of nearshore waters as Southwest stock critical habitat, which occurs in nearshore marine waters ranging from the mean high tide line seaward for a distance of 100 m or to a water depth of 20 m (65.6 ft) (74 FR 51988). Further, as part of the ESA recovery plan for this DPS-listed stock, the USFWS delineated five management units (MU): Western Aleutians; Eastern Aleutians; South Alaska Peninsula; Bristol Bay; and Kodiak, Kamishak, and Alaska Peninsula.

Sea otter distribution and density can vary at small spatial scales seasonally and across years as sea otters seek refuge from storms (Stewart et al. 2015) and populations recover across their historical range (Larson et al. 2014). Historically, sea otters occurred across the North Pacific Rim, ranging from Hokkaido, Japan, through the Kuril Islands, the Kamchatka Peninsula, the Commander Islands, the Aleutian Islands, Alaska Peninsula, and southern coasts of Alaska, and south through British Columbia, Canada, into Washington, Oregon, California and Baja California, Mexico (Kenyon 1969).

Range-wide reductions and extirpations during the commercial fur trade of the 18th and 19th centuries occurred not simply because of excessive harvest, but because the harvest was not allocated proportionally to the abundance and distribution of sea otters (Bodkin and Ballachey 2010). Commercial exploitation of sea otters extirpated them from much of their range, with probably fewer than 2,000 animals remaining in an estimated thirteen remnant colonies (Kenyon 1969) when they were afforded protection by the International Fur Seal Treaty in 1911. The best available information indicates that the Southwest stock in the Aleutian archipelago declined by up to 90 percent in the 1990s (Doroff et al. 2003).

As part of efforts to re-establish sea otters in portions of their historical range to offset costs of nuclear testing in Alaska and reinvigorate fur harvest, otters from Amchitka Island and Prince William Sound were translocated to other areas in the 1960s and 1970s, including to southeast Alaska, Washington, and Oregon

(Jameson et al. 1982). Through both natural population growth and human-assisted translocations, sea otters have since repatriated much of their historical range in Alaska.

The Southwest stock inhabits a region extending more than 2,500 km distance (1,553 mi). The current sea otter population estimate for each of the MUs are: Kodiak, Kamishak, and Alaska Peninsula MU: 30,658 sea otters (CV = 0.18); Bristol Bay MU: 9,733 sea otters (CV = 1.07), South Alaska Peninsula MU: 546 sea otters (CV = 0.33); Eastern Aleutians MU: 8,593 sea otters (CV = 0.07); Western Aleutians MU: 2,405 sea otters (CV = 0.16). The combined population estimate for the Southwest stock is 51,935 sea otters. Overall, the population trend across the five MUs is highly variable. One MU, the South Alaska Peninsula, is in decline. Another MU, Western Aleutians, declined and is low but stable. Two MUs, Eastern Aleutians and Bristol Bay, are increasing in recent years. The MU Kodiak, Kamishak, and Alaska Peninsula is stable or slightly increasing. Overall, available data suggests that the Southwest stock trend is generally stable to increasing.

Sea otters primarily inhabit nearshore habitats within the 40 meters (m) (~ 130 feet [ft]) depth contour where they forage for benthic invertebrates in shallow subtidal and intertidal zones (Riedman and Estes 1990), though they can forage and will occur at depths over 100 m (~ 328 ft) (Bodkin et al. 2004). Sea otters are not migratory and generally do not disperse over long distances, although movements of tens of kilometers (km) (tens of miles [mi]) are common (Garshelis and Garshelis 1984). Annual home range sizes of adult sea otters are relatively small, with male territories ranging from 4 to 11 square kilometers (km2) (~ 1.5 to 4.2 square miles [mi2]) and adult female home ranges from a few to 24 km2 (~ 9.3 mi2) (Garshelis and Garshelis 1984, Ralls et al. 1988, Jameson 1989).

Predation by killer whales was suspected to be the primary cause of decline (U.S. Fish and Wildlife Service 2013). The best estimate of the average rate of annual human-caused mortality and serious injury for the Southwest stock for the period 2017 through 2021 is 177 sea otters/year, which is below the calculated PBR of 2,296. Self-reported fisheries interactions averaged < 1 sea otter interaction per year. Data for subsistence harvest of sea otters in the Southwest stock are collected by a mandatory Marking, Tagging, and Reporting Program (MTRP) administered by the Service since 1988. Total annual subsistence harvest removals averaged 176 sea otters/year over this same 5-year period, which represents less than one percent of NMIN, but this is likely an underestimate. The MTRP indicates they have received some anecdotal reports of illegal and unreported harvest, but the extent to which it occurs across the stock is unknown. Rates of serious injury and strike and loss are also unknown, not quantified.

Additional factors likely to result in human-caused mortality or serious injury for this stock include oil and gas development and spills, boat strikes, and anthropogenic disturbance-related mortalities associated with fisheries or mariculture farms. Thus, the estimated annual human-caused mortality rate should be considered negatively biased to an unknown degree. Therefore, it is difficult to state the total combined effect of fisheries on the Southwest stock, including whether the total fishery mortality and serious injury rate is insignificant and approaching a zero mortality and serious injury rate.

Activities associated with exploration, development, and transport of oil and gas resources can adversely impact sea otters and nearshore ecosystems in Alaska. While the catastrophic release of oil has the potential to negatively affect many sea otters, there is currently no evidence that other effects (such as disturbance) associated with routine oil and gas development and transport have had a population-level impact on the Southwest stock. There have been no large oil spills impacting sea otters in the Southwest stock in the past five years (2017–2021).

The MMPA exempts Alaska Natives from the prohibition on take of marine mammals, provided such taking is not wasteful and is done for subsistence use or for creating and selling authentic handicrafts or clothing. The mean reported annual subsistence harvest during the past five complete calendar years (2017 to 2021) was 176 animals/year across the Southwest stock (Figure 8), which represents < 1 percent of NMIN. Annual sea otter harvest increased between 2015 and 2018 to a high of 379 sea otters, reflecting escalated hunting effort to increase the availability of sea otter hides to be sold.

The extent to which sea otters are illegally killed as a result of conflict with fisheries-related activities is unknown. The Service's Law Enforcement office maintains records of the number of prosecutions for unlawful take, possession, transport, or sale of sea otters or sea otter hides. From 2017-2021 there were three illegal instances of take of sea otters in the Southwest stock, but the origin of the incident, the nature of the takes, or the number of sea otters taken in these incidents is unknown. Sea otter predation occurs in all three stocks from killer whales, wolves, bears, and eagles on pups. Where sea otters have recolonized and frequently haul out, they become susceptible to terrestrial predators such as bears and wolves (Monson 2021, Roffler et al. 2021); however, terrestrial predators are unlikely to have stock-wide population impacts (Monson 2021). Eagle predation primarily occurs on pups less than 1 month old, and experienced sea otter mothers will alter behavior to minimize eagle predation risk to pups (Esslinger et al. 2014). While the population-level impacts from predators are generally difficult to discern, predation from killer whales was a driver of population dynamics for the Southwest stock (USFWS 2020).

Sea surface temperatures (SST) have been increasing around the world for several decades, including in the northeast Pacific Ocean and the southeast Bering Sea (IPCC 2013). Although there is no evidence linking sea otter mortality to increased SSTs, there are potential indirect effects of increasing SSTs on sea otter prey.

The ocean is also experiencing ocean acidification, whereby atmospheric carbon dioxide is absorbed by the ocean, which reduces seawater pH and the concentration of carbonate ions (Feely et al. 2004). The pH of ocean surface waters has decreased by about 0.1 units since the beginning of the industrial revolution (Caldeira and Wickett 2003, Orr et al. 2005). Changes in pH may affect reproduction, larval development, growth, behavior, and survival of calcifying marine organisms, such as sea urchins (e.g., Strongylocentrotus droebachiensis), abalone and other marine snails (e.g., Haliotis kamtschatkana), crabs (e.g., Telmessus spp.), mussels (Mytilus spp.), and clams (e.g., Saxidomus spp.) (Kroeker et al. 2013). The long-term impacts of ocean acidification on the distribution and availability of calcifying marine organisms, which comprise a large portion of the sea otter diet, are uncertain.

Recent assessments of sea otter population viability in the Western Aleutians MU have revealed a pattern of inter-island and intra-island fragmentation (Tinker et al. 2023). Killer whale predation led to sea otter declines across islands resulting in a pattern of inter-island fragmentation. Declining sea otter populations on each island were likely able to persist within predation refuges particularly at larger islands with more complex habitat. Restriction of sea otters to these predation refuges has led to intra-island fragmentation, whereby sea otters in larger islands consist of several discrete clusters separated by seemingly inhospitable stretches of coastline habitat. The combination of inter-island and intra-island fragmentation may increase the risks of demographic stochasticity, and depending on the degree of disconnect among discrete clusters, there may be limited potential for rescue effect if some clusters become extirpated. It is not known whether habitat fragmentation is an issue to sea otter populations in the other four MUs.

Polar Bear

Polar Bear (Ursus maritimus) was listed as Threatened under the ESA in May 2008 due to loss of sea ice habitat caused by climate change; it is also protected under the MMPA. The polar bear is managed by the USFWS under the Department of the Interior. The Service designated polar bear critical habitat on November 24, 2010 (75 FR 76086). On January 10, 2013, the U.S. District Court for the District of Alaska issued an order vacating the Final Rule designating critical habitat for the polar bear. However, on February 29, 2016, the 9th Circuit Court Panel reversed the District Court's judgment that vacated the U.S. Fish and Wildlife Service's (Service) designation of critical habitat in Alaska for the polar bear and the original designation was reinstated.

Polar bears have a circumpolar distribution and are found throughout the Arctic. They are most abundant near shore in shallow-water areas and in other areas where currents and ocean upwellings increase productivity and serve to keep the ice cover from becoming too solidified in winter (Stirling and Smith 1975, Stirling and Cleator 1981, Amstrup and DeMaster1988, Stirling 1990, Stirling and Øritsland 1995, Amstrup et al. 2000). There are 19 recognized populations, of which two occur in U.S. waters. The Chukchi Sea and Southern Beaufort Sea populations overlap in Alaskan waters, with the Chukchi Sea population ranging from Eastern Russia to near Icy Cape, Alaska, and including the Bering Sea to the south. The Southern Beaufort Sea population ranges from Icy Cape in the west across the U.S.-Canadian border to Pearce Point, Northwest Territory, Canada (Schliebe et al. 2006).

The distribution of polar bears in most areas varies with the seasonal extent of sea-ice cover and availability of prey. In Alaska in the winter, sea-ice may extend 400 km south of the Bering Strait, and polar bears will extend their range to the southernmost proximity of the ice (Ray 1971). Sea-ice disappears from the Bering Sea and is greatly reduced in the Chukchi Sea in the summer, and polar bears occupying these areas may migrate as much as 1000 km to stay with the pack ice (Garner et al. 1990, 1994). Throughout the polar basin, during the summer polar bears generally concentrate along the edge or into the adjacent persistent pack ice. Significant northerly and southerly movements appear to be dependent on seasonal melting and refreezing of ice (Amstrup et al. 2000).

Polar bears prefer to inhabit areas of pack ice throughout the Arctic. Typically, they are found on the edge of the ice flow and in areas of moving ice. Much of their habitat depends on sea ice, and they generally do not spend large amounts of time on land, unless the ice has melted, and they are in areas without ice access (Amstrup and DeMaster 1988). Monnett and Gleason (2006) present aerial survey results that indicate polar bears are observed on land at a much higher rate than in the water (3.8 percent of observations in water in years 1987–2003 and 19.9 percent in 2004) (Monnett and Gleason 2006). Observations of free-swimming polar bears from 1987 to 2003 showed that they can occur at a distance of 3 to 47 mi (4.8 to 75.6 km) from land and 14 to 217 mi (22.5 to 349.2 km) from pack ice (Monnett and Gleason 2006).

There are two populations of polar bear that occur in the Action Area: the Chukchi Sea and Southern Beaufort Sea stocks (Schliebe et al. 2006). The two populations overlap in Alaskan waters, with the Chukchi Sea population ranging from Eastern Russia to near Icy Cape, Alaska, and including the Bering Sea to the south. The Southern Beaufort Sea population ranges from Icy Cape in the west across the U.S.-Canadian border to Pearce Point, Northwest Territory, Canada (Schliebe et al. 2006). There is no population estimate available for the Chukchi Sea population at this time, but a recent analysis of body condition and reproduction in this population indicates that bears from this population have better body condition and higher reproductive success than bears in the Southern Beaufort Sea population (Rode et al. 2014). The Southern Beaufort Sea population is exhibiting signs of poor body condition, fasting, and unusual behaviors, which may be connected to more reduced-ice days than seen in the Chukchi Sea population (Rode et al. 2014). The most recent population estimate for this population is from 2006, models indicated there were 1,526 individuals (95 percent Confidence interval: 1,211 – 1,841) (Regehr et al. 2006).

Polar bears obtain most of their prey from the sea but rarely hunt directly in the water (Amstrup 2003; Jefferson et al. 2008b) and have no natural predators though cannibalism has been documented among some populations (Rode et al. 2014). They feed mainly on ringed seals and bearded seals. Although seals are their primary source of prey, they are known to hunt larger animals, such as walruses and even small beluga whales and narwhals (Rugh and Shelden 1993; Stirling 2009). Similar to other bear species, polar bears will feed on human refuse, and when trapped on land for long periods are known to feed on small amounts of terrestrial vegetation (Amstrup 2003). They sometimes feed on Arctic cod as well. Polar bears in Hudson Bay and southeastern Baffin Island fast for many months while ice is melting during the summer, returning to the ice when it re-forms in the autumn. If bears have regular access to sea ice throughout the year, they generally do not fast. Polar bears hunt individually, by waiting near a hole in the ice used by seals for breathing and then attack when the seal surfaces to breathe. They have a well-developed sense of smell, which they use to do much of their hunting (Amstrup 2003). In at least some areas, the diets of polar bears have shifted from species associated with ice (ringed and bearded seals) to species less associated with ice (harbor and harp seals) (McKinney et al. 2009).

Reproduction in polar bears varies across populations, with age at sexual maturity and denning habits dependent on environmental characteristics (Schliebe et al. 2006). In the Chukchi Sea and Southern Beaufort Sea populations, bears become sexually mature at around 6 years for males and 5 – 6 years for females (Rosing-Asvid et al. 2002). Breeding generally occurs between March and June but may happen as late as July. Female polar bears exhibit delayed implantation, and gestation begins in the fall. Birth occurs during the winter, while females are in hibernation in dens either on land (usual) or in the pack ice (sometimes observed in the Chukchi and Southern Beaufort populations). Cubs stay with their mothers for 2–3 years.

Polar bears have no natural predators but may be susceptible to disease. However, a recent status review did not identify any significant threat from disease or parasites (Schliebe et al. 2006). Commercial hunting is not a threat to polar bears in the U.S., due to restrictions under the MMPA. However, because both populations that reside in the U.S. cross international borders, hunting by Russia and Canada will cause some mortality in these populations. Subsistence hunting does occur in Alaska and is regulated in cooperation with Native corporations. The most recent available harvest levels are 32 bears in 2004 – 2005 from the Chukchi Sea population and 46 bears in 2004 – 2005 from the Southern Beaufort Sea population (27 in Alaska, 19 in Canada) (Schliebe et al. 2006).

The primary threat to this species is climate change and associated sea ice loss. Changes in sea ice patterns thought to be caused by climate change are reducing the size, growth, reproduction, and survival of polar bears in affected areas and is significantly shrinking their available habitat (Amstrup 2003; Durner et al. 2009). Schliebe et al. (2006) note that decreases in sea ice habitat may increase the amount of time polar bears spend in open water, which may decrease survival rates for cubs and young bears without the endurance of adults. Additionally, changes to ice and snow cover regimes may decrease available denning habitat for females during the winter months when cubs are born. Polar bear prey will also be affected by reductions in sea ice. The primary prey species (ringed seals) uses subnivean lairs for pupping; polar bears hunt by scenting dens and digging out infant seals. Reductions in sea ice could therefore reduce available prey for bears (Schliebe et al. 2006).

Wood Bison

Wood Bison (Bison bison athabascae) was listed as Endangered under the ESA in 1970 due to low abundance. In May 2012, the wood bison was downlisted to a threatened species under the ESA as a result of a 2007 petition from Canada’s National Wood Bison Recovery Team. The wood bison is managed by the USFWS under the Department of the Interior. Critical habitat has not been designated for the wood bison.

Wood bison are primarily grazers, relying on a variety of grasses and sedges found in meadows occurring on alkaline soils and early successional habitats (Reynolds et al. 1978; Reynolds and Hawley 1987). These meadows are typically interspersed among tracts of coniferous forest, stands of poplar or aspen (Populus spp.), bogs, fens, and shrublands. Meadows typically represent 5 to 20 percent of the landscape occupied by wood bison where they occur in Canada (Larter and Gates 1991a; Gates et al. 2001b). Wood bison are extremely plastic in their ability to adapt to local resources and show strong seasonal changes in diet, selecting plants that yield the greatest protein (Larter and Gates 1991a). Wood bison generally tend to use wet meadows with predominantly native graminoid vegetation as winter grazing habitat. Summer grazing habitats often include meadows that contain slough sedge (Carex atherodes), northern reed-grass (Calamagrostis canadensis), and/or willow (Salix spp.). Deciduous and pine (e.g., Jack pine, Pinus banksiana) forests associated with these meadow types are used for resting, ruminating, avoiding biting flies, protection from deep snow and wind, and foraging at various times throughout the year (Reynolds et al. 1978; Larter and Gates 1991b; Jung et al. 2015). Female groups tend to select larger meadows during the calving season (Calef and Van Camp 1987).

