ENVIRONMENTAL ASSESSMENT FOR ARCTIC SHIELD 2017

June 2017

U.S. Coast Guard
District 17
Juneau, Alaska

U.S. Department of Homeland Security

United States Coast Guard

Executive Summary

Introduction

This document is an Environmental Assessment (EA) prepared in accordance with the National Environmental Policy Act, 42 U.S.C. § 4321, *et seq*., Council on Environmental Quality (CEQ) Regulations, 40 C.F.R. § 1500 *et seq*., and the Coast Guard National Environmental Policy Act Implementing Procedures and Policy for Considering Environmental Impacts, COMDTINST M16475.1D (2000).

The Coast Guard's Proposed Action is to implement the Arctic Shield Operational Plan (OPLAN) for 2017 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 (specifically to Categorical Exclusions 22 and 23). However, under COMDTINST M16475.1D, categorical exclusions are not available in "extraordinary circumstances." As stated under Section 2.B.2.b.(8) of COMDTINST M16475.1D, the potential exists for "extraordinary circumstances" to exist in the Arctic because vessels and aircraft participating in Arctic Shield 2017 will be in areas involving species or habitats protected by the Endangered Species Act, the Marine Mammal Protection Act, the Magnuson-Stevens Fishery Conservation and Management Act, and the Migratory Bird Treaty Act. Thus, in accordance with COMDTINST M16475.1D, the Coast Guard has chosen to analyze the impact or harm of Arctic Shield 2017 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 2017, 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 2014-2016 occurred in a smaller action area within the ARPA area. These previous Arctic Shield operations were of similar context and intensity as the Proposed Action for Arctic Shield 2017. For each of those years, the Coast Guard prepared an EA, each resulting in a FONSI. Because Arctic Shield 2017's scope and intensity is similar to those of 2014 through 2016, the Coast Guard has determined that an EA is necessary in order to determine whether Arctic Shield 2017 will have significant impact or harm on the human environment.

[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."

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

Coast Guard District 17 proposes to conduct operations and training events to meet Coast Guard mission responsibilities in the U.S. Arctic Region. This seasonal increase of Coast Guard presence is conducted under the operational name Arctic Shield. There has been a progressive, yearly decline in the thickness and extent of Arctic sea ice. The retreat of ice has created navigation routes through the Northwest Passage and Northern Sea Route and vessel activity in the Arctic has increased with the retreat of sea ice (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 and oil and gas industry vessels, government and private research vessels, oil industry vessels, ore carriers, coastal resupply vessels, cruise ships, recreational/adventurer vessels, and commercial fishing boats. With increased traffic comes an increased potential for search and rescue, water pollution, illegal fishing, and infringement on the U.S. Exclusive Economic Zone (EEZ) which requires Coast Guard presence. 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).

Thus, the purpose of the Proposed Action is to meet the seasonal surge and mission requirements that typically occur in the Arctic from the spring through fall months and to provide consistent and reliable Coast Guard presence. The Coast Guard has previously conducted these operations and training events during this timeframe. These activities support the Coast Guard's Arctic Strategy (U.S. Coast Guard 2013b) and enable the Coast Guard to fulfill its missions, guided by direction from the President of the United States, including 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 and Maritime Domain Awareness, National Ocean Policy, and Executive Order 13580.

The Coast Guard sends vessels and aircraft to the Arctic during the summer months to provide largely the same humanitarian services, wildlife protection, federal law enforcement, and national security missions that it performs in the sub-Arctic waters off Alaska year round. The number of vessels and aircraft that the Coast Guard sends somewhat mirrors the vessel traffic for commercial, recreational, and subsistence purposes which increases as the ice recedes to the North.

Arctic Shield refers to integrated summer activities in which the Coast Guard conducts safety and security operations in the seasonal seas, and evaluates both its operational capabilities and the strength of its relationships with federal and state partners as well as with Alaskan communities. The primary activities performed by the Coast Guard in sub-Arctic waters off Alaska are: (1) searching for passengers or crew that have fallen overboard into sub-Arctic waters from recreational vessels, subsistence fishing boats, commercial fishing boats, cruise ships, research vessels, container ships, and car carriers; (2) rescuing persons in sub-Arctic waters or persons in medical extremis on vessels in the sub-Arctic requiring evacuation by helicopter or 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; (3) emergency response by Coast Guard vessels and aircraft to reports of oil spills from vessels in the sub-Arctic; (4) establishing aids-to-navigation, and (5) enforcing federal law in the U.S. Territorial Sea and the High Seas. Many of these duties can only be performed by the Coast Guard under specific federal statutes, including but not limited to, Title 14 U.S. Code, Sections 81, 86, 88, 89, 90, the federal Clean Water Act, the Oil Pollution Act, and other specialized authorities.

Although the Coast Guard is a military service and a branch of the Armed Forces, the Coast Guard does not perform gunnery operations in the Arctic, does not deploy missiles, mines, or torpedoes, nor does it operate sonar for purposes of Anti-Submarine Warfare, nor are Coast Guard vessels equipped with Low-Frequency or Mid-Range Frequency sonar. None of the above would be used as a part of the Proposed Action.

In addition, the Coast Guard does not hunt or participate in any subsistence hunts of marine mammals. The Coast Guard has promulgated written avoidance measures designed to avoid take of marine mammals; the negligent or intentional disregard of which would place the Commanding Officer of a Coast Guard vessel or aircraft in jeopardy of disciplinary action or even criminal prosecution under the Uniform Code of Military Justice.

Coast Guard actions intended to conserve endangered, threatened, and candidate species include law enforcement at-sea in the Arctic on behalf of other federal agencies, including in the area of wildlife protection where the Coast Guard acts as Co-Investigators for the Marine Mammal Health and Stranding Response Program under Permit No. 18786 issued by the National Marine Fisheries Service.

Proposed Action and Alternatives

Arctic Shield 2017 includes the dispatch of two MH-60 helicopters to Kotzebue from late June 2017 through October 2017. The Coast Guard would dispatch the Coast Guard Cutters MAPLE, HICKORY, HEALY, ALEX HALEY, and SHERMAN to the proposed action area on staggered schedules, resulting in one to two cutters in the Arctic Region in July and October and two to three cutters in the Arctic Region in August and September. The dispatched cutters would perform the same humanitarian, law enforcement, and national security duties, functions, and missions of the Coast Guard as are performed in the sub-Arctic Region of Alaska year round. These include:

1. Emergency searches and rescues 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 persons on vessels in Arctic waters in medical extremis 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;
3. Establishing aids-to-navigation in Arctic waters;
4. Enforcing federal law in the U.S. Territorial Sea and the High Seas of Arctic waters.
5. Maintaining awareness of vessel and aircraft activities in the Arctic maritime domain. Broadening Coast Guard partnerships with Alaska Native Villages in the Arctic; and,
6. Enhancing and improving preparedness, prevention and response capabilities.

The Proposed Action consists of five main elements employed to meet the objectives of Arctic Shield 2017. These elements are:

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

4. Training exercises; and,
5. Tribal and local government engagement.

Shore operations for Arctic Shield 2017 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 and MH-65 Dolphin 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 in the Arctic in 2017. 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 standard operating procedures (SOPs) 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.

The results of the analysis indicate that, with the implementation of SOPs and BMPs (Chapter 6), the Proposed Action would not significantly impact or harm the physical, biological, and socioeconomic environments.