Based on estimates made between 2010 and 2016, there are approximately 8,587 free-ranging wood bison in Canada: approximately 4,363 wood bison in nine free-ranging, disease-free local populations, approximately 4,224 in three free-ranging local populations with diseases, and 300 in one captive local population maintained for conservation purposes at Elk Island National Park (EINP) (Gates et al. 2001b; COSEWIC 2013; ECCC 2018). In 2015, the Alaska Department of Fish and Game (ADF&G) released 130 captive reared wood bison in western Alaska to create a wild, free-ranging herd known as the Lower InnokoYukon herd. This is currently the only free-ranging herd in Alaska.

During the early 1800s, wood bison numbers were estimated at 168,000; but by the late 1800s, the subspecies was nearly eliminated, with only a few hundred remaining (Gates et al. 2001b). Factors leading to the extirpation of wood bison from Alaska most likely included hunting by humans, along with the isolation of subpopulations caused by changes in habitat distribution during the late Holocene (Stephenson et al. 2001). The fact that populations in Canada began to rebound once protection was in place and enforced supports the idea of overharvest and unregulated hunting as the most significant sources of decline (Soper 1941).

Wood bison are susceptible to a variety of diseases that may affect their population dynamics. There are three major infectious bacterial diseases of concern to the conservation of wood bison, none of which are endemic to wood bison (Gates et al. 2010). Anthrax (Bacillus anthracis) and bovine Tb are considered to have the most serious disease implications for bison restoration. Bovine brucellosis is also considered a significant stressor and an impediment to recovery. The greatest current stressor to wood bison is the presence of bovine Tb and brucellosis and the resultant management actions taken to reduce exposure risk and transmission to disease-free populations.

Another factor thought to have played a role in the decline of wood bison is a gradual loss of meadow habitat throughout forest encroachment (Stephenson et al. 2001; Quinlan et al. 2003; Strong and Gates 2009). Although not quantified, it is likely that because of fire suppression, and subsequent forest encroachment on meadows, there was a net loss of suitable open meadow habitat for wood bison throughout their range through about 1990. More intensive fire management began in Canada in the early 1900s with the philosophy that fire was destructive and should be eliminated to protect property and permit proper forest management (Stocks et al. 2003). However, wildfire is an integral component of boreal forest ecology (Weber and Flannigan 1997; Rupp et al. 2004; Soja et al. 2007). Without fire, trees encroach on meadows and eventually the meadow habitat is lost and replaced by forest.

Hunting and population control is a stressor common to several local populations of wood bison. Population numbers are maintained at a smaller size to prevent range expansion and potential contact between diseased and disease-free populations, reduce hybridization potential through contact with plains bison and domestic cattle, limit the risk to people and property, and to provide hunting opportunities. Social intolerance due to perceived competition with other ungulates, disease transmission, property damage, and human safety is a significant factor influencing policies that reduce, control, and limit the number of wood bison in large landscapes. Unregulated hunting of some subpopulations constrains effective population size where small population effects may negatively impact viability. Disease (livestock-borne and native, e.g., anthrax) and severe weather are other threats that have caused significant mortality events, both recently and historically.

Marine Mammal Hearing

Marine mammals use sound for communication, feeding, and navigation. Measurements of marine mammal sound production and hearing capabilities provide some basis for assessment of whether exposure to a particular sound source may affect a marine mammal behaviorally or physiologically. Hearing has been directly measured in some odontocete and pinniped species [in air and underwater] (see reviews in ((Erbe 2015; Finneran et al. 2005; Southall et al. 2007)). To better reflect marine mammal hearing, Southall et al. (2007) recommended that marine mammals be divided into hearing groups and in 2016, NMFS made modifications (Table 4-1) as part of their technical guidance (NMFS 2016b).

TABLE 0-1. MARINE MAMMAL FUNCTIONAL HEARING GROUPS

Hearing Group	Generalized Hearing Range
Low-frequency (LF) cetaceans (baleen whales)	7 Hz to 35 kHz
Mid-frequency (MF) cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales)	150 Hz to 160 kHz
High-frequency (HF) cetaceans (true porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger*, *L. australis*)	275 Hz to 160 kHz
Phocid pinnipeds (PW) underwater (true seals)	50 Hz to 86 kHz
Otariid pinnipeds (OW) underwater (sea lions and fur seals)	60 Hz to 39 kHz

Mysticetes

Direct measurements of mysticete hearing are lacking. Thus, hearing predictions for mysticetes are based on other methods including anatomical studies and modeling (Cranford and Krysl 2015; Houser et al. 2001; Parks et al. 2007; Tubelli et al. 2012), vocalizations (see reviews in (Au and Hastings 2008; Richardson et al. 1995; Wartzok and Ketten 1999)) taxonomy; and behavioral responses to sound ((Dahlheim and Ljungblad 1990); see review in (Reichmuth et al. 2007)). It is generally assumed that most animals hear well in frequency ranges similar to those used for their vocalizations (songs or calls), which are mainly below 1 kHz in baleen whales (Richardson et al. 1995). Although auditory frequency range and vocalization frequencies do not always perfectly align, caution should be taken when considering vocalization frequencies along in predicting hearing capabilities of species for which no data exists, like mysticetes. Estimation of hearing ability based on inner ear morphology was completed for two baleen whale species: humpback whales (700 Hz to 10 kHz; (Houser et al. 2001) and North Atlantic right whales (10 Hz to 22 kHz; (Parks et al. 2007)). Further, preliminary anatomical data indicate minke whales (Balaenoptera acutorostrata) may be able to hear slightly above 22 kHz (Ketten and Mountain 2009). The anatomy of the baleen whale inner ear seems to be well adapted for detection of low-frequency sounds (Ketten 1992a, 1992b, 1994). Thus, the auditory system of baleen whales is almost certainly more sensitive to low-frequency sounds than that of the smaller moderate-sized toothed whales. However, auditory sensitivity in at least some large whale species extends up to higher frequencies than the maximum frequency of the calls, and relative auditory sensitivity at different low-moderate frequencies is unknown. Given the range of best hearing (roughly 7 Hz to 35 kHz or more), ESA-listed mysticetes may be able to detect a range of underwater noise, including acoustic transmissions, vessel noise, and aircraft noise.

Odontocetes

Odontocetes use high frequency biosonar signals to sense their environment. They have a broad hearing range extending to 200 kHz, but the frequency of best hearing ranges from 150 Hz to 160 kHz (Mooney et al. 2012; Tougaard et al. 2014). Auditory response curves for odontocetes show maximum auditory sensitivity near the frequencies where toothed whale signals have peak power (Mooney et al. 2012; Tougaard et al. 2014) at about 1,000 to 20,000 Hz for social sounds and 10,000 to 100,000 Hz or higher for echolocation. Like mysticetes, it is assumed that most animals hear well in the frequency ranges similar to those used for their vocalizations (songs or calls); although auditory frequency range and vocalization frequencies do not always perfectly align. Odontocetes use underwater communicative signals that, while not as low in frequency as those of many mysticetes, likely serve similar functions. These include tonal whistles, clicks, and pulsed calls in some odontocetes. Odontocetes generate short-duration (500–200 μs), specialized clicks used in biosonar with peak frequencies between 10 and 200 kHz to detect, localize, and characterize underwater objects such as prey (Au 1993; Wartzok and Ketten 1999). These clicks are often more intense than other communicative signals, with reported source levels as high as 229 dB re 1 μPa peak-to-peak (Au et al. 1974). The echolocation clicks of high-frequency cetaceans (e.g., porpoises) are narrower in bandwidth (i.e., the difference between the upper and lower frequencies in a sound) and higher in frequency than those of mid-frequency cetaceans. Given the range of best hearing (from 150 Hz to 160 kHz), ESA-listed odontocetes may be able to detect a range of underwater noise, including acoustic transmissions, vessel noise, and aircraft noise.

Pinnipeds

Unlike cetaceans who spend their entire lives in the water, pinnipeds and carnivores are adapted to live part of their lives in water and part on land and therefore would be expected to adapt to hearing in water and in air. Underwater hearing in otariid seals is adapted to low frequency sound and less auditory bandwidth than phocid seals. Hearing in otariid seals has been tested in California sea lion (Kastak and Schusterman 1998) and northern fur seal (Babushina et al. 1991). Kastelein et al. (2005) provided underwater audiograms of a male and female Steller sea lion, whose range also overlaps with the proposed action area. The audiogram of the male had a maximum hearing sensitivity at 77 dB at 1 kHz, with a best hearing range, between 1 and 16 kHz. The female Steller sea lion had a maximum sensitivity at 73 dB at 25 kHz. Kastelein et al. (2005) concluded that low frequency sounds are audible to Steller sea lions. Based on these studies, otariid seals would be expected to hear sounds within the ranges of 50 Hz to 75 kHz in air and 50 Hz to 50 kHz in water.

Phocid species have consistently demonstrated an extended frequency range of hearing compared to otariids, especially in the higher frequency range (Hemila et al. 2006; Kastelein 2009; Reichmuth et al. 2013). Phocid ears are anatomically distinct from otariid ears in that phocids have larger, more dense middle ear ossicles, inflated auditory bulla, and larger sections of the inner ear (i.e., tympanic membrane, oval window, and round window), which make them more adapted for underwater hearing (Hemila et al. 2006; Kastak and Schusterman 1998; Mulsow et al. 2011; Reichmuth et al. 2013; Schusterman and Moore 1978; Terhune and Ronald 1975).

BIRDS

For the purpose of this document, "marine birds" refers to shoreline, coastal, bay, and pelagic bird species. A description is provided below of each major taxonomic group of marine birds that may occur in the proposed action area and includes species protected under the MBTA. Three ESA-listed bird species exist within the proposed action area (Table 3-2).

TABLE 0-2. ESA-LISTED MARINE BIRDS PRESENT IN THE PROPOSED OPERATION ARCTIC SHIELD ACTION AREA.

Common Name	Scientific Name	Status	Type of Bird	Order
Short-tailed albatross	*Phoebastria albatrus*	Endangered	soaring, gull-like	Procellariiformes
Spectacled eider	*Somateria fischeri*	Threatened, Critical Habitat in proposed action area	dabbling duck	Anseriformes
Steller's eider	*Polysticta stelleri*	Threatened, Critical Habitat in proposed action area	dabbling duck	Anseriformes

Short-tailed Albatross

The short-tailed albatross (Phoebastria albatrus) is one of the rarest species of albatrosses and one of the world's rarest birds (Harrison 1983; International Union for the Conservation of Nature 2010). The short-tailed albatross is listed as endangered under the ESA throughout its range (35 FR 8491). Additionally, it is listed as endangered by the state of Alaska (AS 16.20.190). Currently, no critical habitat has been designated for this species, because little is known about its life in the open ocean (Piatt et al. 2006; U.S. Fish and Wildlife Service 2000). The most recent recovery plan for the short-tailed albatross was issued in 2008 (U.S. Fish and Wildlife Service 2008).

Short-tailed albatrosses are typically found in the open ocean and tend to concentrate along the edge of the continental shelf and upwelling zones (NatureServe 2004). Upwelling zones are not only nutrient rich, but they also bring prey (for example, squid and fish) typically found only deeper in the water column to the surface, where they become available to albatrosses. Short-tailed albatross prefer to nest on isolated, windswept, offshore islands protected from human access (U.S. Fish and Wildlife Service 2000). Current and historical nesting habitat can be described as flat to steep slopes that are sparsely or fully vegetated. Short-tailed albatrosses disperse throughout the temperate and subarctic North Pacific from Japan through California, between May and October when they are not breeding (U.S. Fish and Wildlife Service 2005a, 2008). Non-breeders and failed breeders disperse from the colony at an earlier time than breeding albatrosses. While many non-breeders return to the colonies each year, the presence of immature birds far from the colony (such as the U.S. Pacific coast) during the breeding season suggests that some immature birds may spend years at sea before they return to the colony (U.S. Fish and Wildlife Service 2005b).

Short-tailed albatrosses are surface feeders and scavengers, foraging more inshore than other North Pacific albatrosses. Short-tailed albatrosses feed at the surface and their diet consists of shrimp, squid, and fish (U.S. Fish and Wildlife Service 2005b). Unlike other North Pacific albatrosses, short-tailed albatrosses frequently forage in sight of land.

Spectacled Eider

Spectacled eider (Somateria fischeri) is listed as threatened under the ESA (58 FR 27474) and is a species of special concern in the state of Alaska (AS 16.20.190). In 2001 the USFWS designated critical habitat for spectacled eider (66 FR 9146-9185). The critical habitat encompasses approximately 38,610 mi2 (100,000 km2) and includes the Yukon-Kuskokwim Delta and Norton Sound within the Bering Sea, Ledyard Bay in the Chukchi Sea, and the Bering Sea between St. Lawrence and St. Matthew islands (66 FR 9146-9185). Spectacled eiders use these areas for breeding, molting, and wintering (Alaska Department of Fish and Game 2017d). The most recent recovery plan for the spectacled eider was issued in 1996, with an updated task list released in 2007 (U.S. Fish and Wildlife Service 1996).

Most spectacled eiders in North America breed in western Alaska at the Yukon-Kuskowim Delta from Nelson Island to the Askinuk Mountains near the Bering Sea. In northern Alaska, they breed in wetlands along the coasts of the Beaufort and Chukchi seas from Demarcation Point to Utqiagvik (Barrow) and from Utqiagvik (Barrow) to Wainwright during the summer months (Fredrickson 2001). Outside of North America, they breed in arctic Russia (Fredrickson 2001). Spectacled eiders nest on small islands and peninsulas, along the shorelines of ponds, and dry areas of wet meadows (Anderson et al. 1999; Dau 1976; Kistchinski and Flint 1974; Kondratev and Zadorina 1992; Pearce et al. 1998).

In the winter, from November through March or April, spectacled eiders congregate in the Bering Sea around open leads and holes in pack ice or in open sea at water depths greater than 262 ft (80 m) (Grebmeier and Cooper 1995). They are typically found south of 64 degrees North latitude (° N), west of 168 degrees West longitude (° W), east of 175° W, and north of 61° N and their core wintering area in most years is restricted to a relatively small area (about 31 by 47 mi [50 by 75 km]) centered at about 62° N 173°W (Petersen et al. 1995; Petersen et al. 1999). Rarely, individuals or small flocks of spectacled eiders inhabit Izembek Lagoon, Kodiak Island, and Kachemak Bay in the winter, but the vast majority of the population inhabit the Bering Sea (Dau and Kistchinski 1977). During their spring and fall migration periods, spectacled eiders inhabit the offshore regions of the Arctic, Chukchi, and Bering Seas (Petersen et al. 1995; Petersen et al. 1999).

Females move to molting areas in July if unsuccessful at nesting, or in August/September if successful (Petersen et al. 1999). When moving between nesting and molting areas, spectacled eiders travel along the coast up to 37 mi (60 km) offshore (Petersen et al. 1999). Molting flocks gather in relatively shallow coastal water, usually less than 118 ft (36 m) deep. Late summer and fall molting areas have been identified in eastern Norton Sound (northern Bering Sea) and Ledyard Bay (eastern Chukchi Sea) in Alaska. Eiders are particularly vulnerable during the fall molting period, when they are unable to fly for approximately three weeks between June and October (Petersen et al. 1999).

During the breeding season, spectacled eiders prey upon insects and insect larvae, seeds, and plant materials along the edges and bottoms of freshwater ponds (Dau 1974; Kistchinski and Flint 1974; Kondratev and Zadorina 1992) by feeding at the surface, upending, dabbling, or diving for their prey (Dau 1974; Kistchinski and Flint 1974; Kondratev and Zadorina 1992). During the non-breeding seasons, they forage in marine habitats and mostly consume benthic invertebrates in waters greater than 262 ft (80 m) deep (Petersen et al. 1998) by diving for their prey (Dau 1974; Kondratev and Zadorina 1992). Foxes, gulls, and ravens prey upon spectacled eider eggs and ducklings on their breeding grounds (Alaska Department of Fish and Game 2017d).

Steller's Eider

Steller's eider (Polysticta stelleri) is listed as threatened under the ESA (62 FR 31748) and is a species of special concern in the state of Alaska (AS 16.20.190). In 2001, the USFWS designated critical habitat for the Alaska breeding population of Steller's eiders (66 FR 8850). The critical habitat encompasses approximately 2,819 mi2 (7,300 km2) and includes breeding habitat on the Yukon-Kuskokwim Delta and Kuskokwim Shoals, Sea Islands, Nelson Lagoon, and Izembek Lagoon in western Alaska (Alaska Department of Fish and Game 2017d). The most recent recovery plan for the Steller's eider was released in 2002, with an updated recovery task list released in 2007 (U.S. Fish and Wildlife Service 2002).

Currently, three breeding populations of Steller's eiders are recognized worldwide. Two of these populations breed in Russia and the other breeds in Alaska. The Russian-Atlantic population breeds in Russia and winters in the Barents and Baltic Seas of northern Europe and the Russian-Pacific population breeds in Russia and winters in the Bering Sea and northern Gulf of Alaska (Alaska Department of Fish and Game 2017d). The third population of Steller's eiders breed along the arctic coast of Alaska, particularly near Utqiagvik (Barrow) (Kertell 1991; Quakenbush and Suydam 1999). Steller's eiders also breed in western Alaska on the Yukon-Kuskoskwim Delta, but only in small numbers (Alaska Department of Fish and Game 2017d). Steller's eiders nest in tundra habitats near the coast, generally 12—19 mi (20–30 km) from the coast but may use nesting locations as far as 62—93 mi (100–150 km) from the coast (Bowler et al. 1997; Solovieva 1997a; Syroechkovski Jr. 1997). Steller's eiders nest on low hillocks, peat ridges, or elevated dry habitats covered with mosses, sedges, grasses, and lichens (Cramp and Simmons 1977; Palmer 1976; Solovieva 1997b) in the vicinity of freshwater ponds (Deygtyarev et al. 1999). Steller's eiders migrate long distances each year, up to 2,983 mi (4,800 km), between their breeding and wintering grounds. They migrate side by side in long lines only a few feet above the water. They generally travel along coastlines or follow open leads in the ice. The timing of the molt migration appears to be highly variable, occurring sometimes as early as August, but in some years not until November (Kear 2005).

Steller's eiders prey upon larvae in freshwater ponds and mollusks, crustaceans, polychaete worms, echinoderms, small fish, gephyrean worms, gastropods, and brachiopods in marine environments (Bustnes et al. 2000; Cottam 1939; Cramp and Simmons 1977; Metzner 1993; Petersen 1981). They forage in coastal lagoons and inlets, around reefs, and in marine bays. They are often associated with sea lettuce (Ulva), eelgrass (Zostera), and brown seaweed (Fucus) where small mollusks, gastropods, and crustaceans are abundant (Fredrickson 2001). Steller's eider eggs and ducklings are predated upon by common ravens (Corvus corax), jaegers (Stercorarius parasiticus), snowy owls (Bubo scandiacus), Arctic foxes (Vulpes lagopus), red foxes (Vulpes vulpes), and large gulls. On their wintering grounds, adults are preyed upon by bald eagles (Haliaeetus leucocephalus) (Alaska Department of Fish and Game 2017d).

Sea Stars

A single species of sea star, the sunflower sea star (Pycnopodia helianthoides), was proposed as a proposed threatened species on March 16, 2023 (88 FR 16212). The NMFS determined that the sunflower sea star is likely to become an endangered species within the foreseeable future throughout its range.

The sunflower sea star is among the largest sea stars in the world, reaching over 1 meter (m) in total diameter from ray tip to ray tip across the central disk. The documented geographic range spans the Northeastern Pacific Ocean from the Aleutian Islands to Baja California (NMFS 2023), including 33 degrees of latitude (3,663 km) across western coasts of the continental United States, Canada, and northern Mexico. The farthest northern reaches of sunflower sea star observations include Bettles Bay, Anchorage, Alaska (Gravem et al., 2021), and westernmost include central and eastern Aleutian Islands (Kuluk Bay, Adak Island east to Unalaska Island, Samalga Pass, and Nikolski) (Feder 1980; O'Clair and O'Clair 1998; Jewett et al. 2015; Gravem et al. 2021). The sunflower sea star is generally most common from the Alaska Peninsula to Monterey, California.

The sunflower sea star has no clear associations with specific habitat types or features and is considered a habitat generalist (Gravem et al. 2021). The large geographic and depth range of the sunflower sea star indicates this species is well adapted for a wide variety of environmental conditions and habitat types. The species is found along both outer coasts and inside waters, which consist of glacial fjords, sounds, embayments, and tidewater glaciers. They inhabit kelp forests and rocky intertidal shoals (Hodin et al. 2021) but are regularly found in eelgrass meadows as well (Dean and Jewett 2001; Gravem et al. 2021). Sunflower sea stars occupy a wide range of benthic substrates including mud, sand, shell, gravel, and rocky bottoms while roaming in search of prey (Konar et al. 2019; Lambert et al. 2000). They are most common at depths less than 25 m but occur in the low intertidal and subtidal zones to a depth of 435 m; however, are rare in waters deeper than 120 m (Fisher 1928; Lambert 2000; Hemery et al. 2016; Gravem et al. 2021).

Most sea star species, including the sunflower sea star, have separate sexes that are externally indistinguishable from one another, and each ray of an adult contains a pair of gonads (Chia and Walker 1991). Gametes are broadcast through gonopores on each ray into the surrounding seawater and fertilization occurs externally. Fertilized larvae develop through pelagic planktotrophic stages, capturing food with ciliary bands (Strathmann 1971; 1978; Byrne 2013). Time from egg fertilization to metamorphosis for the sunflower sea star under various conditions has been described as 49 to 77 days (Hodin et al. 2021), 60 to 70 days (Greer 1962), and 90 to 146 days (Strathmann 1978). The longevity of sunflower sea stars in the wild is unknown, as is the age at first reproduction (as noted above) and the period over which a mature individual is capable of reproducing, but these parameters are needed to calculate generation time.

Larval and pre-metamorphic sunflower sea stars are planktonic feeders. The diet of adult sunflower sea stars generally consists of benthic and mobile epibenthic invertebrates, including sea urchins, snails, crab, sea cucumbers, and other sea stars (Mauzey et al. 1968; Shivji et al. 1983), and appears to be driven largely by prey availability. Sunflower sea stars also feed on sessile invertebrates, such as barnacles and various bivalves (Mauzey et al. 1968). Mussels are a common prey in intertidal regions in Alaska (Paul and Feder 1975). Clams can also constitute a major proportion of their diet, with up to 72 percent coming from clams at subtidal sites within Puget Sound (Mauzey et al. 1968). Adults excavate clams from soft or mixed-substrate bottoms by digging with one or more arms (Smith 1961; Mauzey et al. 1968). Sunflower sea stars locate their prey using chemical signals in the water and on substrate, and may show preference for dead or damaged prey (Brewer and Konar 2005), likely due to reduced energy expenditure associated with catching and subduing active prey; thus, they occasionally scavenge fish, seabirds, and octopus (Shivji et al. 1983).

Primary threats to the sunflower sea star include disease, habitat degradation and modification, pollutants, and climate change. Disease, specifically SSWS, was identified by the SRT as the single greatest threat affecting the persistence of the sunflower sea star both now and into the foreseeable future (Lowry et al. 2022). While the etiology of the disease as well as what trigger(s) resulted in its rapid spread to pandemic levels remain unknown (Hewson et al. 2018), the widespread occurrence of, and impacts from, the disease from 2013 through 2017 are broadly documented. Hamilton et al. (2021) noted a 94.3 percent decline throughout the range of the sunflower sea star after the outbreak of SSWS. The 12 regions defined by Hamilton et al. (2021) encompass the known range of the sunflower sea star, and each region exhibited a decline in density and occurrence from approximately 2013 through 2017, with populations in the six more northern regions characterized by less severe declines (40 to 96 percent declines) than those in the six regions spanning from Cape Flattery, WA, to Baja, MX, where the sunflower sea star is now exceptionally rare (99.6 to 100 percent declines). A number of factors ranging from environmental stressors to the microbiome in the sea stars may play a role (Lloyd and Pespeni 2018; Konar et al. 2019; Aquino et al. 2021). Ocean warming has also been linked to outbreaks, hastening disease progression and severity (Harvell et al. 2019; Aalto et al. 2020). Regardless of the pathogen’s unknown etiology to date, stress and rapid degeneration ultimately result with symptomatic sea stars suffering from abnormally twisted arms, white lesions, loss of body tissue, arm loss, disintegration, and death.

Habitat degradation and modification in nearshore areas of the Pacific Coast as a consequence of direct human influence is largely concentrated in urbanized centers around estuaries and embayments (Lowry et al. 2022), with considerable tracts of sparsely populated, natural shoreline in between. This is especially true of the northern portion of the range. In urbanized areas, nearshore modification to accommodate infrastructure has dramatically changed the available habitat over the last two hundred years. The relative importance of specific habitats to the range-wide health and persistence of the sunflower sea star is difficult to quantify, however, because suitable habitat occurs well beyond the depth range where most sampling occurs. Under current nearshore management practices, the sunflower sea star has persisted in urban seascapes at apparently healthy population levels until very recently, when SSWS resulted in the death of

90 percent or more of the population. As a result, the SRT determined that nearshore habitat destruction or modification was a low-level contributor to overall extinction risk (Lowry et al. 2022). Sunflower sea stars also occur on benthic habitats to depths of several hundred meters, and anthropogenic stressors affecting these offshore waters are markedly different from those affecting the nearshore. Quantifying impacts to sunflower sea star habitat in deeper waters is more complicated, however, and less information is available to support a rigorous evaluation. Fishing with bottom-contact gear, laying communications or electrical cables, mineral and oil exploration, and various other human activities have direct influence on benthic habitats in offshore waters of the North Pacific Ocean. The activities are highly likely to interact with sunflower sea stars at some level, but data are lacking regarding both the distribution of individuals in these deeper waters and impacts from particular stressors.

The direct impacts of environmental pollutants to the sunflower sea star are unknown, but they likely have similar effects to those seen in other marine species, given physiologically similar processes (Lowry et al. 2022). Reductions in individual health and disruption of nutrient cycling through food webs are hallmarks of industrial chemicals, heavy metals, and other anthropogenic contaminants. Any impacts that do exist are likely to be more intensive near their source, such as urban bays and estuaries, though many persistent contaminants are known to bioaccumulate in some organisms and spread over long distances over the course of decades or more.

The addition of anthropogenically released greenhouse gases into the atmosphere since the industrial revolution has resulted in climate change that is affecting organisms and environments on a global basis (Lowry et al. 2022). While direct linkages between climate change and sunflower sea star population status have not been made in the literature, impacts to prey base, habitat, and SSWS can all be inferred from available data.

FISH

ESA-Listed Fish Species

A general description of habitat preference and life history of all ESA-listed fish species that may occur within the proposed action areas is provided in this section. Table 3-3 summarizes these species and where they may be encountered. No ESA-listed fish species have designated critical habitat within the proposed action area.

TABLE 0-3. ESA-LISTED FISH SPECIES WITHIN THE PROPOSED ACTION AREA

Species	Listing Status	Relative Occurrence	Critical Habitat
Chinook Salmon (Oncorhynchus tshwytscha)	Endangered (Sacramento River Winter-run, Upper Columbia River Spring-run); Threatened (Snake River Spring/Sumer-run, Snake River Fall-run, Central valley Spring-run, California Coastal, Puget Sound, Lower Columbia River, Upper Willamette River)	Likely*	No Overlap
Chum Salmon (Oncorhynchus keta)	Threatened (Hood Summer-run, Columbia River)	Likely	No Overlap

Species	Listing Status	Relative Occurrence	Critical Habitat
Coho Salmon (Oncorhynchus kisutch)	Endangered (Central California Coast); Threatened (Southern Oregon/Northern California Coasts, Lower Columbia River, Oregon Coast)	Likely*	No Overlap
Pacific Eulachon (Thaleichthys pacificus)	Threatened (Southern Distinct Population Segment [DPS])	Likely*	No Overlap
Sockeye Salmon (Oncorhynchus nerka)	Endangered (Snake River); Threatened (Ozette Lake)	Likely*	No Overlap
Steelhead Trout (Oncorhynchus mykiss	Endangered (Southern California); Threatened (Upper Columbia River, Snake River Basin, Middle Columbia River, Lower Columbia River, Upper Willamette River, South-Central California Coast, Central California Coast, Northern California, California Central Valley, Puget Sound)	Likely*	No Overlap
Yelloweye Rockfish (Sebastes ruberrimus)	Threatened	Potential	No Overlap

*Although this species would be expected to be encountered in the proposed action area, individuals from the ESA listed population would not be expected or would have an extremely low likelihood of being present.

Chinook Salmon

Many West Coast salmon (Oncorhynchus spp.) stocks have declined substantially from their historic numbers and now are at a fraction of their historical abundance. There are several factors that contribute to these declines, including: overfishing, loss of freshwater and estuarine habitat, hydropower development, poor ocean conditions, and hatchery practices. These factors collectively led to NMFS's listing of 28 salmon and steelhead stocks that spawn in California, Idaho, Oregon, and Washington under the ESA. Six Chinook salmon (Oncorhynchus tshwytscha) ESUs are considered in this Letter of Concurrence, including one endangered ESU and five threatened ESUs.

There are different seasonal (i.e., spring, summer, fall, or winter) "runs" in the migration of Chinook salmon from the ocean to freshwater, even within a single river system. These runs have been identified on the basis of when adult Chinook salmon enter freshwater to begin their spawning migration. However, distinct runs also differ in the degree of maturation at the time of river entry, the temperature and flow characteristics of their spawning site, and their actual time of spawning.

Chinook salmon, also called king salmon, are the largest (average 10-50 pounds, maximum 126 pounds) and least abundant species of Pacific salmon (Wahle et al. 1981). They are anadromous, spending most of their adult lives (2-6 years) in the ocean before returning to their natal streams to spawn and die. Juvenile fish spend three months to two years in the freshwater streams post-hatching before migrating to the ocean.

Chinook salmon range throughout the North Pacific as far west as waters off the coasts of Japan and Russia, and south to southern California. The six Chinook ESUs considered in this Letter of Concurrence have all been documented in the Gulf of Alaska, including Southeast Alaska troll fisheries and Gulf of Alaska ground fisheries (Wahle and Vreeland 1978, Wahle et al. 1981, Crane et al. 2000, Templin and Seeb 2004). The Lower Columbia River and Upper Willamette River Chinook ESUs are also found in the Bering Sea

(NMFS 2009a). Chinook salmon from the six ESA-listed ESUs considered in this Letter of Concurrence are potentially present in Alaska marine waters only as juveniles or adult because their spawning/egg and larval life stages occur exclusively in freshwater streams in Washington, Oregon, and Idaho.

The Upper Columbia River spring-run and Sacramento River winter-run evolutionarily significant units (ESUs) of Chinook salmon are listed as endangered under the ESA (79 FR 40004; July 11, 2004; 59 FR 440; January 4, 1994). Seven other ESUs, including California Coastal and Central Valley spring-run are listed as threatened (81 FR 51549; August 4, 2106). NMFS has published recovery plans for multiple Chinook salmon ESUs (NMFS 2006, 2007, 2011, 2013a, 2016a). Critical habitat has been designated in streams and rivers along the Pacific Coast of the continental U.S. but does not overlap with the proposed action area. Sacramento River winter-run Chinook salmon are listed as endangered, and Sacramento River spring-run are listed as threatened by the state of California. The contribution of listed chinook salmon stocks to the ocean fishery is very small, and largely limited to California waters, therefore the likelihood of encountering an individual from an ESA-listed ESU in the Arctic Shield proposed action area is very low (Barnett-Johnson et al. 2007; Groot and Margolis 1991).

Within Alaska, early life history stages of Chinook salmon occur in freshwater and juveniles and adults utilize marine habitats. Juvenile Chinook salmon migrate to marine waters after three months to two years spent in freshwater (Groot and Margolis 1991; Healey 1991; Myers et al. 1998) and prefer coastal areas less than 34 mi (54 km) from shore throughout California, Oregon, and Washington, north to the Strait of Georgia and the Inland Passage, Alaska (PFMC 2000). The majority of marine juveniles are found within 17 mi (34 km) of the coast (PFMC 2000) and tend to concentrate around areas of pronounced coastal upwelling (PFMC 2000). Chinook salmon return to estuarine waters in early spring, shortly before moving upriver to spawn (Keefer et al. 2008). Chinook spawning in rivers south of the Rogue River in Oregon rear in marine waters off California and Oregon, whereas salmon spawning in rivers north of the Rogue River migrate north and west along the Pacific coast (NOAA 2005). These salmon migrations are important from a management perspective as fish from Oregon, Washington, British Columbia, and Alaska could potentially be harvested in Alaska (NOAA 2005). Juvenile Chinook salmon feed on terrestrial and aquatic insects, amphipods, and other crustaceans. Adult Chinook salmon feed primarily on other fish species (AECOM 2013).

Chum Salmon

Columbia River and Hood Canal summer-run ESUs of chum salmon (Oncorhynchus keta) are listed as threatened under the ESA (70 FR 37160; June 28, 2005). Recovery plans were published for both chum salmon ESUs in 2005 and 2013, respectively (Brewer et al. 2005; NMFS 2013a). Designated critical habitat for chum salmon does not overlap with any of the proposed action areas, as it occurs within coastal water bodies in the states of Washington and Oregon (70 FR 52630; September 2, 2005). Chum salmon would be expected to occur within the Arctic Shield proposed action area.