The Coast Guard completed informal consultations with USFWS in 2012 and 2014 and received letters of concurrence from USFWS thereby completing the Coast Guard’s obligations under ESA Section 7 to consult with FWS. The two letters of concurrence are appended to this EA at Appendix B. 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, 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 or the candidate species Pacific walrus (*Odobenus rosmarus divergens*) 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 2017 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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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

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 2017. 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 below).

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 all of the Arctic Region, proposes to conduct Arctic Shield operations and training exercises in order to fulfill this mission in response to a substantial increase in Arctic maritime activity from mid-May to mid-November of 2017.

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 2017 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.

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[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."

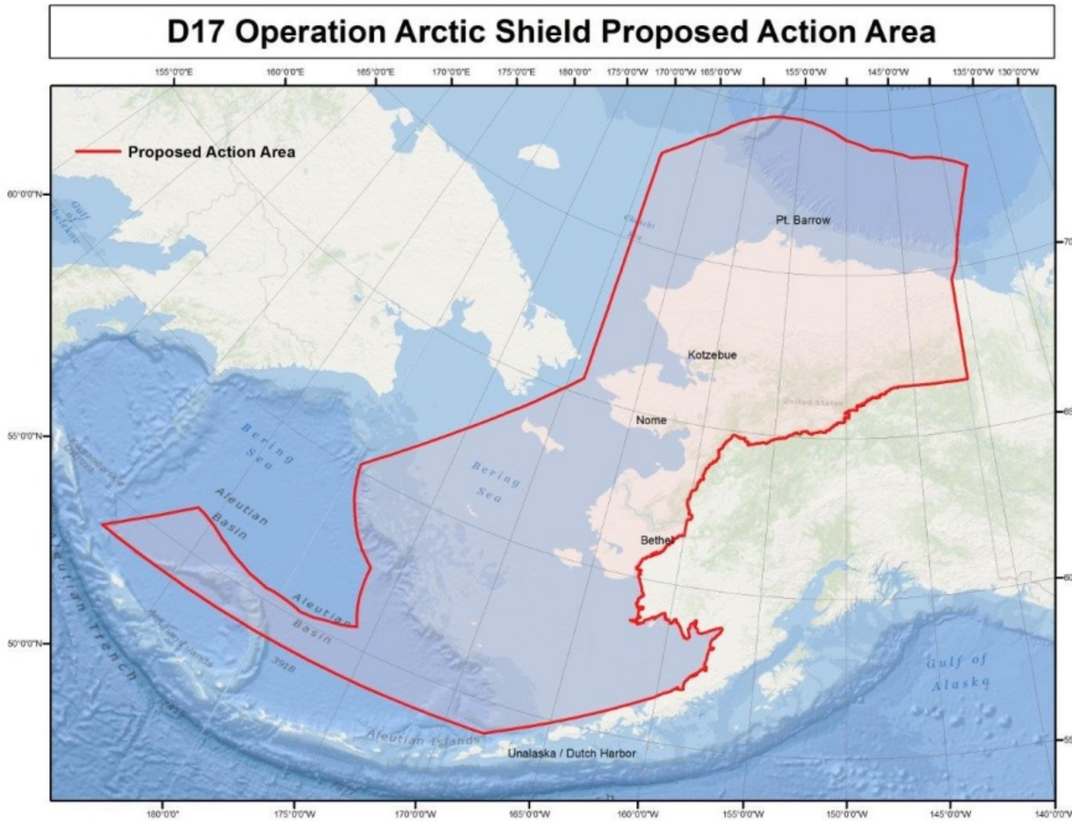

Figure 1-1. The Proposed Action Area.

1.2 PURPOSE AND NEED

The purpose of the Proposed Action is to provide consistent and reliable Coast Guard presence in the Arctic from mid-May to mid-November of 2017 to fulfill the Coast Guard's Arctic Strategy (U.S. Coast Guard 2013b), guided by the Coast Guard's Arctic Strategy Implementation Plan, with direction from the President of the United States, including 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, and Maritime Domain Awareness, National Ocean Policy, and Executive Order 13580. Coast Guard District 17 proposes to implement the Arctic Shield Operations Plan (OPLAN) by conducting Arctic Shield operations and training events to meet the Coast Guard mission responsibilities in the U.S. Arctic Region of operation.

The need for the Proposed Action is to meet the Coast Guard's missions in the Arctic Region of operation. Increased levels of human activity in the Arctic due to a decrease in the extent of sea ice result in an increase in associated marine activities. Thus, the objective of the Proposed Action is to meet this seasonal surge, and mission requirements, that typically occur from the spring through fall months, and to provide consistent and reliable Coast Guard presence. The requirement for the Coast Guard to be present in the Arctic during the ice-free season of 2017 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.

Coast Guard District 17 proposes to conduct operations and training events to meet Coast Guard mission responsibilities in the U.S. Arctic Region. The Coast Guard has previously conducted operations and training events in the Arctic to meet Coast Guard mission responsibilities resulting from the increase in national and international activities. What began as Operation Arctic Crossroads (when the Coast Guard tested platforms for helicopters and boats on Alaska's North Slope Borough near Utqiagvik [Barrow]) has now become Arctic Shield, integrated 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. From 2012 through 2016, responding to increases in national and international maritime activities, the Coast Guard broadened the scope of Arctic Shield by establishing a Forward Operating Location (FOL) and deploying a variety of air and sea assets.

There has been a progressive, yearly decline in the thickness and extent of Arctic sea ice. The retreat of ice has created navigation routes through the Northwest Passage and Northern Sea Route and vessel activity in the Arctic has increased with the retreat of sea ice (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 and oil and gas industry vessels, government and private research vessels, oil industry vessels, ore carriers, coastal resupply vessels, cruise ships, 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. Exclusive Economic Zone (EEZ) which requires Coast Guard presence.

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 essential 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.

The CAA was amended in 1977 primarily to set new goals (i.e., dates) for achieving attainment of NAAQS, because many areas of the country had failed to meet the deadlines. However, the 1990 amendments were intended to meet unaddressed or insufficiently addressed problems such as acid rain, ground-level ozone, stratospheric ozone depletion, and air toxics. 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 CWA does not directly deal with ground water or water quality issues. 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 USFWS based on the determination that the Proposed Action may affect, but is not likely to adversely affect, the bowhead whale (*Balaena mysticetus*), 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*), short-tailed albatross (*Phoebastria albatrus*), spectacled eider (*Somateria fischeri*), Steller's eider (Polysticta stelleri), polar bear (*Ursus maritimus*), or the candidate species Pacific walrus (*Odobenus rosmarus*). 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 apply to Arctic Shield 2017[3].

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

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, or the proposed ringed seal 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 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 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).

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 MMPA and ESA (Chapter 6). 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 § 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. Under this regulation, the Coast Guard must consider the potential environmental effects of its actions and assess the adverse effects of activities on migratory birds. If the Coast Guard determines that the Proposed Action may result in a significant adverse effect on a population of migratory bird species, the Coast Guard shall consult with the USFWS to develop and implement appropriate conservation measures to minimize or mitigate these effects. 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 2017. 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 (U.S. Coast Guard 2013b) and enable the Coast Guard to fulfill its mission requirements, codified in the Homeland Security Act of 2002.

Arctic Shield 2017 includes the dispatch of two MH-60 helicopters to Kotzebue from late June 2017 through October 2017. The Coast Guard would dispatch the Coast Guard Cutters MAPLE, HICKORY, HEALY, ALEX HALEY, and SHERMAN to the proposed action area on staggered schedules, resulting in one to two cutters in the Arctic Region in July and October and two to three cutters in the Arctic Region in August and September. The dispatched cutters would perform the same humanitarian, law enforcement, and national security duties, functions, and missions of the Coast Guard as are performed in the sub-Arctic Region of Alaska year round. These include:

1. Emergency searches and rescues 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 persons on vessels in Arctic waters in medical extremis 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;
3. Establishing aids-to-navigation in Arctic waters;
4. Enforcing federal law in the U.S. Territorial Sea and the High Seas of Arctic waters.
5. Maintaining awareness of vessel and aircraft activities in the Arctic maritime domain. Broadening Coast Guard partnerships with Alaska Native Villages in the Arctic; and,
6. Enhancing and improving preparedness, prevention and response capabilities.

The Proposed Action consists of five main elements employed to meet the objectives of Arctic Shield 2017. These elements are:

1. Land/shore operations;
2. Air operations;
3. Sea operations;
4. Training exercises; and
5. Tribal and local government engagement.

2.2 PREFERRED ALTERNATIVE

2.2.1 Shore Operations

Several locations do, or may, serve as temporary Coast Guard home bases for sea and air support during the seasonal surge of Arctic activities (see Figure 2-1).

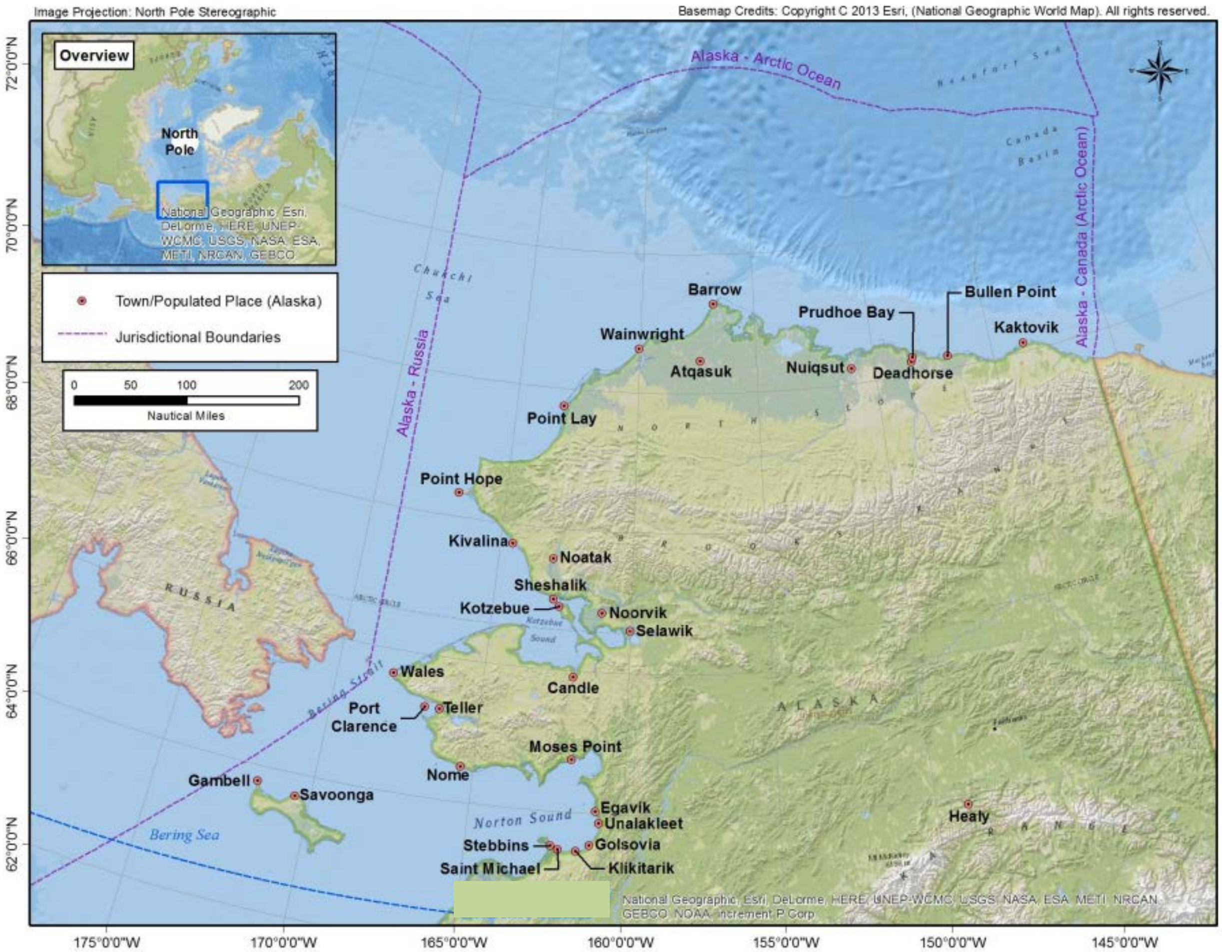

Figure 2-1. Possible Locations of Temporary Home Bases for Sea and Air Support During Arctic Shield 2017

2.2.1.1 Forward Operating Locations and Logistics/Staging Locations

FOLs are scalable facilities that can support sustained operations, but with only a small permanent presence of support or contractor personnel. The FOLs 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 FOL in Alaska is the Army National Guard Hanger in Kotzebue. Other areas could include Utqiagvik (Barrow) and Nome. Kotzebue, Utqiagvik (Barrow), and Nome are further discussed in Section 3.3, and analyzed in Chapter 4 (see sections regarding socioeconomic resources).

The FOL at Kotzebue would involve the deployment of up to two MH-60 Jayhawk helicopters, personnel, and use of a leased Army National Guard Hanger facility. This FOL leverages existing infrastructure, and positions the Coast Guard to conduct standard operations and respond to maritime emergencies in the Arctic area. Kotzebue would also serve as a refueling station for two MH-60 Jayhawk helicopters. Missions could include support for SAR, Arctic domain awareness flights, and, upon request, as support for other federal agency missions. Emergency SAR medivacs would depart from an FOL. Nome and Utqiagvik (Barrow) may serve as FOLs in a capacity similar to that of Kotzebue. Nome has a medium draft port and Utqiagvik (Barrow) has close proximity to continental shelf oil and gas endeavors. Flight and service crews would reside in hotels during Arctic Shield 2017, as they did during previous Arctic Shield events.

2.2.1.2 Inspections and Safety

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 dockside access to the vessel is not available, it would be accessed via a Coast Guard vessel (small boat). There have been infrequent inspections in Nome, Utqiagvik (Barrow), Kotzebue, and Kivalina. Inspections take approximately a half day and 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.

2.2.2 **Air Operations**

2.2.2.1 Search and Rescue

SAR missions are those that have the goal of preventing the loss of life and property. Because of the vast area of Coast Guard SAR responsibilities in Alaska, an aircraft, typically a MH-60 Jayhawk helicopter, is often sent first to find the vessel and report its location and status before a Coast Guard vessel is then dispatched for rescue. Air searches for persons in the water must be performed at an altitude below 500 feet (ft; 152 meters [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). All deployed materials (i.e., life jackets, life rafts), with the exception of flares, are expected to be recovered during a SAR mission. See Section 2.2.3.1 for "at-sea" SAR activities.