Chum salmon have the largest range of natural geographic and spawning distribution of all the Pacific salmon species (Pauley et al. 1988). Juvenile chum salmon occur along the coast of North America and

Alaska in a band that extends out to 22 mi (36 km) from shore (Salo 1991). Chum salmon are an anadromous species distributed throughout the North Pacific Ocean and Bering Sea (Salo 1991). They are highly migratory with fry heading seaward immediately after emergence (North Pacific Fishery Management Council 1990; Salo 1991). Migrations of juvenile chum salmon are correlated with the warming of nearshore waters (Salo 1991). Within the Gulf of Alaska, early life history stages for chum salmon occur in freshwater, but juveniles and adults utilize marine habitats. Juvenile chum salmon migrations follow the Gulf of Alaska coastal belt to the north, west, and south during their first summer at sea (Salo 1991). Juvenile chum salmon within the Gulf of Alaska tend to move offshore into the central Gulf of Alaska or westward along the Aleutian Islands into the North Pacific Ocean and the Bering Sea as they mature (Urawa et al. 2009). Migrations of immature fish during the late summer, fall, and winter occur in a broad southeasterly fashion, primarily south of 50°N and east of 155°W in the Gulf of Alaska. During the spring and early summer, chum salmon migrate to the north and west (Salo 1991). Maturing fish destined for North American streams are widely distributed throughout the Gulf of Alaska during the spring and summer (Salo 1991).

Young chum salmon feed on a variety of aquatic insects during their run from natal streams down to the ocean. While rearing in estuarine environments, juvenile chum salmon eat primarily epibenthic invertebrates, including copepods, amphipods, mysids, and other crustaceans (Brewer et al. 2005; NMFS 2013a).

Coho Salmon

Three ESUs of coho salmon (Oncorhynchus kisutch) are listed as threatened under the ESA, and the Central California coast ESU is listed as endangered (70 FR 37160; June 28, 2005; 76 FR 35755; June 20, 2011). NMFS published recovery plans for the Southern Oregon/Northern California Coast ESU in 2014, the Lower Columbia ESU in 2013, and for the Central California coast ESU in 2012 (NMFS 2012b, 2013a, 2014). Critical habitat for coho salmon, is designated within rivers and tributaries in Washington, Oregon, and California, but does not overlap with any of the proposed action areas (central California coast ESU: 64 FR 24049; May 5, 1999; Oregon coast ESU: 73 FR 7816; February 11, 2008; lower Columbia River ESU: 81 FR 9251; February 24, 2016). Coho salmon are likely to occur within the Arctic and Pacific Northwest proposed action areas. However, individuals from listed stocks rarely extend further north than Puget Sound, and individuals captured further north than the Yakutat region of Alaska are virtually exclusively from Alaskan natal stocks. Thus, it would be extremely uncommon to encounter a fish from a listed stock in the Arctic Shield proposed action area (Adams et al. 2007; Weitkamp and Neely 2002).

Coho salmon spawn in freshwater drainages from Monterey Bay, California northwards along the west coast of North America up to Alaska, around the Bering Sea south through Russia to Hokkaido, Japan (CDFG 2002). Oceanic life stages are found from Baja California north to Point Hope, Alaska and through the Aleutian Islands (Marine Biological Consultants 1987; NOAA 2005; Sandercock 1991). Adult coho salmon migrate into streams where they deposit their eggs in gravel (Sandercock 1991). Eggs incubate throughout the winter and emerge in the spring as free-swimming fry (Sandercock 1991).

In Alaska, coho salmon spend up to four months in coastal waters before migrating offshore (NOAA 2005; Spence and Hall 2010). The extent of coho salmon migrations appears to extend westward along the Aleutian Islands chain ending somewhere around Emperor Seamount, which is thought to be an area of high prey abundance (PFMC 2000). Coho salmon spend a minimum of 18 months at sea before returning to their natal streams to spawn (North Pacific Fishery Management Council 1990; Sandercock 1991).

Coho salmon eat a variety of aquatic and terrestrial insects and invertebrates while rearing and have been observed leaping from the water to capture flying insects. Coho salmon rapidly transition to piscivory, including cannibalism, to supplement their diet during their extended overwinter rearing interval. Oceanic coho salmon eat a variety of small fish, as well as larger invertebrates including amphipods, isopods, and euphausiids (CDFG 2016; CDFG 2002; Miller and Simenstad 1997; Sandercock 1991).

Sockeye Salmon

Sockeye salmon (Oncorhynchus nerka) are the third most abundant of the Pacific salmonids, but two ESUs, the Ozette Lake ESU, which is listed as threatened (64 FR 14528; March 25, 1999), and the Snake River ESU, which is listed as endangered (56 FR 58619; November 20, 1991), remain listed under the ESA (Irvine et al. 2009). Designated critical habitat for sockeye salmon is located in interior Washington State and does not overlap with the proposed action area (Snake River ESU: 58 FR 68543; December 28, 1993; Lake Ozette ESU: 70 FR 52630; September 2, 2005). NMFS published a recovery plan for the Lake Ozette ESU in 2009 and a recovery plan for the Snake River ESU in 2015, respectively (NMFS 2009b, 2015a). Sockeye salmon occurring in the Arctic Shield proposed action area are thought to be exclusively from the non-ESA listed populations that use Canadian and Alaskan natal streams. Therefore, the likelihood of encountering an ESA-listed fish from the two listed ESUs in the Arctic Shield proposed action area is extremely low (Beacham et al. 2005; Wilcock et al. 2011).

Spawning is temperature-dependent and varies by location, generally occurring from August to December and peaking in October (Emmett et al. 1991). Sockeye salmon typically spawn in streams associated with lakes where the juveniles rear in the limnetic zone before they migrate to the ocean (Burgner 1991; Emmett et al. 1991). For this reason, the two largest spawning complexes are the Bristol Bay watershed in southwestern Alaska and the Fraser River watershed in British Columbia, both of which have extensive lake-rearing habitats accessible to sockeye salmon (Burgner 1991).

Seaward migrations of Alaska natal stocks begin in mid-May in association with salinity gradients (North Pacific Fishery Management Council 1990). Ocean residency for sockeye salmon is from one to four years (Pauley et al. 1989). The diet of juvenile sockeye salmon includes insects and large zooplankton, while larger fish become more piscivorous, consuming fish such as sand lance, walleye pollock and squid (Farley et al. 2007).

Steelhead Trout

Steelhead trout (Oncorhynchus mykiss) are an anadromous form of rainbow trout protected under the ESA. Of the 15 steelhead trout DPSs, one is listed as endangered, ten are listed as threatened, and one is an ESA species of concern (71 FR 834; January 5, 2006) (81 FR 51549; August 4, 2106). Critical habitat for steelhead trout is designated in areas of Oregon, Washington, Idaho, and California, but does not overlap with the proposed action area (70 FR 52488 and 70 FR 52630; September 2, 2005; 81 FR 9251; February 24, 2016). Steelhead trout are likely to be encountered in the very southern portions of the Arctic Shield proposed action area in Bristol Bay or along the Aleutian Islands (Good et al. 2005). NMFS has published recovery plans for multiple steelhead trout DPSs (NMFS 2007, 2009c, 2011, 2012d, 2013a, 2013c, 2016a). Of the listed steelhead trout, it is extremely difficult to differentiate between stocks when considering steelhead trout offshore; trout undergo substantial migrations offshore, although some fish may move farther due to distance between centers of high abundance and natal streams (Burgner et al. 1989).

The present distribution of steelhead trout extends from the Kamchatka Peninsula in Asia, east to Alaska and south to Southern California (Good et al. 2005). Steelhead trout may exhibit either an anadromous lifestyle or spend their entire life in freshwater (where they are commonly referred to as rainbow trout) (NMFS 1997). Most steelhead trout within the vicinity of the Pacific Northwest proposed action area are likely from the "winter" run that migrate to freshwater in the fall and winter, where they spawn within a few weeks or months (McEwan and Jackson 1996). Ocean-maturing steelhead trout typically spawn between December and April, with the peak between January and March, but migrating steelhead trout may be seen in the San Francisco Bay and Suisun Marsh and Bay as early as August (Leidy 2000). The ocean distribution for steelhead trout is not known in detail, but steelhead trout are caught only rarely in ocean salmon fisheries. Studies suggest that steelhead trout do not generally congregate in large schools as other Pacific salmon species (Burgner et al. 1992; Groot and Margolis 1991).

Steelhead trout spend little time in estuaries and are abundant throughout the North Pacific and Gulf of Alaska (Emmett et al. 1991). In coastal Alaska, eggs and larvae of steelhead trout are found only in freshwater habitats, while the later life history stages (i.e., juveniles and adults) utilize the marine environment. In the spring, Alaskan steelhead smolt, leave their natal streams, and enter the ocean where they reside for one to three years before returning to spawn (NOAA 2005). Populations may return in July (summer-run) or in August, September, and October (fall run) (NOAA 2005). Summer returns are rare in Alaska and are only found in a few southeast Alaska streams. Fall-run steelhead trout are much more common in Alaska, north of Frederick Sound (near Juneau). Steelhead trout also exhibit spring runs (April, May, and June), but they are predominately found in southeast Alaska. Juvenile steelhead trout feed primarily on zooplankton. Adult steelhead trout feed on aquatic and terrestrial insects, mollusks, crustaceans, fish eggs, minnows, and other small fish species (Moyle et al. 2008).

It is unlikely that any of the listed steelhead trout would be present in the Arctic Shield proposed action area as the ESA-listed stocks are found in continental U.S. waters (NMFS 2007, 2009a, 2011, 2012d, 2013a, 2013c, 2016a). Therefore, no further analysis of ESA-listed steelhead trout will be included.

Pacific Eulachon

The Southern Distinct Population Segment (DPS) of eulachon (Thaleichthys pacificus) is listed as threatened under the ESA (75 FR 13012; March 18, 2010). NMFS published a recovery plan for the

Southern DPS of eulachon in 2017 (NMFS 2017). Critical habitat for the Southern DPS of eulachon has been designated in the Lower Columbia River (76 FR 65324; October 20, 2011) but does not overlap with the proposed action area. Eulachon are likely to occur within the Arctic Shield proposed action area; however, Eulachon occurring in the Arctic Shield proposed action area are thought to be exclusively from the non-ESA-listed Northern DPS. The Northern DPS uses Canadian and Alaskan natal streams and the Southern DPS uses natal streams in the continental US. Therefore, the likelihood of encountering a Eulachon from the Southern DPS in the Arctic Shield proposed action area is extremely low (Flannery et al. 2013; Gustafson et al. 2016; National Oceanic and Atmospheric Administration 2014).

Eulachon are endemic to the eastern Pacific Ocean, ranging from northern California to southern Alaska and into the southeastern Bering Sea. In the continental U.S., most eulachon originate in the Columbia River Basin. Eulachon occur in nearshore ocean waters, except for the brief spring spawning runs into their natal streams. Spawning grounds are typically in the lower reaches of larger snowmelt-fed rivers with water temperatures ranging from 39 to 50 degrees Fahrenheit (4 to 10 degrees Celsius) (National Oceanic and Atmospheric Administration 2014). Eulachon typically spend three to five years in saltwater before returning to freshwater to spawn from late winter through mid-spring. The larvae are then carried downstream and are dispersed by estuarine and ocean currents shortly after hatching. Juvenile eulachon move from shallow nearshore areas to deeper water and may be observed in depths up to 2,000 ft (600 m), but typically remain between 80 and 500 ft (25-150 m) (Allen and Smith 1988). Eulachon are filter feeders, consuming primarily zooplankton (National Oceanic and Atmospheric Administration 2014).

Yelloweye Rockfish

The Puget Sound/Georgia Basin DPS of yelloweye rockfish (Sebastes ruberrimus) is listed as threatened under the ESA (75 FR 22276; April 28, 2010) and may occur in the far southern portions of the Arctic Shield proposed action area. Critical habitat for the Puget Sound/Strait of Georgia yelloweye rockfish DPS is the same as critical habitat designated in 2015 for bocaccio (79 FR 68042; November 13, 2015). Critical habitat does not overlap with the proposed action area. Yelloweye rockfish are present through the Aleutian Islands, and thus, may be encountered at the southern edge of the proposed action area, though they are most common from central California through the Gulf of Alaska. NMFS has not published a final recovery plan for this species.

Yelloweye rockfish larval release occurs between February and September. The larval young are found in surface waters and may be distributed over a wide area extending several hundred miles offshore. Larvae and small juvenile rockfish may remain in open waters for several months, being passively dispersed by ocean currents. Yelloweye rockfish juveniles do not typically occupy shallow, intertidal areas, but settle in deeper waters from 300—590 ft (91—180 m) (Drake et al. 2010). Juvenile rockfish consume a variety of large marine zooplankton (e.g., copepods and euphausiids), while adults are primarily piscivorous, with large adult yelloweye considered apex predators (Love et al. 2002).

Fish Hearing

All fish have two sensory systems to detect sound in the water: the inner ear, which functions very much like the inner ear in other vertebrates, and the lateral line, which consists of a series of receptors along the fish's body (Popper and Schilt 2008). The inner ear generally detects relatively higher-frequency sounds, while the lateral line detects water particle motion at low frequencies (below a few hundred Hz) (Hastings and Popper 2005). Lateral line receptors respond to the relative motion between the body surface and surrounding water; this relative motion, however, only takes place very close to sound sources and most fish are unable to detect this motion at more than one to two body lengths distance away (Popper et al. 2014).

Although hearing capability data only exist for fewer than 100 of the 32,000 fish species, data suggest that most species of fish detect sounds from 50 to 1,000 Hz, with a few fish hearing sounds above 4 kHz (Popper 2008). Most fish are believed to have their best hearing sensitivity from 100 to 400 Hz (Popper 2003). Permanent hearing loss has not been documented in fish. A study by Halvorsen et al. (2012) found that for temporary hearing loss or similar negative impacts to occur, the noise needed to be within the fish's individual hearing frequency range; external factors, such as developmental history of the fish or environmental factors, may result in differing impacts to sound exposure in fish of the same species. The sensory hair cells of the inner ear in fish can regenerate after they are damaged, unlike in mammals where sensory hair cells loss is permanent (Lombarte et al. 1993; Smith et al. 2006). As a consequence, any hearing loss in fish may be as temporary as the timeframe required to repair or replace the sensory cells that were damaged or destroyed (Smith et al. 2006), and no permanent loss of hearing in fish would result from exposure to sound.

The inner ears of fish are directly sensitive to acoustic particle motion rather than acoustic pressure. Although a propagating sound wave contains pressure and particle motion components, particle motion is most significant at low frequencies (less than a few hundred Hz) and closer to the sound source. A fish's gas-filled swim bladder can enhance sound detection by converting acoustic pressure into localized particle motion, which may then be detected by the inner ear. Fish with swim bladders generally have better sensitivity and better high-frequency hearing than fish without swim bladders (Popper and Fay 2010). Some fish also have specialized structures such as small gas bubbles or gas-filled projections that terminate near the inner ear. These fish have been called "hearing specialists," while fish that do not possess specialized structures have been referred to as "generalists" (Popper 2003). In reality, many fish species possess a continuum of anatomical specializations that may enhance their sensitivity to pressure (versus particle motion), and thus higher frequencies and lower intensities (Popper and Fay 2010).

Past studies indicated that hearing specializations in marine fish were quite rare (Amoser and Ladich 2005; Popper 2003). However, more recent studies show there are more fish species than originally investigated by researchers, such as deep-sea fish, that may have evolved structural adaptations to enhance hearing capabilities (Deng et al. 2011). Marine fish families holocentridae (squirrelfish and soldierfish, in the Order Beryciformes), pomacentridae (damselfish in the Order Perciformes), gadidae (cod, hakes, and grenadiers in the Order Gadiiformes), and sciaenidae (drums, weakfish, and croakers also in the Order Perciformes) have some members that can potentially hear sound up to a few kHz. There are marine fish in the Orders of Beryciformes, Perciformes, and Gadiiformes present in the proposed action area. Some families within these Orders are thought to possibly have hearing sensitivities in the range of the frequencies of the Proposed Action (though research is inconclusive; details below).

Additional evidence exists, based on the structure of the ear and the relationship between the ear and the swim bladder, that at least some deep-sea species, including myctophids, may have hearing specializations and thus be able to hear higher frequencies (Popper 1977, 1980), although it has not been possible to do actual measures of hearing on these fish.

While no auditory studies have been completed on Arctic cod specifically, and anatomical differences may result in different hearing abilities, other Gadidae have the potential to be surrogate species for Arctic cod. Gadidae have been shown to detect sounds up to about 500 Hz (Popper 2008; Sand and Karlsen 1986). Atlantic cod (Gadus morhua) may also detect high-frequency sounds (Astrup and Mohl 1993). Astrup and Møhl (1993) indicated that conditioned Atlantic cod have high frequency thresholds of up to 38 kHz at 185 to 200 dB re 1 μPa, which likely only allows for detection of odontocetes' clicks at distances no greater than 33—98 ft (10—30 m) (Astrup 1999). A more recent study by Schack et al (2008) revisited the conclusions from Astrup and Mohl's study, arguing that hearing and behavioral responses in Atlantic cod would be different with unconditioned fish. They found that ultrasound exposures mimicking those of echosounders and odontocetes would not induce acute stress responses in Atlantic cod, and that frequent encounters with ultrasound sources would therefore most likely not induce a chronic state of stress (Schack et al. 2008). The discrepancies between the two studies remain unresolved, but it has been suggested the cod in Astrup and Mohl's (1993) study were conditioned to artifacts rather than to the ultrasonic component of the exposure (Astrup 1999; Ladich and Popper 2004; Schack et al. 2008). Additionally, Jørgensen et al (2005) found that juvenile Atlantic cod did not show any clear behavioral response when exposed to either 1.5 or 4 kHz simulated sonar sound. Therefore, accepted research on cod hearing indicates sensitivities limited to low-frequency sounds.