Figure 2-2. A Coast Guard MH-60 Jayhawk Helicopter

2.2.2.2 Routine Patrols, Arctic Domain Awareness Flights, and Reconnaissance

These operations serve to locate, identify, and document human contacts in the Arctic Region. 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 are 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. During Arctic Shield 2016, the USFWS requested three flights with the Coast Guard for their scientific data requests. It is expected that a similar number of flights associated with scientific data requests (less than five) could occur as part of Arctic Shield 2017.

Arctic domain awareness flights provide an opportunity for pilot and crew familiarization with the Arctic Region and can be the only safe opportunity for media coverage of events. Routine patrols and Arctic domain awareness flights are typically performed above 500 ft (152 m), weather permitting.

Helicopters conduct reconnaissance flights to detect open water leads in the ice and communicate this information to other assets in the area (e.g., an open water lead is an area where an icebreaker can more easily transit). 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.

2.2.3 **Sea Operations**

Sea operations in the proposed action area include SAR missions (in conjunction with air support, and if necessary, in collaboration with an icebreaker), establishment and enforcement of safety zones, routine patrols, and establishment of berthing and facilities for operations and support personnel. Other small boat operations could include inspections, as discussed in Section 2.2.1.2. Sea operations and associated training activities include movement and operation of vessels and associated support craft in the proposed action area. All Coast Guard vessels are equipped with standard navigational technologies, including radar and navigation sonars. Characteristics of acoustic sources associated with sea operations are given in Table 2-1. These sonar devices, which are in use at all times when a vessel is underway, allow ships to operate safely in the complex Arctic environment and would be used by all relevant platforms during standard operations, training, and other missions. The Coast Guard would use one high endurance cutter or medium endurance cutter and one buoy tender (Figure 2-3) during Arctic Shield 2017. Small boats, specifically rigid-hull inflatable boats (RHIBs), would be deployed from cutters and would go ashore to transport personnel to villages to attend meetings with the local community.

Table 2-1. Underwater Acoustic Sources Associated with the Proposed Action

Source type	Frequency range [kHz][a]	Source level (dB re 1µPa @ 1m)[b]	Associated Action
Small vessel	1–7	175	Small boat training, routine patrols
Large vessel	0.02–0.30	190	All sea operations and training
Single-beam echosounder (Fishfinder, Depth Sounder)	3.5–1,000 (24–200)[c]	205[d]	All sea operations and training

[a] Kilohertz

[b] Decibels (dB) referenced to 1 microPascal at 1 meter for underwater sound

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

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

References: (National Marine Fisheries Service 2012; Richardson et al. 1995; U.S. Coast Guard 2013a)

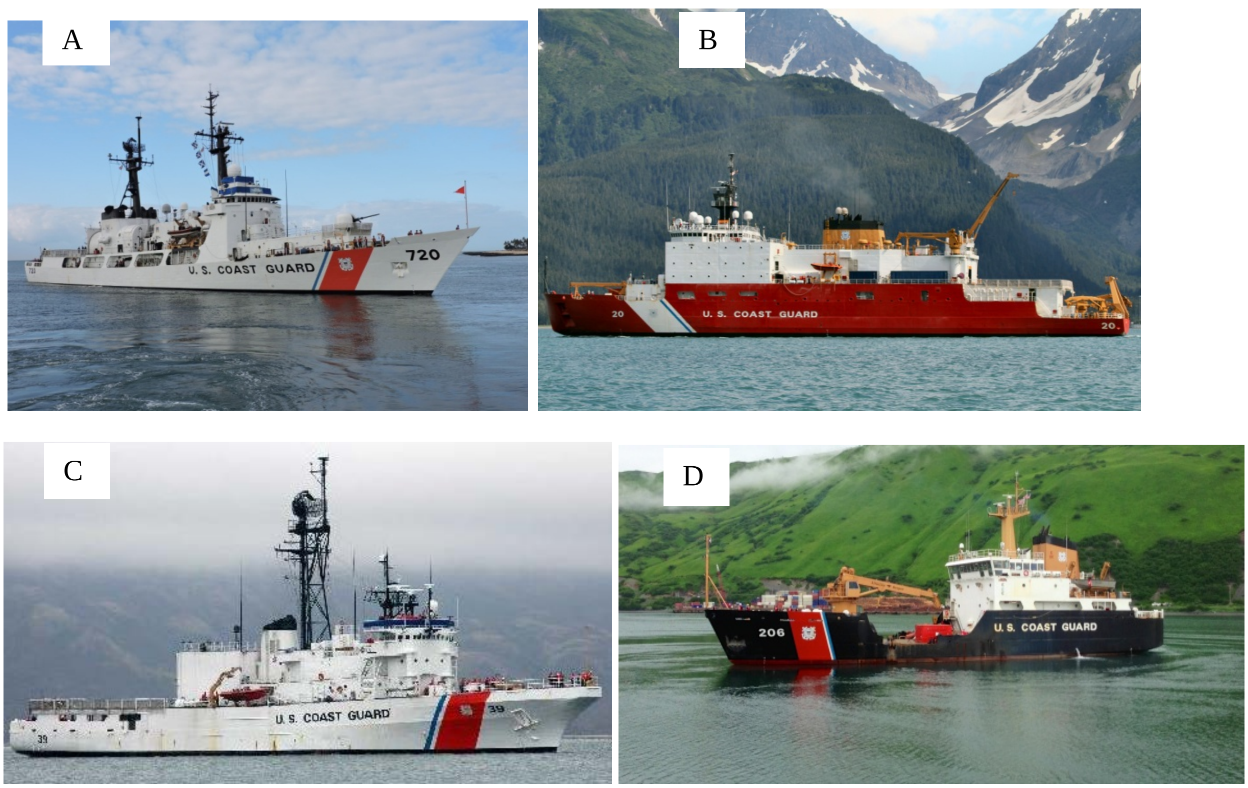

Figure 2-3. Coast Guard Sea Assets Include a High Endurance Cutter (A), Polar Icebreaker (B), Medium Endurance Cutter (C), and/or Buoy Tenders (D)

2.2.3.1 Search and Rescue

Coast Guard vessels would transit to a vessel in distress when air support provides the location (see Section 2.3.2.1). Flight deck equipped vessels provide logistical support to aircraft. Cutters can carry and deploy small boats to assist with rescues. Coast Guard vessels can also locate victims without air support through satellite emergency position-indicating radio beacon locators, cell phones, satellite phones, distress flares, and by conducting search patterns in last known locations. Search vessels may employ radar and sonar technologies to aid in detection. When vessels carrying a large number of people aboard require rescue, Coast Guard vessels must get to the site quickly, as a helicopter alone cannot carry numerous additional passengers. The vessels for Arctic Shield 2017 are the HICKORY and MAPLE, buoy tenders; the HEALY, a polar icebreaker; the ALEX HALEY, a medium endurance cutter; and, the SHERMAN, a high endurance cutter. The cutters also have small (zodiac-type) boats, RHIBs that would be deployed. Coast Guard assets will support SAR and fast response cutters could act as aids to Arctic SAR. Depending on the emergency and location, a very large emergent military response, would require many Coast Guard assets, such as the HEALY icebreaker, but icebreaking itself is not proposed as part of Arctic Shield 2017.