REPTILES (Sea Turtles)

There are six species of sea turtles and all sea turtles found in U.S. waters are listed under the ESA. Of the six, the leatherback sea turtle (Dermochelys coriacea) and loggerhead sea turtles (Caretta caretta) are listed as endangered under the ESA (leatherback sea turtle: 35 FR 8491; June 2, 1970, and loggerhead sea turtle: 76 FR 58868; September 22, 2011), while green sea turtles (Chelonia mydas) are listed as threatened (81 FR 20057; May 6, 2016). Only the range of the endangered leatherback sea turtle extends into the Arctic Shield proposed action area (specifically, the southern Bering Sea). All other sightings are limited to the Alaskan Gulf Coast.

Leatherback Sea Turtle

The leatherback sea turtle (Dermochelys coriacea) is listed as endangered under the ESA (35 FR 8491; June 2, 1970). There are seven recognized subpopulations of leatherback sea turtles, but only the western Pacific leatherback subpopulation is found in the proposed action area. NMFS published a recovery plan for the western Pacific subpopulation in 1998 (NMFS and USFWS 1998). Critical habitat for leatherback sea turtles has been designated off the coasts of California, Oregon, and Washington (77 FR 4170; January 26, 2012) (NMFS 2012c). The proposed action area does not overlap designated leatherback sea turtle critical habitat. Leatherback sea turtles may rarely occur in the southernmost portion of the Arctic proposed action area but are considered extralimital.

Leatherback sea turtles are commonly known as pelagic animals, but they also forage in coastal waters (Dodge et al. 2014). The leatherback sea turtle is the most widely distributed of all sea turtles, foraging in temperate and subpolar regions of all oceans, and migrating to tropical nesting beaches (NMFS and USFWS 1992). Leatherback sea turtles are highly migratory, exploiting convergence zones and upwelling areas in the open ocean, along continental margins, and in archipelagic waters (Eckert 1999). In the eastern North Pacific Ocean, leatherback sea turtles are broadly distributed from the tropics to as far north as Alaska (Hodge and Wing 2000). As mentioned previously, there are seven recognized subpopulations of leatherback sea turtles that vary widely in size, range, and population trend, but total global abundance is estimated at 54,262 nests (Wallace et al. 2013). Wallace et al. (2013) reported that the western Pacific leatherback sea turtle subpopulation has declined by 83 percent over the past three generations (roughly 100 years), mainly due to human exploitation, low hatching success, and fisheries bycatch.

Primary prey includes salps and jellyfish, which leatherback sea turtles eat with tooth-like cusps and sharp-edged jaws adapted for feeding on soft-bodied animals (Bjorndal 1997). Off of Washington, foraging peaks during the summer and fall when large aggregations of jellyfish arrive, particularly brown sea nettles (Chrysaora fuscescens) and moon jellies (Aurelia labiata) (Sato 2016). They also feed on other soft-bodied organisms (e.g., tunicates, cephalopods).

Sea Turtle Hearing

The auditory system of the sea turtle appears to work via water and bone conduction, with lower frequency sound conducted through skull and shell, and does not appear to function well for hearing in air (Lenhardt et al. 1983; Lenhardt et al. 1985). Sea turtles do not have external ears or ear canals to channel sound to the middle ear, nor do they have a specialized eardrum. Instead, fibrous and fatty tissue layers on the side of the head may be the sound-receiving membrane in the sea turtle, a function similar to that of the eardrum in mammals or may serve to release energy received via bone conduction (Lenhardt et al. 1983). Sound is transmitted to the middle ear, where sound waves cause movement of cartilaginous and bony structures that interact with the inner ear (Ridgway et al. 1969). Unlike mammals, the cochlea of the sea turtle is not elongated and coiled, and likely does not respond well to high frequencies, a hypothesis supported by a limited amount of information on sea turtle auditory sensitivity (Bartol 1994; Ridgway et al. 1969). Investigations suggest that sea turtle auditory sensitivity is limited to low-frequency bandwidths, such as the sound of waves breaking on a beach. The role of underwater low-frequency hearing in sea turtles is unclear. Sea turtles may use acoustic signals from their environment as guideposts during migration and as cues to identify their natal beaches (Lenhardt et al. 1983) but appear to rely on other non-acoustic cues for navigation, such as magnetic fields (Lohmann and Lohmann 1996) and light (Avens and Lohmann 2003). Additionally, they are not known to produce sounds underwater for communication.

Sea turtles typically hear low frequencies from 30 to 2,000 Hz, with a range of maximum sensitivity between 100 and 800 Hz (Bartol 1994; Bartol and Ketten 2006; Lenhardt 2002; Ridgway et al. 1969). Research of leatherback sea turtle hatchlings using auditory evoked potentials showed the turtles respond to tonal signals between 50 and 1,200 Hz in water (maximum sensitivity 100 to 400 Hz) (84 dB re: 1 μPa-rms [root mean square] at 300 Hz) (Piniak et al. 2012).

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Appendix F. Fishery Management Plans

The North Pacific Fishery Management Council (NPFMC) has fishing regulatory jurisdiction over Alaska's 0.89 million mi2 (2.3 million km2) EEZ. The Council manages fisheries in the Bering Sea, Aleutian Islands, and Gulf of Alaska and has developed six FMPs to achieve specified management goals for a fishery. Within the proposed action area, the Crab (North Pacific Fishery Management Council 2021a), Groundfish of the Gulf Alaska (North Pacific Fishery Management Council 2020a), Groundfish of the Bering Sea and Aleutian Islands (North Pacific Fishery Management Council 2020b), Salmon (North Pacific Fishery Management Council 2021b), and Scallop (North Pacific Fishery Management Council 2014) FMPs are applicable (Table 3-5). There is also an Arctic FMP (North Pacific Fishery Management Council 2009) which closed Federal waters of the U.S. Arctic to commercial fishing for any species of finfish, mollusk, crustacean, or any other form of marine animal or plant life. The harvest of marine mammals or birds is not regulated by the Arctic FMP, nor is subsistence or recreational fishing.

Crab Fishery Management Plan

Many commercially viable crab species, including red king and golden king crab (Paralithodes camtschaticus and Lithodes aequispina, respectively) as well as several species of tanner crab (Chionoectes spp.) can be found within the proposed action area. Seven species of crab have EFH within the proposed action area: blue king crab (Paralithodes platypus), golden king crab, grooved tanner crab (Chionoecetes tanneri), red king crab, snow crab (C. opilio), tanner crab (C. bairdi), and triangle tanner crab (C. angulatus). These species are predominantly fished in the Bering Sea, Aleutian Islands, and Bristol Bay region. Within the Groundfish FMP (Section 3.2.4.4), there are specific area closures to protect king and tanner crab habitat and molting grounds in the vicinity of Kodiak, Alaska, which is outside of the proposed action area.

Salmon Fisheries Management Plan

Five species of Pacific salmon have EFH designated in the proposed action area: Chinook salmon, chum salmon, coho salmon, pink salmon, and sockeye salmon. Salmon EFH includes streams, lakes, ponds, wetlands, and other water bodies currently or historically accessible to salmon. Freshwater EFH does not overlap with the proposed action area. The geographic extent of marine EFH for salmon stretches from the nearshore tidal submerged environments within state territorial seas out to the full extent of the EEZ, 200 nm (370 km) offshore, which overlaps with the proposed action area.

Scallop Fishery Management Plan

Scallops are managed jointly by NMFS and the Alaska Department of Fish and Game under the FMP for the scallop fishery off of Alaska. This FMP covers all scallop stocks off the coast of Alaska, including the weathervane scallop (Patinopecten caurinus), the only commercially exploited scallop in Alaska waters with EFH located within the proposed action area. EFH for the weathervane scallop is located along the Aleutian Island chain and in the southeast Bering Sea.

Groundfish Fishery Management Plan

Of the 66 groundfish species managed by the North Pacific Fisheries Management Council (NPFMC), 23 are known to occur within the proposed action area. These groundfish species occupy various marine environments including estuaries, tideland marshes, bays, fjords, sandy beaches, unprotected rocky shores, river deltas, and a variety of continental shelf, slope, seamount, and deep ocean habitats encompassing different physical and biological attributes at various stages in their life histories. The flatfishes have been divided into several categories for management purposes. With the exception of arrowtooth flounder (Atheresthes stomias), rex sole (Glyptocephalus zachirus), and flathead sole (Hippoglossoides elassodon), which are managed as individual species, the remaining flatfishes are managed as "shallow-water" and "deep-water" assemblages. Each of the managed individual species has its own EFH designation.

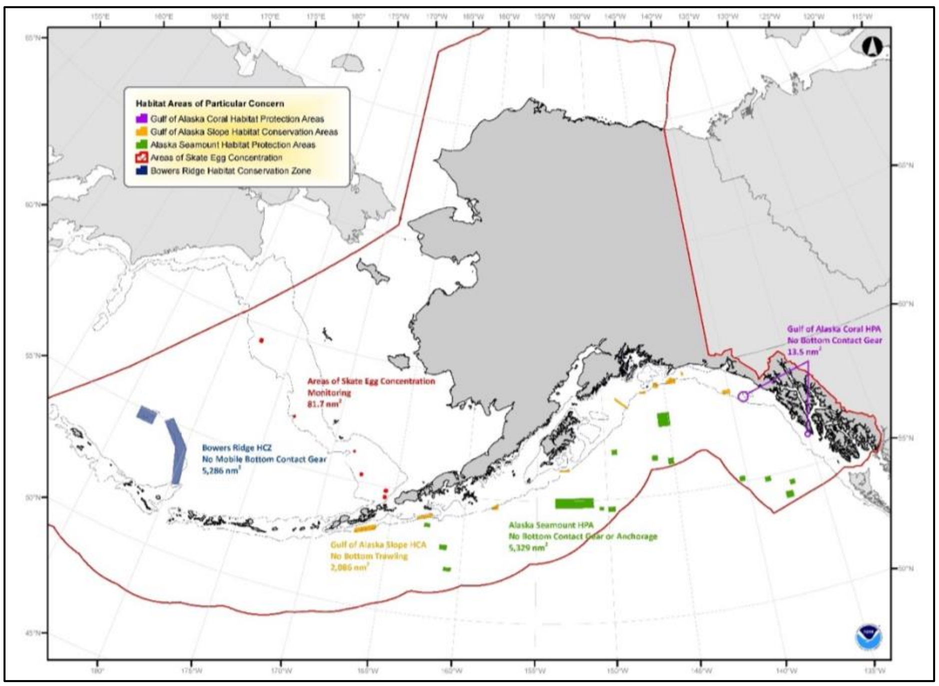

FIGURE 0-1. HABITAT AREAS OF PARTICULAR CONCERN (HAPC) LOCATED WITHIN ALASKA FISHERIES. ALL HAPCS EXCEPT THE GULF OF ALASKA CORAL HABITAT PROTECTION AREAS ARE LOCATED WITHIN THE PROPOSED ACTION AREA

TABLE 0-1. HABITAT AREAS OF PARTICULAR CONCERN (HAPC) LOCATED WITHIN

ALASKA FISHERIES. ALL HAPCS EXCEPT THE GULF OF ALASKA

HAPC	Individual HAPC's	Total Area Size	Fishery Management Application	Specific Regulation
Alaska Seamount Habitat Protection Areas	Dickens Seamount Denson Seamount Brown Seamount Welker Seamount Dall Seamount Quinn Seamount Giacomini Seamount Kodiak Seamount Odessey Seamount Patton Seamount Chirikof & Marchand Seamounts Sirius Seamount Derickson Seamount Unimak Seamount Bowers Seamount	5,300 nm^2	No federally permitted vessel may fish with bottom contact gear[i]. 50 CFR 679.22(a)(12)	Federal Register 50 CFR Part 679 Volume 71, No.124 Wednesday, June 28,2006 http://www.fakr.noaa.gov/frules/71fr36694.pdf
Bowers Ridge Habitat Conservation Zone	Bowers Ridge Ulm Plateau	5,330 nm^2	No federally permitted vessel may fish with mobile bottom contact gear [ii]. 50 CFR 679.22(a)(15)	Same as above
Gulf of Alaska Coral Habitat Protection Areas	Cape Ommaney 1 Fairweather FS1 Fairweather FS2 Fairweather FN1 Fairweather FN2	14 nm^2	No federally permitted vessel may fish with bottom contact gear [iii]. 50 CFR 679.22(b)(9)	Same as above
Gulf of Alaska Slope Habitat Conservation Areas	Yakutat Cape Suckling Kayak Island Middleton Island east Middleton Island west Cable Albatross Bank Shumagin Island Sanak Island Unalaska Island	1,892 nm^2	No federally permitted vessel may fish with nonpelagic trawl gear [iv]. 50 CFR 679.22(b)(10)	Same as above
Skate Nursery Areas	Bering 1 Bering 2 Bristol Pribilof Zhemchug Pervenets	81.7 nm^2	Monitoring Priority	Federal Register Vol. 80, No.6 Friday, January 09, 2015 http://alaskafisheries.noaa.gov/frules/80fr1378.pdf

[i] Bottom contact gear means nonpelagic trawl, dredge, dinglebar, pot, or hook-and-line gear http://alaskafisheries.noaa.gov/regs/679a2.pdf.

[ii] Mobile contact gear means nonpelagic trawl, dredge, or dinglebar gear http://alaskafisheries.noaa.gov/regs/679a2.pdf.

[iii] See footnote i.

[iv] Nonpelagic trawl means a trawl other than a pelagic trawl. http://alaskafisheries.noaa.gov/regs/679a2.pdf

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Appendix G. Arctic-Yukon-Kuskokwim Region Management Areas

Yukon Management Area

The Yukon Salmon Management Area encompasses the largest river in Alaska, and the Yukon River and its tributaries drain an area of approximately 220,000 square miles within Alaska, while the Canadian portion of the river accounts for another 110,000 square miles (Alaska Department of Fish and Game 2024a). The Yukon River flows 2,300 miles from its origin 30 miles from the Gulf of Alaska to its terminus in the Bering Sea, and the Chinook salmon and chum salmon, both summer and fall, are of the most importance to the Yukon River area with sockeye, pink, and coho salmon being of minor importance (Alaska Department of Fish and Game 2024a). Chinook salmon have been in a prolonged period of low productivity and this has resulted in much hardship to the residents of the Yukon River drainage (Alaska Department of Fish and Game 2024a). Chum salmon returns, while better than Chinook returns, have been erratic since 1993, with some very poor returns that restricted both commercial and subsistence fishing, and adding to these problems, poor prices and lack of buyers depressed the value of chum salmon harvested from the Yukon River at a time that fuel costs skyrocketed, making the economics of salmon fishing in the Yukon River even more challenging (Alaska Department of Fish and Game 2024a).

Both the state and federal government increased funding for management and research after the poor fishery performance of the 1990s, and the result has been a major increase in information about the numbers, spawning locations, and relative importance of particular tributaries in the total production of Yukon River salmon (Alaska Department of Fish and Game 2024a).

Arctic Management Area

The Arctic Management Area encompasses all waters of Alaska north of the latitude of the western most tip of Point Hope and west of 141 degrees West longitude, including those waters draining into the Arctic Ocean and the Chukchi Sea, and the area consists of 91,000 square miles and the largest river system, the Colville River, drains 29% of the North Slope (Alaska Department of Fish and Game 2024a). Many subsistence fishers operate gillnets in the rivers and coastal marine waters of the Arctic Area to harvest marine and freshwater finfish, and small numbers of chum, pink, and Chinook salmon (Oncorhynchus ssp.) have been reported by subsistence fishers along the coast (Alaska Department of Fish and Game 2024a). Arctic cisco and broad whitefish (Coregonus spp.) are most commonly used for subsistence purposes along with Dolly Varden (Salvelinus malma), and Arctic grayling (Thymallus arcticus), and commercial fishery for freshwater finfish has existed in the Colville River delta since 1964 primarily harvesting (Coregonus spp.) (Alaska Department of Fish and Game 2024a).

Historically, commercial fishing generally took place during late June and July for broad and humpback whitefish, and October through early December for Arctic and least cisco. Beginning around 1990 commercial fishing effort shifted to predominately occurring in October and November for Arctic and least cisco using set gillnets operated under the ice (Alaska Department of Fish and Game 2024a).

Norton Sound and Kotzebue Management Area

Norton Sound, Port Clarence, and Kotzebue Sound management districts include all waters from Point Romanof in southern Norton Sound to Point Hope at the northern edge of Kotzebue Sound, and St Lawrence Island., and these management districts encompass over 65,000 square miles, and have a coastline exceeding that of California, Oregon, and Washington combined (Alaska Department of Fish and Game 2024a). Approximately 17,000 people, primarily Alaska Natives, reside in 30 small communities within these management districts, and nearly all local residents are dependent to varying degrees on fish and game resources for their livelihood (Alaska Department of Fish and Game 2024a). Chum and pink salmon are abundant in Norton Sound and smaller populations of sockeye, coho, and Chinook salmon are also present, and only chum salmon are found in sufficient abundance to support commercial fishing in Kotzebue Sound (Alaska Department of Fish and Game 2024a). Small, isolated populations of salmon are found north of Kotzebue Sound. Herring are present in all three management districts; Norton Sound has the largest abundance of herring in the entire AYK Region, and the remote location of these herring stocks, and their later timing relative to other herring stocks, makes attracting buyers difficult for these fisheries (Alaska Department of Fish and Game 2024a).

An important commercial and subsistence king crab fishery takes place in Norton Sound. This fishery was restricted to small boats in 1993 and designated a super exclusive fishery in 1994, which means that a vessel registered for the Norton Sound king crab fishery cannot participate in any other king crab fishery during that year (Alaska Department of Fish and Game 2024a).

Kuskokwim Management Area

The Kuskokwim Management Area includes the Kuskokwim River drainage, all waters of Alaska that flow into the Bering Sea between Cape Newenham and the Naskonat Peninsula, and Nunivak and St Mathew Islands, and commercial and subsistence fishing in this area focuses primarily on salmon and herring (Alaska Department of Fish and Game 2024a). Herring are abundant along the coast of the Kuskokwim area, but there has been little market for commercial herring in some time, and salmon fishing occurs primarily within the main stem of the Kuskokwim River and in Kuskokwim and Goodnews Bays (Alaska Department of Fish and Game 2024a).

Kuskokwim salmon fisheries are noteworthy for the role played by the Kuskokwim River Salmon Working Group, which serves as a public forum for federal and state fisheries managers to meet with local users of the salmon resource and review run assessment information and reach a consensus on how to proceed with management of Kuskokwim River salmon fisheries, and subsistence fishing is of major importance to the residents of this region and the largest subsistence harvest of Chinook salmon in the state is taken from the Kuskokwim River (Alaska Department of Fish and Game 2024a).

Appendix H: Noise Effects

Vessel Noise

Marine species within the proposed action area may be exposed to vessel noise associated with Coast Guard assets during the Proposed Action. It is difficult to differentiate between behavioral responses to vessel sound and visual cues associated with the presence of a vessel (Hazel et al. 2007); thus, it is assumed both could play a role in prompting reactions from animals. The potential effect from vessel noise is from masking of other biologically relevant sounds as well as behavioral reactions, such as an alerting or avoidance response.

Underwater sound from vessels is generally at relatively low frequencies, usually between 5 and 500 Hz (Hildebrand 2009; NRC 2003; Southall et al. 2017; Urick 1983; Wenz 1962). However, high levels of vessel traffic are known to elevate background levels of noise in the marine environment (Andrew et al. 2011; Chapman and Price 2011; Frisk 2012; Miksis-Olds et al. 2013; Redfern et al. 2017; Southall 2005). Anthropogenic sources of sound in the proposed action areas includes smaller vessels such as skiffs, larger vessels for pulling barges to deliver supplies to communities or industry work sites, icebreakers, and vessels for tourism and scientific research which all produce varying noise levels and frequency ranges. Commercial ships radiate noise underwater with peak spectral power at 20–200 Hz (Ross 1976). The dominant noise source is usually propeller cavitation which has peak power near 50–150 Hz (at blade rates and their harmonics), but also radiates broadband power at higher frequencies, at least up to 100,000 Hz (Arveson and Vendittis 2000; Gray and Greeley 1980; Ross 1976). While propeller singing is caused by blades resonating at vortex shedding frequencies and emits strong tones between 100 and 1,000 Hz, propulsion noise is caused by shafts, gears, engines, and other machinery and has peak power below 50 Hz (Richardson et al. 1995). Overall, larger vessels generate more noise at low frequencies (<1,000 Hz) because of their relatively high power, deep draft, and slower turning (<250 rotations per minute) engines and propellers (Richardson et al. 1995).

Low frequency ship noise sources include propeller noise (cavitation, cavitation modulation at blade passage frequency and harmonics, unsteady propeller blade passage forces), propulsion machinery such as diesel engines, gears, and major auxiliaries such as diesel generators (Ross 1976). Globally, commercial shipping is not uniformly distributed (NRC 2003). Other vessels may be found widely distributed outside of ports and shipping lanes. These include military vessels participating in training exercises, fishing vessels, and recreational vessels. The vessels participating in the Proposed Action may be in the proposed action areas at any given time for any given amount of time and would overlap spatially and temporally with other vessels described above.

Vessel operations associated with the Proposed Action could create a zone of masking in the water for marine species. The potential effect from vessel noise from auditory masking is missing biologically relevant sounds that species may rely on, as well as eliciting behavioral reactions such as an alert, avoidance, or other behavioral reaction (NRC 2003, 2005; Williams et al. 2015). The effects of masking can vary depending on the ambient noise level within the environment, the received level, frequency of the vessel noise, and the received level and frequency of the sound of biological interest (Clark et al. 2009; Foote et al. 2004; Parks et al. 2010; Southall et al. 2000). In the open ocean, ambient noise levels are between about 60 and 80 dB re 1 μPa, especially at lower frequencies (below 100 Hz) (NRC 2003). When the noise level is above the sound of interest, and in a similar frequency band, auditory masking could occur (Clark et al. 2009). Any sound that is above ambient noise levels and within an animal's hearing range needs to be considered in the analysis; however, the degree of masking increases with the increasing noise levels; a noise that is just detectable over ambient levels is unlikely to actually cause any substantial masking above that which is already caused by ambient noise levels (NRC 2003, 2005).

Vessel presence, particularly for activities such as shipping, is diffuse and spread throughout the world's oceans (Hildebrand 2009). Vessel noise associated with the Proposed Action would not contribute meaningfully to these ambient sound levels in areas experiencing higher vessel traffic, such as frequently used transit routes. In the more remote regions of the Arctic, the additional vessel noise would still be minimal compared to the noise of the ambient environment. As observed by Worcester et al. (2015), the median noise level at 98 m depth during the first two weeks of May not far from the North Pole had a maximum between 10 and 20 Hz of approximately 75 dB re 1 μPa2/Hz. Dziak et al. (2015) recorded tens of "icequakes" per day in Antarctica with underwater sound levels ranging between 190–247 dB RMS re 1μPa @ 1 m. Veirs et al. (2016) measured ship noise in Puget Sound, WA and determined that median received spectrum levels of noise from 2,809 isolated transits are elevated relative to median background levels not only at low frequencies (20-30 dB re 1 mPa2/Hz from 100 to 1,000 Hz), but also at high frequencies (5-13 dB from 10 to 96 kHz). Under the Proposed Action, the frequency of the vessel noise could overlap with the hearing range of ESA-listed fish, sea turtles, and marine mammals.

Fish

Vessel noise has the potential to expose fish to both sound and disturbance from particle motion, which could result in short-term behavioral or physiological responses (e.g., avoidance, stress, increased respiration rate). Vessel noise from transiting, operations, or training activities associated with the Proposed Action is not expected to affect fish, as available evidence does not suggest that ship noise can injure or kill a fish (Popper 2014). Misund (1997) found that fish ahead of a ship showed avoidance reactions at ranges of 49 to 149 m. When the vessel passed over them, some species of fish exhibited sudden escape responses that included lateral avoidance or downward compression of the school of fish; though it is unclear if this avoidance behavior is to the physical presence of the vessel, particle motion, or actual detection of the sound. Avoidance behavior of vessels, vertically or horizontally in the water column, has been reported for cod and herring, and was attributed to vessel noise. Vessel activity can also alter schooling behavior and swimming speed of fish (UNEP 2012).

It is not anticipated that temporary behavioral reactions (e.g., temporary cessation of feeding or avoidance response) would affect the individual fitness of a fish, as individuals are expected to resume feeding upon cessation of the sound exposure and unconsumed prey would still be available in the environment.

Furthermore, while vessel sounds may influence the behavior of some fish species (ex., startle response, masking), other fish species can be equally unresponsive (Becker et al. 2013). Shipping is diffuse and spread throughout the world's oceans, raising the ambient levels of sound (Hildebrand 2009). It is expected that vessels associated with the Proposed Action, similar to other ships in the area, would also contribute to ambient levels of sound in the proposed action areas, but are not expected to increase the current ambient sound levels. In the unlikely event that an ESA-listed fish was present in the proposed action area, vessel noise associated with the Proposed Action may affect individual fish; however, responses to vessel noise would be short-term and insignificant behavioral reactions, and thus, would not be expected to have any population level impacts.

Sea Turtles

Little is known about how sea turtles use sound in their environment. They may use sound for navigation, locating prey, avoiding predators, and general environmental awareness. However, sea turtles do not appear to use sound for communication. When presented with acoustic stimuli at 430 Hz and 1.5 dB re 1 μPa, sea turtles placed in 50-gallon tanks responded with abrupt body movements, such as blinking, head retraction, and flipper movement, all of which were interpreted as startle responses (Lenhardt et al. 1996). Higher level responses, such as changes in swimming patterns and orientation, were noted when sea turtles, located in a confined canal (300 m long, 45 m wide, and up to 10 m deep), suspended at 2-m depth and positioned 33 m inward from one side of the tank, and exposed to high-pressure air gun pulses (120 dB re 1 mbar at 1 m) with frequencies ranging from 25 to 750 Hz (O'Hara and Wilcox 1990). Vessel noise in the open ocean may cause a startle response in sea turtles. However, any response is expected to be short term and temporary in nature. Overlap between the proposed action area and the range of the leatherback sea turtle is very small (e.g., only a far north as the Aleutian Island chain); however, in the unlikely event that a leatherback sea turtle was present in the proposed action area, vessel noise associated with the Proposed Action may affect individual sea turtles. Any responses to vessel noise would be short-term and insignificant behavioral reactions, and thus, would not be expected to have any population level impacts. Furthermore, given the concentration of offshore vessel traffic in the proposed action area, the vessel noise from the Proposed Action would have no significant changes to ambient noise levels nor create any additional masking impacts, and therefore would not impact a sea turtle's ability to perceive other biologically relevant sounds.

Marine Mammals

Since many marine mammals rely on sound to find prey, moderate social interactions, and facilitate mating (Tyack 2008), noise from anthropogenic sound sources like ships can interfere with these functions, but only if the noise spectrum overlaps with the hearing sensitivity of the marine mammal (Clark et al. 2009; Hatch et al. 2012; Southall et al. 2007). It is difficult to differentiate between behavioral responses to just a vessel sound or just the visual cues associated with the presence of a vessel; thus, it is assumed that both play a role in prompting reactions from animals (Richardson et al. 1995).

As mentioned previously, hearing sensitivity isn't yet characterized in mysticetes, but based on their signals they are likely most sensitive at frequencies 10-10,000 Hz and therefore constitute a low-frequency functional hearing group (Southall et al. 2007). They typically emit signals with fundamental frequencies well below 1,000 Hz (Au et al. 2006; Cerchio et al. 2001; Munger et al. 2008) although non-song humpback signals have peak power near 800 and 1,700 Hz (Stimpert 2010) and humpback song harmonics extend up to 24,000 Hz (Au et al. 2006). While most mysticetes hear best at low frequencies, blue whales (B. musculus) have been observed reacting to mid-frequency sound in the range of 3.5-3.6 kHz (Goldbogen et al. 2013). However, the responses varied across individuals and the responses themselves were strongly affected by the whale's behavioral state at the time of exposure, with surface feeding animals typically showing no change in behavior. By contrast, deep feeding and non-feeding whales' responses ranged from termination of deep foraging dives to prolonged mid-water dives. The potential effects of ship noise can be assessed more confidently in odontocetes because they constitute midfrequency or high-frequency functional hearing groups (Southall et al. 2007) in which auditory response curves have been obtained for many species. These curves show maximum auditory sensitivity near the frequencies where toothed whale signals have peak power (Mooney et al. 2012; Tougaard et al. 2014) at about 1-20 kHz for social sounds and 10-100 kHz or higher for echolocation.

Marine mammals have been recorded in several instances altering and modifying their vocalizations to compensate for the masking noise from vessels, or other similar sounds (Holt et al. 2011; Parks et al. 2011). Vocal changes in response to anthropogenic noise can occur across the repertoire of sound production modes used by marine mammals, such as whistling, echolocation click production, calling, and singing. Changes to vocal behavior and call structure may result from a need to compensate for an increase in background noise. In cetaceans, vocalization changes have been reported from exposure to anthropogenic sources such as sonar, vessel noise, and seismic surveying. Behavioral responses to boat (as opposed to ship) noise have been documented in toothed whales. Bottlenose dolphins whistle (at 4-20 kHz) less when exposed to boat noise at 500-12,000 Hz (Buckstaff 2004), and Indo-Pacific bottlenose dolphins lower their 5-10 kHz whistle frequencies when noise is increased by boats in a band from 5,000 to 18,000 Hz (Morisaka et al. 2005).

Vessel noise also has the potential to disturb marine mammals and elicit an alerting, avoidance, or other behavioral reaction (Huntington et al. 2015; Pirotta et al. 2015; Williams et al. 2014). Most studies have reported that marine mammals react to vessel sounds and traffic with short term interruption of feeding, resting, or social interactions (Huntington et al. 2015; Magalhães et al. 2002; Merchant et al. 2014; Pirotta et al. 2015; Richardson et al. 1995; Williams et al. 2014). In cases where vessels actively approached marine mammals (e.g., whale watching), scientists have documented that animals exhibit altered behavior such as increased swimming speed, erratic movement, and active avoidance behavior (Acevedo 1991; Baker and MacGibbon 1991; Bursk 1983; Constantine et al. 2003; New et al. 2015; Parsons 2012; Pirotta et al. 2015; Trites and Bain 2000; Williams et al. 2002), reduced blow interval (Richter et al. 2003b), disruption of normal social behaviors (Lusseau 2003; Lusseau 2006; Pirotta et al. 2015), and the shift of behavioral activities which may increase energetic costs (Constantine et al. 2003; Constantine et al. 2004). These reactions could be caused by vessel noise or the presence of the vessel itself. Some species respond negatively by retreating or responding to the vessel antagonistically, while other animals seem to ignore vessel noises altogether (Watkins 1986). Marine mammals are frequently exposed to vessels due to research, ecotourism, commercial and private vessel traffic, and government activities. Veirs et al. (2016) measured ship noise in Puget Sound, WA and determined that median received spectrum levels of noise from 2,809 isolated transits are elevated relative to median background levels not only at low frequencies (20-30 dB re 1 mPa2/Hz from 100 to 1,000 Hz), but also at high frequencies (5-13 dB from 10,000 to 96,000 Hz). Based on these results, noise received from ships at ranges less than 3 km could extend to frequencies used by odontocetes.

Studies showed that bowhead whales avoided encroaching vessels by as much as 2.5 mi (4 km) but returned to the displaced area within a day (Koski and Johnson 1987; Richardson et al. 1985). If vessels were not moving towards bowhead whales, bowhead whales did not demonstrate avoidance behaviors such as those described previously. Bowhead whales located more than 1,640 ft (500 m) behind the moving vessel did not demonstrate avoidance behavior and approached vessels to within 328 to 1,640 ft (100 to 500 m) (Wartzok et al. 1989). Therefore, it would appear that directionality and vessel speed could influence behavioral reactions of bowhead whales.

Other baleen whales, like the humpback whale have exhibited varied responses to vessels, ranging from approaching to avoiding (Au and Green 2000; Baker and Herman 1989; Bauer and Herman 1986; Stamation et al. 2009). Vertical avoidance was observed within 1 mi (2 km), while horizontal avoidance occurred from 1-2 mi (2-4 km) away (Baker and Herman 1989; Baker et al. 1983). Humpback whales are less likely to react if actively engaged in feeding (Krieger and Wing 1984, 1986) although Blair et al. (2016) reported that humpback whales significantly changed foraging behavior in response to high levels of ship noise in the North Atlantic. Although vessels could cause some short-term changes in behavior, any disturbance is expected to be temporary, and any whales are expected to return to their normal behavior.

Sperm whales have also exhibited varied responses to outboard vessels up to 1 mi (2 km) away (Cawthorn 1992). However, many individual sperm whales remained in areas with regular boat presence (Gordon et al. 1992). Smaller odontocetes, including some dolphins and porpoises and other smaller toothed whales (and occasionally sea lions and fur seals), interact with vessels by bow riding when a vessel is moving. Bow-riding is when the animals position themselves in such a manner as to be lifted up and pushed forward by the circulating water generated to form a bow pressure wave of an advancing vessel (Hertel 1969; Lang 1966).

Based on these studies, whales are not expected to be disturbed by vessels that maintain a reasonable distance from them, though this varies with vessel size, geographic location, frequency of exposure, and tolerance levels of individuals. As stated in the Coast Guard SOPs in Section 2, crew members would be trained as PSOs in marine mammal and protected species identification and will alert the Command of the presence of marine mammals or protected species. In response to sightings, operators will initiate adaptive mitigation responses including reducing vessel speed, posting additional PSOs to assist in monitoring location of the animals, avoiding sudden changes in speed and direction, or if a swimming whale is spotted, attempting to parallel the course and speed of the moving whale so as to avoid crossing its path, and avoiding approach of sighted whales head-on, or directly from behind (see COMDTINST M16247.1H).

Pinnipeds could react to vessels when hauled out, and thus react to both the in-air sound of a vessel as well as to the visual cue from the vessel itself. In 1997, Henry and Hammill (2001) conducted a study to measure the effects of small boats (i.e., kayaks, canoes, motorboats and sailboats) on harbor seal haulout behavior in Metis Bay, Quebec, Canada and noted that the most frequent disturbances were caused by lower speed, lingering kayaks, and canoes as opposed to motorboats conducting high speed passes. The study concluded that boat traffic at current levels had only a temporary effect on the haulout behavior of harbor seals in the Metis Bay area because once the animals were disturbed, there did not appear to be any significant lingering effect on the recovery of numbers to their pre-disturbance levels.