2.2.3.2 Routine Patrols

The Coast Guard would routinely patrol Arctic waters to detect, deter, and disrupt maritime terrorist attacks, sabotage, or subversive acts; detect and investigate violations of the MMPA and the ESA; and to reduce the threat of foreign poaching of U.S. natural resources.

2.2.4 **Training**

The Coast Guard must continually assess the capability of personnel, assets, and resources operating in the Arctic. Training is required for 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 would follow Standard Operating Procedures (SOPs) and Best Management Practices (BMPs) described in Chapter 6 to minimize training impact or harm to biological resources.

2.2.4.1 Flight Training

Flight crews would be required to log in-flight hours to meet ongoing training requirements while at their FOL. As weather permits, MH-60T and MH-65D (Dolphin) helicopters would be flown in the FOL area to meet this requirement. The MH-60T helicopter would be stationed out of Kotzebue while the MH-65D helicopter would be stationed on the medium or high endurance cutter. Flight crews would coordinate with local tribes to ensure their proposed flight paths would 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 cutters have the training needed 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. There is no other type of flight training expected as part of Arctic Shield 2017 other than what has been described above. It is expected that up to 70 flight training exercises would occur during Arctic Shield 2017.

2.2.4.2 Small Boat Training

Coast Guard vessels under 65 (ft) (20 m) are classified as “boats,” which include cutter-based boats ranging from 14 to 28 ft (4 to 8.5 m). Small boat training would include boat launching and maneuvers, typically in the vicinity of the cutter that they support. Up to 25 training exercises would occur during Arctic Shield 2017 with no high-speed maneuvering or intercepts. Some shore-based boats may be transported to facilities by air and then launched via vehicle on a case-by-case basis.

2.2.4.3 Oil Recovery Training

Oil training field exercises during Arctic Shield 2017 would occur onshore or in the nearshore area in the Alaskan port of Utqiagvik (Barrow). The primary focus of the exercise is to provide both classroom and practical training consistent with the State and Federal Unified (Response) Plan Geographic Response Strategies. Participants would only practice deploying and retrieving a boom in the port's onshore and nearshore environment. All other training would be on shore. There will be no oil spill response activities conducted as part of Arctic Shield 2017.

2.2.5 Tribal and Local Government Engagement

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

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 or email with local governments, elected officials, Tribal leadership, mayors, and other leaders in affected communities (including Native 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, 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 2017, 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 reach out to tribes and villages and offer classes such as:

- Kids Don't Float - The Coast Guard would continue this program to maintain and supply remote communities with proper safety equipment to ensure youths can safely enjoy water and subsistence activities with their families.

- 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.

- 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.

2.3 No Action Alternative

Under the No Action Alternative, the Coast Guard would not be able to fulfill its mission requirements in the Arctic in 2017. 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 2017. 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 of 2017 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 2017 were considered as an alternative. The Coast Guard has concluded that an alternate level of air asset support for Arctic Shield activities in 2017 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 2017. 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 2017 were considered as an alternative. The Coast Guard has concluded that an alternate level of surface asset support for Arctic Shield from mid-May to mid-November of 2017 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 2017 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	
Invertebrates	Vessel noise and aircraft noise have the potential to impact or harm invertebrates within the proposed action area.
Marine 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.
Fish	Underwater acoustics, vessel noise, and vessel movement have the potential to impact or harm fish in the proposed action area.
EFH	Underwater acoustics, vessel noise, and aircraft noise have the potential to impact or harm EFH.
Marine Mammals	Underwater acoustics, aircraft noise, vessel noise, and vessel movement have the potential to impact or harm marine mammals within 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	The Proposed Action would occur offshore of Alaska on water and existing airstrips. Therefore, the Proposed Action would not impact or harm land use.
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.
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	
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.
Sea Turtles	No sea turtles are present within the proposed action area. Thus, the Proposed Action would not impact or harm sea turtles.
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 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, thence follows a rhumbline 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 Bering Sea's main features are the Aleutian Basin, several seamounts and islands, Bower's Ridge and Basin, and the bordering Aleutian Islands. The basins within the Bering Sea average a maximum depth of roughly 13,123 ft (4,000 m) (National Oceanic and Atmospheric Administration (NOAA) 2004). The Bering Sea is a moderately high productivity ecosystem currently undergoing a climate driven change in species dominance and abundance (Protection of the Arctic Marine Environment (PAME) 2013). The only gateway between the Pacific and the Arctic is the Bering Strait, a narrow, shallow passageway at only 46 nm wide and 164 ft (50 m) deep (Woodgate 2013). Due to the width of this passage, it is only an inflow point. Cold, less saline water (averaging about 32.5 practical salinity units) enters the Bering Strait from the Pacific Ocean and flows to the Arctic (Woodgate et al. 2005).

The dominant bathymetric features of the Chukchi Sea are the Hanna and Herald Shoals. Herald Shoal averages only 23 ft (7 m) water depth while the much larger Hanna Shoal averages closer to 148 ft (45 m) deep (National Oceanic and Atmospheric Administration (NOAA) 2008). In winter, winds from interior Alaska blow over the shallow Chukchi Sea, freezing the water into ice and moving the ice away from land. This process is constantly creating and moving ice as well as leaving behind salt, causing the dense, cold water to sink into the western Arctic. The cold, salty water from the Pacific shelf, lying atop the warmer, saltier water (about 35 practical salinity units) from the Atlantic Ocean creates the Arctic halocline. This halocline prevents the warm, dense bottom water from melting the polar ice from below (Woods Hole Oceanographic Institution (WHOI) 2006). Throughout the Arctic, a cold halocline layer is important in providing a density barrier trapping heat from Atlantic Water at depth away from the ice.

The Beaufort Sea, east of Utqiagvik (Barrow), contains many coastal shoals and islands (National Oceanic and Atmospheric Administration (NOAA) 2006). The primary bathymetric feature is the Canada

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[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."

Basin, which averages a depth of 12,500 ft (3,810 m) (Ostenso 2014). The high Arctic waters (a term used to describe barren polar areas) have water of relatively low nutrient loads. Nutrient concentrations undergo seasonal depletion in surface waters due to photosynthesis during spring/summer and renewal during winter when photosynthesis stops (Whitledge et al. 2008).

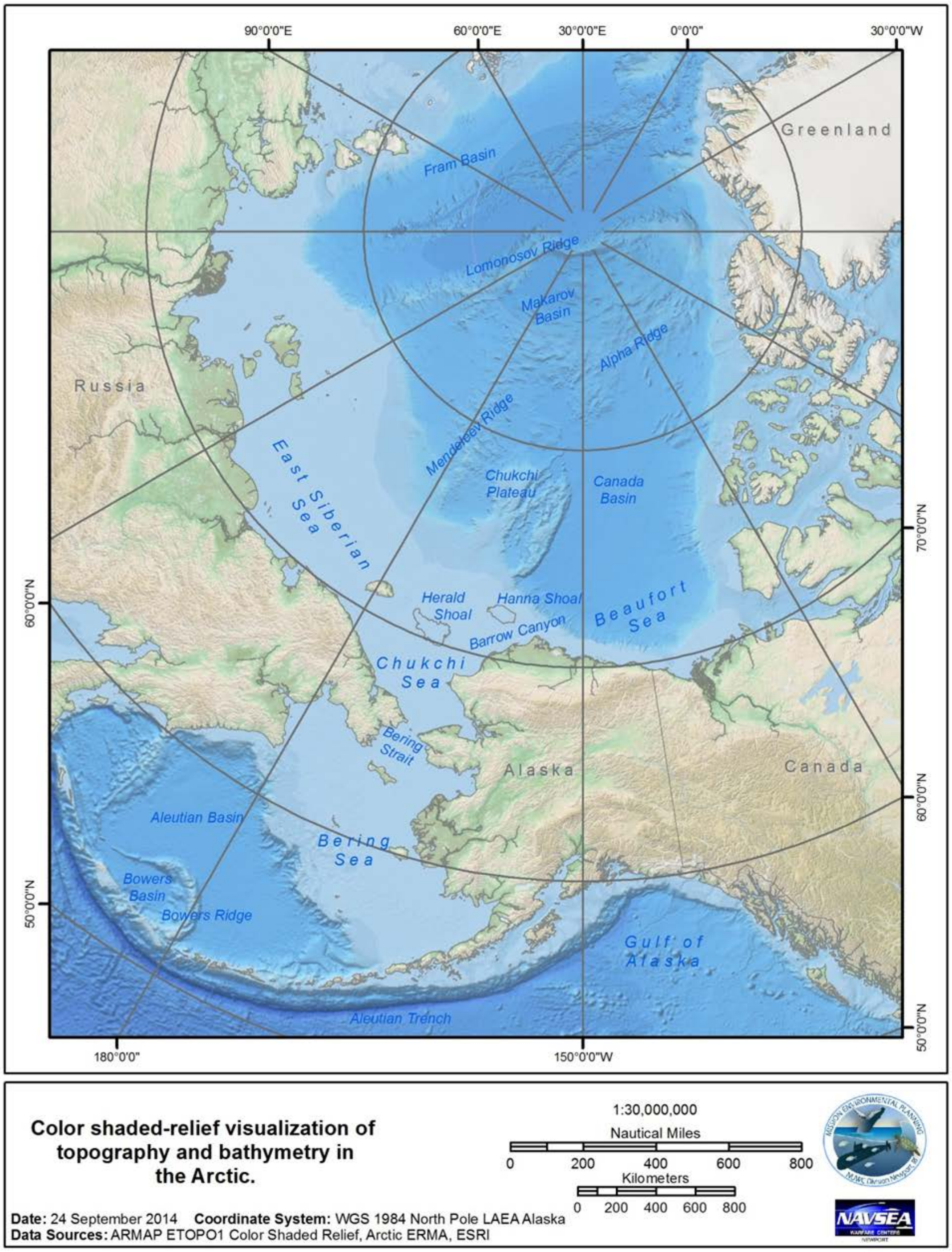

Figure 3-1. Topographic and Bathymetric Features in the Proposed Action Area

The Earth's climate has warmed approximately 1.1 degrees Fahrenheit (°F; 0.6 degrees Celsius [°C]) over the past 100 years with two main periods of warming occurring between 1910 and 1945 and from 1976 to present day (Walther et al. 2002). During 2015, the average temperature across global land and ocean surfaces was 1.62°F (0.90°C) above the 20th century average. This was the highest among all 136 years in the 1880–2015 record, surpassing the previous record set last year by 0.29°F (0.16°C) and marking the fourth time a global temperature record has been set this century (National Oceanic and Atmospheric Administration (NOAA) 2016). Temperature trends in the Arctic exhibit regional and annual variability (Maxwell 1997; Symon et al. 2005); however, a general warming trend has been observed since the late 1970s. Warming air temperatures have played a major role in the observed increase in permafrost temperatures around the Arctic rim, earlier spring snowmelt, reduced sea ice, widespread glacial retreat, increases in river discharge into the Arctic Ocean, and an increase in greenness of Arctic vegetation (Richter-Menge and Overland 2010).

Arctic sea ice, the frozen seawater that floats on the surface of the ocean and covers millions of square kilometers, plays a crucial role in Northern Hemisphere climate and ocean circulation (National Snow and Ice Data Center 2007; Serreze et al. 2003). Sea ice forms and melts with polar seasons, and affects both human activity and biological habitat (Richter-Menge and Overland 2010). Sea ice directly impacts coastal areas and broadly affects surface reflectivity, ocean currents, water cloudiness, humidity, and the exchange of heat and moisture at the ocean's surface. Since sea ice reflects the sun's heat, when ice retreat is greater and there is more open ocean, more of the sun's heat is absorbed, increasing the warming of the water (Karl et al. 2007). 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). The rapid loss of sea ice causes large temperature changes inland, which can in turn trigger permafrost degradation or subject permafrost to rapid decomposition in the future. Reduced sea ice also increases coastal erosion and flooding associated with coastal storms. Runoff and storms may alter the timing and location of plankton blooms, which can lead certain marine species, such as fish, to experience biological shifts (Karl et al. 2007). Sea ice reduction may also provide opportunities for increased shipping and transportation as well as increased resource extraction, including an occurrence of these activities where there has not previously been access (Karl et al. 2007). In September of 2007, the sea ice recession was so vast that the Northwest Passage completely opened up for the first time in human memory (National Snow and Ice Data Center 2007).

A general downward trend in Arctic sea ice has occurred during the last few decades (Serreze et al. 2003). The ice is declining faster than computer models had projected, and this downward trend is predicted to continue (Karl et al. 2007; National Snow and Ice Data Center 2007; Timmermans et al. 2014). The decrease in sea ice extent during the month of January from 1979 to 2017 is estimated at approximately a 3.2 percent decrease in sea ice per decade (National Snow and Ice Data Center 2017).

Annually, sea ice extent is at its maximum in March, representing the end of winter, and is at its minimum in September (Richter-Menge and Overland 2010). Data from 2016 reveal a September minimum extent of 1.60 million square miles (mi^2; 4.14 million square kilometers [km^2]). September 2012 remains the record low minimum ice extent of 1.32 million mi^2 (3.41 million km^2) (National Snow and Ice Data Center 2017). All of the ten lowest minimums have occurred in the last decade (National Snow and Ice Data Center 2017). The maximum ice extent from March 2017 continued its third straight year as the new lowest maximum ice extent in the 37 year satellite record. The March 2017 maximum extent (Figure 3-2) measured 5.57 million mi^2 (14.42 million km^2) (National Snow and Ice Data Center 2017).

The age of the sea ice is another key descriptor of the state of the sea ice cover. In March of 2014, the distribution of ice age favored first-year ice, or ice that has not survived a melt season, which is also the thinnest type of ice. In 2014, first-year ice comprised 69 percent of the ice extent. The month of March has shown a decreasing trend in the oldest ice, which is 4 years old or older. In 1988, 26 percent of ice cover was the oldest ice. In 2016, the oldest ice only constituted 1.2 percent of the pack (Perovich et al. 2016). Sea ice has also been experiencing later freeze-up than usual and earlier ice melt over the past few years, leading to a decline in multiyear ice (Overland and Wang 2013; Overland et al. 2010).