Pinnipeds may also react to vessels while they are in the water, from hearing just the in-water vessel noise or hearing the in-water vessel noise and the sight of the vessel approaching (only likely if the pinniped's head is above water). Richardson et al. (1995) stated that for in-water vessel reactions only, pinnipeds are much less likely to react to vessels if in water and not hauled out. While in water pinnipeds show a high tolerance to vessels, though it is not known if these incidents cause them stress, despite their tolerance (Richardson et al. 1995). Johnson and Acevedo-Gutierrez (2007) evaluated the efficacy of buffer zones for watercraft around harbor seal haulout sites on Yellow Island, Washington. The authors estimated the minimum distance between the vessels and the haulout sites, categorized the vessel types, and evaluated seal responses to the disturbances. During the seven-weekend study, the authors recorded 14 human-related disturbances, which were associated with stopped powerboats and kayaks. During these events, hauled out seals became noticeably active and moved into the water. The flushing occurred when stopped kayaks and powerboats were at distances as far as 453 and 1,217 ft (138 and 371 m) respectively. The authors note that the seals were unaffected by passing powerboats, even those approaching as close as 128 ft (39 m), possibly indicating that the animals had become tolerant of the brief presence of the vessels and ignored them. The authors reported that on average, the seals quickly recovered from the disturbances and returned to the haulout site in less than or equal to 60 minutes. Seal numbers did not return to predisturbance levels within 180 minutes of the disturbance less than one quarter of the time observed. The study concluded that the return of seal numbers to pre-disturbance levels and the relatively regular seasonal cycle in abundance throughout the area counter the idea that disturbances from powerboats may result in site abandonment (Johnson and Acevedo-Gutiérrez 2007). Frequent and close disturbances may cause abandonment of a haulout site (Allen et al. 1984) but are not likely to occur from infrequent exposure to boats passing by the haulout. In general, from the available information, pinnipeds exposed to intense (approximately 110 to 120 dB re 20 µPa at 1 m) non-pulsed sounds often leave haulout areas and seek refuge temporarily (minutes to a few hours) in the water (Southall et al. 2007).

The received levels from sources and associated source levels (Table 7) for the Proposed Action are expected to be below the onset of TTS and PTS (Table 6) for all marine mammal groups, including mysticetes, odontocetes, or pinnipeds, that may be within the proposed action area. Underwater noise from all vessels could overlap with the same low-frequency sounds that many whales use for communication for feeding and mating, and therefore, could cause masking. Auditory response curves for odontocetes show maximum auditory sensitivity near where toothed whale signals have peak power (Mooney et al. 2012; Tougaard et al. 2014) at about 1,000—2,000 Hz for social sounds and 10,000—100,000 Hz or higher for echolocation. NMFS (2016) considers sperm whales to be Mid-frequency (MF) cetaceans, with a generalized hearing range from 150 Hz to 160 kHz and pinnipeds as phocids (PW) with a generalized hearing range from 50 Hz to 86 kHz or OW with a generalized hearing range from 60 Hz to 39 kHz. Commercial ships radiate noise underwater with peak spectral power at 20–200 Hz (Ross 1976). The dominant noise source is usually propeller cavitation which has peak power near 50–150 Hz (at blade rates and their harmonics), but also radiates broadband power at higher frequencies, at least up to 100,000 Hz (Arveson and Vendittis 2000; Gray and Greeley 1980; Ross 1976). While propeller singing is caused by blades resonating at vortex shedding frequencies and emits strong tones between 100 and 1,000 Hz, propulsion noise is caused by shafts, gears, engines, and other machinery and has peak power below 50 Hz (Richardson et al. 1995). Overall, larger vessels generate more noise at low frequencies (<1,000 Hz) because of their relatively high power, deep draft, and slower turning (<250 rotations per minute) engines and propellers (Richardson et al. 1995). It is expected that vessels associated with the Proposed Action, similar to other ships in the area, would also contribute to ambient levels of sound in the proposed action area, but are not expected to change current ambient sound levels.

The effect to marine mammals from masking is expected to be temporary due to the Coast Guard's SOPs. Odontocetes and pinnipeds are not expected to be affected by the low-frequency noise produced by ships because the noise produced is outside of the typical hearing range for odontocetes and pinnipeds. However, Veirs et al. (2016) noted that median received spectrum levels of noise from 2,809 isolated transits were elevated relative to median background levels including high frequencies (5-13 dB from 10,000 to 96,000 Hz). Thus, noise received from ships at ranges less than 3 km extends to frequencies used by odontocetes. As these ships enter shallow waters and traverse the estuarine habitat typically occupied by major ports, the noise they radiate may impact coastal marine life. In addition, the Coast Guard vessels would not purposefully approach marine mammals and noise generated by these vessels are not expected to elicit significant behavioral responses. Such reactions are not expected to significantly disrupt behavioral patterns such as migration, breathing, nursing, breeding, feeding and sheltering to a point where the behavior pattern is abandoned or significantly altered or result in reasonably foreseeable takes of marine mammals.

Essential Fish Habitat

Vessel noise could impact or harm EFH due to the temporary increase in ambient sound level during the transmissions. It is expected that vessels associated with the Proposed Action, similar to other ships in the area, would also contribute to ambient levels of sound in the proposed action area, but are not expected to change current ambient sound levels overall. However, this potential reduction in the quality of the acoustic habitat would be localized to the area of the Proposed Action and temporary in duration, due to the movement of the vessels throughout the proposed action area. The quality of the water column environment as EFH would be restored to normal levels immediately following the departure of vessels.

Aircraft Noise

The primary aircraft expected to be used during the Proposed Action is the MH-60 Jayhawk helicopter; however, the Coast Guard will also utilize the C-130J Long Range Surveillance Aircraft, and may also use unmanned air vehicles (UAVs) in place of the helicopter.

The MH-60 Jayhawk is an all-weather, medium-range helicopter (specialized for search and rescue). Helicopter flights associated with the Proposed Action would occur in both the Arctic and Antarctic proposed action areas and would be used for transport of personnel and equipment and for conducting training (e.g., qualifications). Aircraft would not operate at an altitude lower than 1,500 ft (457 m) within 0.5 mi (805 m) of marine mammals observed on ice or land. Helicopters would also not hover or circle above such areas. Aircraft would avoid any identified environmentally sensitive areas, to include, but not be limited to, critical habitat designated under the ESA, and marine mammal haulouts and rookeries, but if deemed necessary (e.g., personnel safety) to pass over such areas, aircraft would stay above 3,000 ft (914 m).

The C-130J provides heavy air transport and long-range maritime patrol capability and is capable of serving as an on-scene command and control platform or as a surveillance platform with the means to detect, classify and identify objects and share that information with operational forces. Normal cruising speed of the C-130J is 320 kn (approximately 368 mph; 593 km/hr). C-130J airplanes associated with the Proposed Action would serve in a non-emergency situation to locate, identify, and assist vessels and persons in distress in the Arctic Region. C-130J airplanes would be used to conduct up to two routine patrol/arctic domain awareness/logistics support flights each month for a total of up to 10 flights each year. While operating the C-130J, Coast Guard personnel will avoid biological resources to the best of their ability providing navigational safety is not compromised.

Search and Rescue air searches for persons in the water or a vessel in distress, may require that the helicopter fly at an altitude below 500 ft (152 m). Emergency recovery of persons in the water and transfer of rescue equipment would also require that the helicopter hover below 500 ft (152 m). Any Coast Guard response during a SAR mission is considered an emergency and is not a part of the Proposed Action. However, normal operations and training for a SAR is part of the Proposed Action. As stated previously, environmentally sensitive areas would be avoided, and flights would be expected to stay above 1,500 ft. Any SAR training that may require helicopters to fly below 1,500 ft, would avoid environmentally sensitive areas and areas where ESA-listed species are known to occur due to the Coast Guard's SOPs (Section 2).

Helicopters produce low-frequency sound and vibration (Pepper et al. 2003; Richardson et al. 1995). Noise generated from helicopters is transient in nature and variable in intensity. Helicopter sounds contain dominant tones from the rotors that are generally below 500 Hz. MH-60 noise levels at the helicopter average approximately 136 dB re 20 μPa in air with frequencies between 20 Hz and 5 kHz. More low frequency components (<1 kHz) are contained in this broad band signal primarily from rotor noise (i.e., helicopter blade rotation).

Helicopters often radiate more sound forward than aft. Sound levels generated by UAVs have not been well-documented. However, two multi-rotor UAVs were measured to produce broad-band in-air source levels of 80 decibels referenced at 20 μPa with frequencies centered at 60 to 150 Hz. When flying at altitudes of 16 to 33 ft (5 to 10 m) above the water's surface, the received levels of these UAVs were considered to be close to ambient noise levels in many shallow water habitats and below the hearing thresholds of most marine mammals (Christiansen et al., 2016). A fixed-wing UAV is expected to be quieter than quadcopters and would operate at a minimum altitude of 3,000 ft (914 m) above the water's surface. Similar to helicopters, UAVs would avoid any identified environmentally sensitive areas, to include, but not be limited to, critical habitat designated under the ESA, and marine mammal haulouts and rookeries.

In Air

Most of the acoustic energy from an aircraft arrives through a relatively narrow cone extending vertically downward from the aircraft (Figure 4-1) (Eller and Cavanagh 2000; Richardson et al. 1995). This cone creates a "footprint" directly beneath the flight path, with the width of the footprint (at the water's surface) being a function of aircraft altitude. Furthermore, in air noise decreases with distance, with a decrease in sound level from any single noise source following the "inverse-square law." In other words, the Sound Pressure Level (SPL) changes in inverse proportion to the square of the distance from the sound source. Therefore, aircraft sound levels actually at the air-water interface (i.e., sea surface) are a function of how high above the surface the aircraft is flying or hovering. Thus, the higher the aircraft, the less sound reaches the sea surface (Eller and Cavanagh 2000; Richardson et al. 1995). Any sound produced by the UAV is expected to be less than that produced by the helicopter.

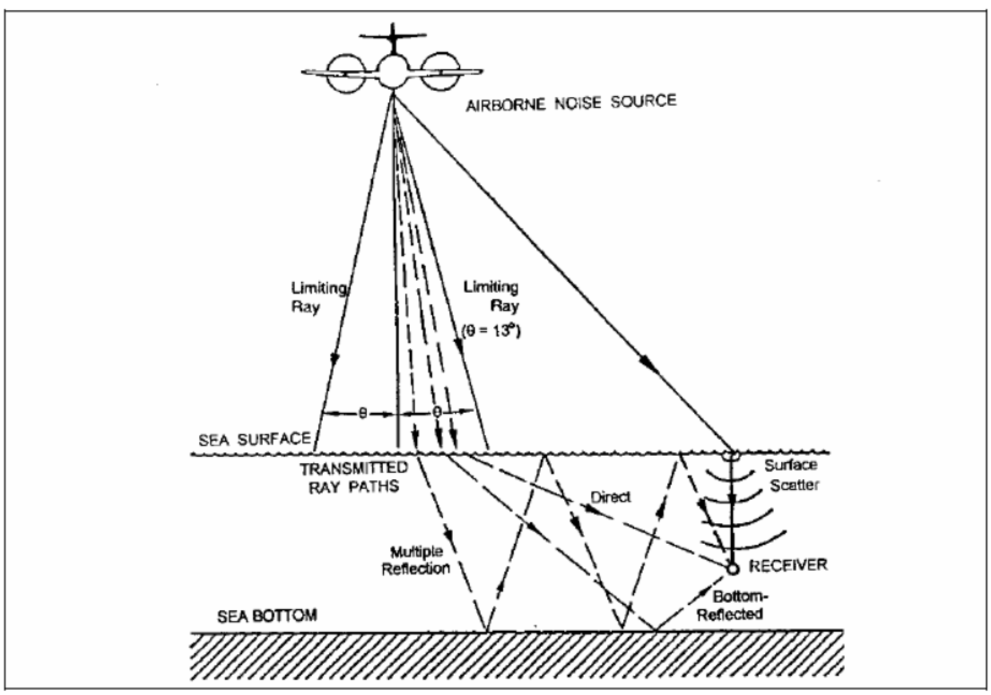

FIGURE 0-1. CHARACTERISTICS OF SOUND TRANSMISSION THROUGH THE AIR-WATER INTERFACE (RICHARDSON ET AL. 1995)

Sea Surface (Air-Water Interface)

As stated above, aircraft sound levels present at the air-water interface (i.e., sea surface) is a function of how high above the surface the aircraft is flying or hovering. Thus, the higher the aircraft, the less sound reaches the sea surface. Given in air transmission loss with distance via the previous discussion of the inverse-square law, it would be estimated that a 136 dB re 20 µPa helicopter source level at an altitude of 100 ft (30.5 m) would measure an SPL of approximately 106 dB re 20 µPa at the air-water interface (i.e., sea surface), while the same source level at 10 ft (3 m) would measure an SPL of approximately 126 dB re 20 µPa at the air-water interface. Aircraft associated with the Proposed Action would not operate at altitudes under 1,500 ft (457 m). Therefore, the received level estimated above would be significantly less than 106 dB re 20 µPa when measured at the surface if the helicopter were at an altitude of 1,500 ft (457 m). Any sound produced by the UAV is expected to be less than that produced by the helicopter.

In Water

Helicopter overflights produce airborne noise and some of this energy is transmitted into the water. Transmission of sound from a moving airborne source to a receptor underwater is influenced by numerous factors and has been addressed Urick (1983), Young (1973), Richardson et al. (1995), and Eller and Cavanagh (2000). Sound is transmitted from an airborne source to a receptor underwater by four principal means: (1) a direct path, refracted upon passing through the air-water interface; (2) direct-refracted paths reflected from the bottom in shallow water; (3) evanescent transmission in which sound travels laterally close to the water surface; and (4) scattering from interface roughness due to wave motion.

Aircraft sound is refracted upon transmission into water because sound waves move faster through water than through air (a ratio of about 0.23:1). Based on this difference, the direct sound path is reflected if the sound reaches the surface at an angle more than 13 degrees from vertical. As a result, most of the acoustic energy transmitted into the water from an aircraft arrives through a relatively narrow cone extending vertically downward from the aircraft.

Traveling beyond the sea surface, the sound values in air and in water are not directly comparable due to the reference units used and must be converted. The result is that sound waves with the same intensities in water and air have relative intensities that differ by 26 dB. This amount (26 dB) must be added to sound levels in air referenced to 20 µPa to obtain the sound level in water referenced to 1 µPa. In consideration of the air-water interface, another 6 dB would have to be added (doubling of pressure across interface), such that 26 dB + 6dB or 32 dB would have to be added to any in air value to estimate its corresponding in water transition value (ex., 100 dB re 20 µPa in air + 26 dB +6 dB= 132 dB re 1 µPa in water)

Therefore, for a helicopter at an altitude of 100 ft, the in-water sound just beneath the surface would be approximately 138 dB re 1 µPa. For a helicopter at 10 ft (30.5 m), the in-water sound just beneath the sea surface would be approximately 168 dB re 1 µPa. Helicopter sounds that do enter the water would be subject to further transmission loss with distance. The underwater noise produced is generally brief when compared with the duration of audibility in the air. Due to the relatively small area over which aircraft noise would radiate outward, the noise would be transient. Any sound produced by the UAV is expected to be less than that produced by the helicopter and would also be transient.

Under Ice

The inhomogeneous nature of sea ice does not necessarily allow for attenuation of noise from the air through an ice layer and into the water. When aircraft noise passes from air to water, there is a limiting ray of 13 degrees, where the noise will be reflected off the surface of the water instead of passing through (Richardson et al. 1995). At frequencies less than 500 Hz, the ice layer is acoustically thin and causes little attenuation of sound (Richardson et al. 1991). This implies that noise travelling through sea ice would only be slightly lower than that same noise travelling directly from the air to the water. It is expected that transmission of low-frequency sound through ice would be only slightly lower than that of low-transmission sound travelling directly from the air into the water (Richardson et al. 1995). Use of the air-water transmission model would provide slight overestimates of underwater sound levels from aircraft overflights, but this is the best model currently available to analyze airborne sound transmission through ice (Richardson et al. 1995).

If ice is present beneath aircraft operations, noise levels would be lowered by the time they reach the ice from an overhead flight and would still have to attenuate through the ice and the resulting underwater noise would be generally brief in nature. Any sound produced by the UAV is expected to be less than that produced by the helicopter. No effect to ESA-listed fish is expected from aircraft noise, as there is a lack of sufficient sound transmission across the air/water interface, to a depth where fish are expected, and the likelihood that ESA-listed species would be present in the proposed action area where overflights may occur is extremely low. The potential effect of aircraft noise to sea turtles and marine mammals is provided below.

Sea Turtles

Sea turtles may use sound for navigation, locating prey, avoiding predators, and general environmental awareness. However, they do not appear to use sound for communication. Piniak et al. (2012) notes that leatherback sea turtle hatchlings are able to detect sounds between 50 and 1600 Hz in air, with maximum sensitivity between 50 and 400 Hz (62 dB re: 20 μPa-rms at 300 Hz). This is within the range of sound typically produced by helicopters. Sea turtles may respond to both the physical presence and to the noise generated by the helicopter, particularly when it is flying at a low altitude and when they are directly underneath it.