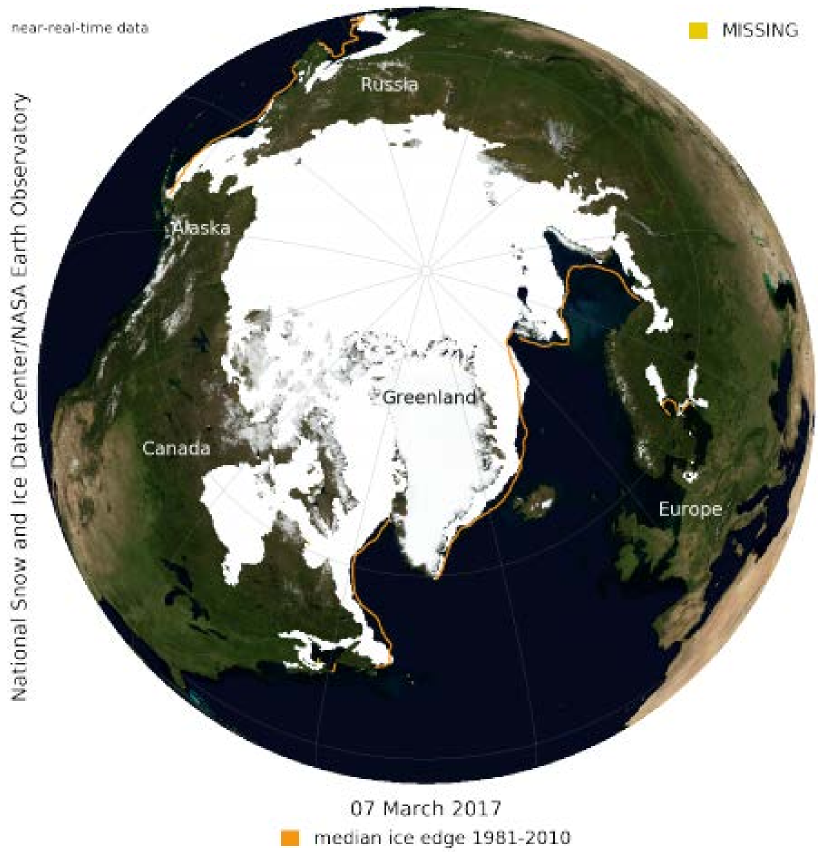

Figure 3-2. The Maximum Sea Ice Extent Reached on March 7, 2017 as compared to that from the Median Extent from March of 1981-2010

3.2 Biological Environment

3.2.1 Invertebrates

Marine invertebrates occur in the world's oceans, from warm shallow waters to cold deep waters, and are the most abundant animals in all habitats of the proposed action area. Excluding microbes, approximately 5,000 known marine invertebrates have been documented in the Arctic; the number of species is likely higher, though, since this area is not well studied (Josefson et al. 2013). Although the greatest diversity of species are found within the benthic zone, marine invertebrates can be found in all zones (sympagic [within the sea ice], pelagic [open ocean], or benthic [bottom dwelling]) of the Arctic (Josefson et al. 2013). Marine invertebrate distribution in the Arctic is influenced by habitat and oceanographic conditions (e.g., depth, temperature, salinity, nutrient concentrations, and ocean currents) (Levinton 2009). The cold water of the Arctic generally results in slow growth and high longevity among invertebrates and food sources which are only seasonally abundant. Major taxonomic groups found within the proposed action area are listed and described in Table 3-1. No ESA-listed species exist within the proposed action area. EFH has been designated for some federally managed invertebrate species within the proposed action area. These are listed in Section 3.2.4. Because of the large number of species, a general discussion of each ecologic zone (sympagic, pelagic, and benthic) is provided below.

3.2.1.1 Sympagic Zone

Sea ice provides a habitat for algae and a nursery ground for invertebrates during times when the water column does not support phytoplankton growth (Michel et al. 2002). Sympagic zone invertebrates live within the pores and brine channels of the ice (small spaces within the sea ice which are filled with a salty solution called brine) or at the ice-water interface. Biodiversity of species is low within the sympagic zone due to the extreme conditions of the sea ice (Nuttall 2005). Species abundance within the ice has been found to be highly variable with most species occurring within the bottom 4 inches (in; 10 centimeters [cm]) of ice core samples. Species are also found in greater densities in coastal fast ice compared to offshore pack ice. Additionally, abundance is 1 to 4 orders of magnitude greater in spring and early summer (compared to winter) in coastal fast ice (Bluhm et al. 2010). The most dominant sympagic species are nematodes, harpacticoid copepods, and rotifers (Josefson et al. 2013). At the ice-water interface, *Apherusa glacialis, Onisimus glacialis, O. nanseni,* and *Gammarus wilkitzkii* are common amphipods (Gradinger et al. 2010).

3.2.1.2 Pelagic Zone

Pelagic habitats include downwelling and upwelling areas and frontal zones. Dominant species groups within the pelagic zone are highly stratified by depth. In a zooplankton survey from the Arctic Canadian Basin (in the Beaufort Sea) within the pelagic zone, 50 percent of the biomass was concentrated in the upper layer from 0—328 ft (0—100 m) in depth (Hopcroft et al. 2005). The pelagic zone invertebrate fauna is dominated by large copepods such as *Calanus glacialis* and *C. hyperboreus*. Copepods in the pelagic zone of the Beaufort Sea have longer life cycles (2–4 years) and are larger than copepod species living in warmer water (Hopcroft et al. 2008). Sirenko (2001) and Sirenko et al. (2010) found that cnidarians are second to copepods in diversity and numbers. Jellyfish are likely important invertebrate predators within this zone (Josefson et al. 2013).

The continental shelf of the northern Bering Sea and southern Chukchi Sea is highly productive, from primary producers to sea birds and marine mammals. Waters in this region are shallow, but receive an advection of oceanic water from the Bering Sea basin to the southwest. The large copepods *Neocalanus cristatus* and *N. plumchrus* as well as *Thysanoessa* spp. euphausiids dominate this Bering Strait region (Bedard 1969; Springer and Roseneau 1985). In the southeastern Bering Sea, these species are joined by *Eucalanus bungii* and *Metridia pacifica* in controlling the spring diatom bloom (Cooney 1981; Smith and Vidal 1986). In Bering Shelf Water and coastal Alaskan water, *Calanus marshallae* dominate.

3.2.1.3 Benthic Zone

The benthic zone is the most diverse and species-rich habitat, where the majority of the species within the proposed action area can be found. Benthic marine invertebrates play an important role in the food web as scavengers, recyclers of nutrients, and habitat-forming organisms or can serve as food themselves to predators such as fish and whales. Within the Arctic region, major species groups within the benthic zone that have the highest diversity and abundance are Arthropoda (e.g., crabs and barnacles), Bryozoa (moss animals), Mollusca (e.g., snails and clams), and Nematoda (Josefson et al. 2013). In a Beaufort Sea trawl, the invertebrates with the highest densities in descending order of abundance were the notched brittle star (*Ophiura sarsi*), snow crab (*Chionoecetes opilio*), mussels (*Musculus* spp.), and the mud star (*Ctenodiscus crispatus*) (Rand and Logerwell 2010). Within the sediment, roundworms are one of the most widespread marine invertebrates with population densities of one million organisms per 11 F (ft^2; 1 square meter [m^2]) of mud (Levinton 2009). The principal habitat-forming invertebrates of the benthos are Porifera (e.g., sponges), Annelida (e.g., tube worms), and Mollusca (e.g., spiral margarite). On the inshore shelf of the Eastern Bering Sea, the sea star *Asterias amurensis* dominates, while offshore areas are most populated with Gastropoda, Paguridae, and snow crab (Yeung and McConnaughey 2006).