Marine Mammals

Potential effects to species from aircraft could involve acoustic and non-acoustic effects and it is unclear if reactions are due to sound or the physical presence of the aircraft flying overhead. Aircraft noise would include noise generated by the MH-60 Jayhawk helicopter during flights associated with the Proposed Action and from the UAVs. Behavioral responses by marine mammals could include quick dives or turns, change in course, or flushing and stampeding from a haulout site. There are few well-documented studies of the effect of aircraft overflight over pinniped haulout sites or rookeries, and many of those that exist are specific to military activities (Efroymson et al. 2001). There are even fewer documented studies of the effect of aircraft overflights to marine mammals at the water's surface and for UAVs. Potential effects to marine mammals from aircraft noise may occur due to auditory fatigue, TTS, PTS, or behavioral reactions.

The reactions of cetaceans to aircraft noise are varied and often dependent on what the animal is doing at the time (e.g., migrating, feeding, mating, etc.). In general, a behavioral response by mysticetes could include a decrease in swim speed, change in direction of travel, or a cessation of feeding or mating in response to broadcast sounds. Mysticetes may exhibit various behavioral reactions to aircraft overflights such as diving underwater, slapping the water's surface with their flukes or flippers, or swimming away from the aircraft track (Richardson et al. 1995). Belugas, for example, may swim away, dive abruptly, look upwards, or turn sharply away from low altitude overflights (Richardson et al. 1995). They have also been recorded to have no visual behavioral reaction to aircraft flights within 100 to 200 m (Richardson et al. 1995).

Bowhead whales, however, react to overflight aircraft in various ways as well such as diving underwater, turning away from the aircraft, and dispersing away from the area exposed to the aircraft. Bowhead whales frequently reacted to a circling piston-engine aircraft at less than 1,000 ft (305 m) in altitude. Infrequent reactions occurred at 1,499 ft (457 m) of altitude and rare reactions occurred at greater than 2,001 ft (610 m) (Richardson et al. 1995). Reactions seem more pronounced when bowhead whales are in shallow water. Repeated overflights did not seem to displace many (if any) bowheads from feeding areas. Watkins and Moore (1983) found that, when below 492 ft (150 m) in altitude, some disturbance to right whales may occur. (Payne et al. 1983) saw rare reactions to a circling aircraft between 16 and 492 ft (5 and 150 m) in altitude. Bowheads appear to be more susceptible to aircraft overflights while resting and less so when actively feeding, mating, or socializing. Patenuade et al. (2002) observed 63 bowhead whale groups and 40 groups of beluga whales. Fourteen percent of bowhead whales and 38 percent of Beluga whales responded to the sound of a Bell 212 helicopter passing overhead repeatedly at an altitude of 492 ft (150 m) and a distance of 820 ft (250 m). Responses included short surfacing, immediate dives or turns, vigorous swimming, and breaching.

Meanwhile, gray whale reactions to aircraft are variable and mothers with calves seem to be particularly sensitive (Clarke et al. 1989; Ljungblad and Moore 1983). Malme et al. (1983; 1984) observed the behavioral reactions of gray whales from underwater playbacks of a Bell 212 helicopter and noted that there were changes to their swim speed and direction of travel. Clarke (1956) observed that some sperm whales showed no reaction to a helicopter at a low altitude unless they were in its downwash. At an altitude of 492–755 ft (150–230 m), some sperm whales remained at the surface while others dove immediately (Mullin et al. 1991). Therefore, as described above, behavioral reactions of cetaceans to aircraft noise associated with the Proposed Action are expected to be, at most, minor to moderate avoidance responses of a few animals, over short and intermittent periods.

Pinnipeds, more so than cetaceans, have the potential to be disturbed by both airborne and underwater noise generated by the engine of the aircraft (Born et al. 1999; Richardson et al. 1995) because they spend part of their life on land and not exclusively in the water. In 2004, researchers measured auditory fatigue to airborne sound in harbor seals, California sea lions, and northern elephant seals after exposure to non-pulse noise for 25 minutes (Holt et al. 2004; Kastak et al. 2004; Kastak et al. 2005). In the study, the harbor seal experienced approximately 6 dB of TTS at 99 dB re 20 μPa. The authors identified onset of TTS in the California sea lion at 122 dB re 20 μPa. The northern elephant seal experienced TTS-onset at 121 dB re 20 μPa (Kastak et al. 2004). There is a dearth of information on acoustic effects of helicopter overflights on pinniped hearing and communication (Richardson et al. 1995) and to the Coast Guard's knowledge, there has been no specific documentation of TTS or PTS in free-ranging pinnipeds exposed to helicopter operations during realistic field conditions. Therefore, as described above, physical effects to pinnipeds from aircraft noise associated with the Proposed Action are not expected. While noise from aircraft would not be expected to cause direct physical effects, aircraft noise has the potential to affect behavior.

Behaviorally, reactions of hauled out pinnipeds to aircraft flying overhead, such as looking up at the aircraft, moving on the ice or land, entering a breathing hole or crack in the ice, or entering the water have been observed (Blackwell et al. 2004; Born et al. 1999). Reactions depend on several factors, including the animal's behavioral state, activity, group size, habitat, age or experience, and the flight pattern of the aircraft (Richardson et al. 1995). Spotted seals hauled out on sea ice react at considerable distances to aircraft by moving swiftly across ice floes and diving off into the water (Richardson et al. 1995). Spotted seals on beaches move into the water when a survey aircraft flies over at altitudes up to 305 to 760 m or more and at lateral distances up to 1 km. This fleeing behavior persists despite frequent exposure to aircraft overflights, but the seals return to their haul out sites shortly after exposure (Richardson et al. 1995). Reactions to helicopter disturbance are difficult to predict, though helicopters have been recorded to elicit a stronger behavioral response (e.g., diving, increase in surfacing) by bearded and ringed seals (Born et al. 1999). Observations of ringed seals within the water column showed some ringed seals surfaced 66–98 ft (20–30 m) from the edge of an ice pan only a few minutes after a helicopter had landed and shut down near the ice edge (Richardson et al. 1995). Additionally, a study found that wind chill was also a factor in level of response of ringed seals hauled out on ice (higher wind chill increases probability of leaving the ice), as well as time of day and relative wind direction (Born et al. 1999). Overall, there has been no indication that single or occasional aircraft flying above pinnipeds in water cause long term displacement of these animals (Richardson et al. 1995). The Lowest Observed Adverse Effects Levels are rather variable for pinnipeds on land, ranging from just over 492 ft (150 m) to about 6,563 ft (2,000 m) (Efroymson et al. 2001). A conservative (90th percentile) distance effects level is 3,773 ft (1,150 m). Most thresholds represent movement away from the overflight. Bowles and Stewart (1980) estimated a Lowest Observed Adverse Effects Level of 1,000 ft (305 m) for helicopters (low and landing) in California sea lions and harbor seals observed on San Miguel Island, CA; animals responded to some degree by moving within the haulout and entering into the water, stampeding into the water, or clearing the haulout completely. Both species always responded with the raising of their heads. California sea lions appeared to react more to the visual cue of the helicopter than the noise. Coast Guard aircraft would maintain a minimum altitude of 1,500 ft (457 m) (Appendix A). Aircraft would also stay at or above 3,000 ft (914 m) within an environmentally sensitive area in order to avoid disturbances.

As a case for reference, in 2008, NMFS issued an Authorization to the USFWS for the take of small numbers of Steller sea lions and Pacific harbor seals, incidental to rodent eradication activities on an islet offshore of Rat Island, AK (USFWS 2009). This rodent eradication would be conducted by helicopter; the 15-minute aerial treatment consisted of the helicopter slowly approaching the islet at an elevation of over 1,000 ft (304.8 m), gradually decreasing altitude in slow circles, and applying the rodenticide in a single pass then returning to Rat Island. The gradual and deliberate approach to the islet resulted in the sea lions present initially becoming aware of the helicopter and calmly moving into the water. Further, the USFWS reported that all responses fell well within the range of Level B harassment, as defined under the MMPA, (i.e., limited, short-term displacement resulting from aircraft noise due to helicopter overflights) (USFWS 2009).

As a general statement from the available information, pinnipeds exposed to intense (approximately 110 to 120 dB re 20 μPa) non-pulse sounds often leave haulout areas and seek refuge temporarily (minutes to a few hours) in the water (Southall et al. 2007). Per Richardson et al. (1995), approaching aircraft generally flush animals into the water and noise from a helicopter is typically directed down in a ‘‘cone’’ underneath the aircraft. In these cases, the helicopter was deliberately approaching areas where pinnipeds were expected. The Coast Guard would not approach known areas where pinnipeds are expected, therefore, no impacts to pinnipeds are expected as a result of proposed action’s activities.

Behavioral reactions of ringed seals to aircraft have been recorded. Ringed seal pups are born in lairs from mid-March through April, and mothers nurse their pups in the lairs for 5 to 8 weeks (Hammill et al. 1991; Lydersen and Hammill 1993; Smith et al. 1973). Sea ice habitat that is suitable for the formation and maintenance of subnivean birth lairs (used for sheltering pups during whelping and nursing), is typically seasonal landfast (shorefast) ice, except for any bottom-fast ice extending seaward from the coastline in waters less than 2 m deep, or dense, stable pack ice that has undergone deformation and contains snowdrifts at least 54 centimeters deep. From mid-May through early June, ringed seals also frequently haulout on the exposed ice surface. Ringed seals were shown to leave their subnivean lairs and enter the water when a helicopter was at an altitude of less than 1,000 ft (305 m) and within 1.2 mi (2 km) lateral distance (Richardson et al. 1995). Ringed seal vocalizations in water were similar between areas subject to low-flying aircraft and areas that were less disturbed (Calvert and Stirling 1985). These data suggest that although a ringed seal may leave a subnivean lair (Burns et al. 1982), aircraft disturbance was temporary and did not cause the animals to leave the general area. Williams et al. (2006) investigated whether ringed seals use of breathing holes and lairs during winter and spring was affected by the construction and drilling on Northstar Island, built in the nearshore Alaskan Beaufort Sea, and determined that activities did not negatively affect the seals’ use of their lairs. Williams et al. (2006) further determined that given the turnover and creation of new structures (lairs) during the ice-covered season, it was unlikely that the loss of a breathing hole or resting structure over the course of the winter, from natural or anthropogenic causes, would significantly affect an individual seal. Structures used by ringed seals are not distributed randomly and are usually concentrated along pressure ridges, cracks, leads, or other surface deformations (Furgal et al. 1996; Hammill and Smith 1989; Lydersen and Smith 1989; Nichols 1999; Smith and Stirling 1975). It is expected that should the Coast Guard land on the ice with a helicopter during personnel transport, these landings would be considered extremely rare (e.g., emergency) and would not occur in the same location (e.g., consecutive repetitive landings in the same spot on the ice). Thus, effects from landing a helicopter on the ice would be short-term. Although lairs are often cryptic and likely difficult to identify from air, they are rarely occupied for long periods and as mentioned previously, ringed seals tend to use structures for shorter periods in areas of higher ice deformation. In all likelihood, most of the personnel transport to any ice location would occur outside of the pupping season, so effects to ringed seals associated with lairs would be extremely low. In addition, the Coast Guard would follow SOPs (Appendix A) to avoid effects to hauled out pinnipeds. Therefore, the Coast Guard does not anticipate any effect from aircraft activities to ringed seals in subnivean lairs during the Proposed Action.

Coast Guard aircraft would support the recovery of protected living marine resources through internal compliance with laws designed to preserve marine protected species, including planning passage around marine sanctuaries, such as federally-designated critical habitat. These actions would minimize the effect of aircraft noise to marine mammals and federally designated critical habitat. As stated in the Coast Guard SOPs in Appendix A, the Coast Guard expects to avoid any aircraft close approaches of marine mammals in the water or any known haulout areas that may be within the proposed action area. The Coast Guard would post PSOs and train crew members so that when a marine mammal is sighted, the bridge or pilot would be alerted, so avoidance measures can be taken. Weather conditions are often a factor in the proposed action area and therefore, an unexpected situation could occur where a helicopter needs to divert from its planned route, or the helicopter needs to fly lower than originally anticipated. The Coast Guard would continue to post PSOs to sight marine mammals, although sighting conditions may be compromised due to the weather conditions and could alter a PSO's ability to detect marine mammals. As long as navigational safety is not compromised, the Coast Guard would follow SOPs to avoid marine mammals. If an unexpected (emergency) situation with regard to flight patterns and weather occurs, and in the unlikely event that pinnipeds are hauled out in area that is not a known haulout site or rookery that is actively being avoided, it is possible that a low-flying helicopter could cause some disturbance to an unknown number of pinnipeds. While the number of pinnipeds is unknown, it is assumed that the total number would be considerably less than what would be expected at a known rookery or haulout site. The initial helicopter approach to these hauled out animals could cause a subset, or all of the marine mammals hauled out, to depart and move into the water. Thus, some animals may be temporarily displaced from the haulout and either raft in the water, relocate to other haulouts, or immediately return to the haulout where they were just displaced. The likelihood of the temporary presence of Coast Guard assets in one area due to unplanned events caused by weather is extremely rare. Therefore, the long-term effect of Proposed Action's activities on hauled out animals is expected to be negligible because any response is expected to be temporary and any animal that did exhibit a behavioral response would be expected to return to its normal behavior once the stimulus is gone. There would be no effect to breeding, feeding, migrating, or sheltering and thus, to the health and fitness of that individual(s). In the unlikely event that a Coast Guard aircraft diverted from its planned course and may have impacted pinniped(s), the Coast Guard would immediately notify NMFS as soon as possible regarding this event.

Any noise generated by the UAV is expected to be minimal and below the hearing threshold of marine mammals, both in-air and under-water (where noise would attenuate even further).

Marine Birds

Altitudes at which migrating birds fly can vary greatly based on the type of bird, where they are flying (over water or over land), and other factors such as weather. Approximately 95 percent of bird flight during migrations occurs below 42,808 ft (3,048 m) with the majority below 2,999 ft (914 m) (Lincoln et al. 1998). The ESA-listed marine bird species that may be encountered during the proposed overflights tend to fly directly above sea level to about 328 ft (100 m) above sea level. In a Day et al. (2004) study done near Utqiagvik (Barrow), Eiders had a mean flight altitude of 40.0 ± 2.6 ft (12.1 ± 0.8 m) above ground or sea level. Short-tailed albatross have been recorded at altitudes between 13 and 26 ft (4 and 8 m) (Pennycuick 1982). Helicopters associated with the Proposed Action are taking off and landing either at sea or from an existing airstrip.

While marine birds may fly below the altitude of helicopter flights associated with the Proposed Action, if a bird is close to an intense sound source, it could suffer auditory fatigue or a threshold shift. Studies have examined hearing loss and recovery in only a few species of birds, and none studied hearing loss in marine birds (Hashino et al. 1988; Ryals et al. 1999; Ryals et al. 1995; Saunders et al. 1974). A bird may experience PTS if exposed to a continuous sound pressure level over 110 dBA re 20 μPa in air. Continuous noise exposure at levels above 90 to 95 dBA re 20 μPa can cause TTS (Dooling and Therrien 2012). Unlike many other species, birds have the ability to regenerate hair cells in the ear, usually resulting in considerable anatomical, physiological, and behavioral recovery within several weeks. Still, intense exposures are not always fully recoverable, even over periods up to a year after exposure, and damage and subsequent recovery vary significantly by species (Ryals et al. 1999). Birds may be able to protect themselves against damage from sustained sound exposures by regulating inner ear pressure, an ability that may protect ears while in flight (Ryals et al. 1999).

Chronic stress due to disturbance may compromise the general health and reproductive success of birds (Kight et al. 2012), but a physiological stress response is not necessarily indicative of negative consequences to individual birds or to populations (Bowles et al. 1991; National Parks Service 1994). It is possible that individuals would return to normal almost immediately after exposure, and the individual's metabolism and energy budget would not be affected long-term. Studies have also shown that birds can habituate to noise following frequent exposure and cease to respond behaviorally to the noise (Larkin et al. 1996; National Parks Service 1994). However, the likelihood of habituation is dependent upon a number of factors, including species of bird (Bowles et al. 1991), and frequency of and proximity to exposure. A study by Komenda-Zehnder et al. (2003) examined the stressed behavioral shifts during aircraft overflights at different altitudes. They observed that flights operating at lower altitudes elicited a greater behavioral response, and that larger, slower moving aircraft also lead to greater stressed response. However, this study also concluded that the stressed behaviors exhibited were decreased to a normal level around five minutes after the overflight occurred; thus the behavioral responses were temporary.

Responses by birds to helicopter overflights include flying, swimming, and displaying alert behaviors

(Conomy et al. 1998; Ward et al. 1999). Even if a behavioral response is not observed, studies have shown that birds physiologically may be affected based on increased heart rates during aircraft overflights (Wooley Jr. and Owen Jr. 1978). However, an occasional startle or alert reaction to aircraft is not likely to disrupt major behavior patterns (such as migrating) or to result in serious injury to any marine bird (U.S. Navy 2011).

Coast Guard aircraft would follow SOPs and BMPs (as outlined in Section 2) to minimize the impact or harm of the Proposed Action. Specifically, Coast Guard vessels would support the recovery of protected living marine resources through internal compliance with laws designed to preserve protected species, including ESA-listed marine birds, marine birds protected by the MBTA, and federally-designated critical habitat for marine bird species.

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