Table 3-1. Taxonomic Groups of Marine Invertebrates Present in the Proposed Action Area

Invertebrate Group		Presence in Proposed Action Area		
Common Name (Taxonomic Group)	**Description**	**Sympagic**	**Pelagic**	**Benthic**
Flatworms (Phylum Platyhelminthes)[1]	Simplest form of marine worm with a flattened body.	✓		✓
Ribbon worms (Phylum Nemertea)[1]	Worms with a long extension from the mouth (proboscis) that helps capture food.		✓	✓
Roundworms (Phylum Nematoda)[1]	Small worms; many live in close association with other animals (typically as parasites).	✓	✓	✓
Sponges (Phylum Porifera)[2]	Large species have calcium carbonate or silica structures embedded in cells to provide structural support.			✓
Segmented worms (Phylum Annelida)[2]	Highly mobile marine worms; many tube-dwelling species.	✓	✓	✓
Bryozoans (Phylum Bryozoa)[3]	Lace-like animals that exist as filter feeding colonies. Form either encrusting or bushy-tuftlike lacy colonies.			✓
Hydroids and jellyfish (Phylum Cnidaria)[2]	Animals with stinging cells.	✓	✓	✓
Cephalopods, bivalves, sea snails, chitons (Phylum Mollusca)[2]	Mollusks are a diverse group of soft-bodied invertebrates with a specialized layer of tissue called a mantle. Mollusks such as squid are active swimmers and predators, while others such as sea snails are predators or grazers and clams are filter feeders.		✓	✓
Shrimp, crab, barnacles, copepods (Phylum Arthropoda – Crustacea)[2]	Diverse group of animals, some of which are immobile. Most have an external skeleton. All feeding modes from predator to filter feeder.	✓	✓	✓
Sea stars, sea urchins, sea cucumbers (Phylum Echinodermata)[2]	Predators and filter feeders with tube feet.			✓

[1]Based on Arctic Ocean Diversity (2015)
[2]Invertebrate phyla are based on the World Register of Marine Species (Appeltans et al. 2010) and Catalogue of Life (Bisby et al. 2014).
[3]Individual species found on Arctic Ocean biodiversity, and verified via the distribution maps on the World Register of Marine Species (Appeltans et al. 2010).

3.2.1.4 Invertebrate hearing

Hearing capabilities of invertebrates are largely unknown (Lovell et al. 2005; Popper 2008). Outside of studies conducted to test the sensitivity of invertebrates to vibrations, very little is known about the effects of anthropogenic underwater noise on invertebrates (Edmonds et al. 2016). While data are limited, they do suggest that some of the major cephalopods and decapods may not hear well (Hanlon 1987; Offutt 1970), and may hear only low-frequency sources (Offutt 1970; Packard et al. 1990), which are most likely within the frequency band of biological signals (Hill 2009). In a review of crustacean sensitivity of high amplitude underwater noise by Edmonds et al. (2016), crustaceans may be able to hear the frequencies at which they produce sound, but it remains unclear which noises are incidentally produced and if there are any negative effects from masking them. Acoustic signals produced by crustaceans range from low frequency rumbles (20—60 Hertz [Hz]) to high frequency signals (20—55 kHz) (Henninger and Watson 2005; Patek and Caldwell 2006; Staaterman 2016). Aquatic invertebrates that can sense local water movements with ciliated cells include cnidarians, flatworms, segmented worms, urochordates (tunicates), mollusks, and arthropods (Budelmann 1992a, 1992b; Popper et al. 2001). Some aquatic invertebrates have specialized organs called statocysts for determination of equilibrium and, in some cases, linear or angular acceleration. Statocysts allow an animal to sense movement and may enable some species, such as cephalopods and crustaceans, to be sensitive to water particle movements associated with sound (Hu et al. 2009; Kaifu et al. 2008; Montgomery et al. 2006; Popper et al. 2001). Because any acoustic sensory capabilities, if present at all, are limited to detecting water motion, and water particle motion near a sound source falls off rapidly with distance, aquatic invertebrates are probably limited to detecting nearby sound sources rather than sound caused by pressure waves from distant sources.

Studies of sound energy effects on invertebrates are few, and identify only behavioral responses. Non-auditory injury, permanent threshold shift (PTS), temporary threshold shift (TTS), and masking studies have not been conducted for invertebrates. Both behavioral and auditory brainstem response studies suggest that crustaceans may sense frequencies up to three kHz, but best sensitivity is likely below 200 Hz (Goodall et al. 1990; Lovell et al. 2005; Lovell et al. 2006). Most cephalopods likely sense low-frequency sound below 1,000 Hz, with best sensitivities at lower frequencies (Budelmann 2010; Mooney et al. 2010; Offutt 1970; Packard et al. 1990). A few cephalopods may sense higher frequencies up to 1,500 Hz (Hu et al. 2009).

3.2.2 **Marine 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).

3.2.2.1 ESA-listed Marine Birds

Table 3-2. ESA-listed Marine Birds Present in the Proposed 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)

3.2.2.1.a 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.

3.2.2.1.b 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 mi^2 (100,000 km^2) 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 off-shore 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).

3.2.2.1.c 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 mi^2 (7,300 km^2) 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).

3.2.2.2 Non-ESA Listed Marine Birds

A combination of short-distance migrants, long-distance migrants, and year-round resident marine bird species occur within the proposed action area. Typical behaviors that would be encountered within the proposed action area predominantly include foraging and migrating, primarily in the open ocean areas, and molting in shallow lagoons.

Twenty species of birds from four Orders may occur within the proposed action area during the Proposed Action. All marine species present in the proposed action area are part of the Orders listed in Table 3-3. There are 18 species of migratory birds protected by the MBTA.

Table 3-3. Orders of Marine Birds Present in the Proposed Action Area

Order	Type of Bird	Common Species in the Proposed Action Area
Anseriformes	Waterfowl	Eiders, geese, ducks
Charaderiiformes	Shorebird	Gulls, knots, murrelets, plovers, puffins, phalaropes
Falconiformes	Bird of prey	Eagles
Gaviiformes	Waterfowl	Loons

3.2.2.2.a Order Anseriformes

The order Anseriformes is made up of three families which include screamers, geese, swans, and ducks (Vernon et al. 2007). These waterfowl inhabit aquatic environments, including some marine environments outside of the breeding season. Nests may be located on or near the water. Anseriformes feed mainly on aquatic vegetation, but may also forage for insects, plankton, shellfish, and small fish. They may forage by diving, dabbling, or grazing on land. Geese, swans, and ducks are migratory, while other types of Anseriformes are sedentary (Vernon et al. 2007). When these birds are not feeding or sleeping, they are typically spending time waterproofing their plummage, using their bill to spread oil over their feathers. When diving, most species do not dive much below 20 ft (6 m), though eiders are capable of deeper dives. They normally remain underwater for less than 30 seconds, though they may occasionally spend up to 90 seconds underwater (Vernon et al. 2007).

3.2.2.2.b Order Charadriiformes

The order Charadriiformes is a large group of birds encompassing sandpipers, plovers, phalaropes, gulls, and auks. In general, these shorebirds, gulls, and alcids are strong-flying birds that nest on the ground but feed on animals in or near water. Many members of this order perform extensive migrations (Zusi 2015).

When foraging, sandpipers use their bills like pinschers probe in mud or pick up surface invertebrates. Plovers forage on open ground, relying on eyesight to find invertebrates on which to feed. Phalaropes feed while swimming, stirring up prey by spinning around in circles (Zusi 2015). Gulls take their food as either carrion or in active predation. Larger gulls may steal food from other birds. Alcids are the only Charadriiformes adapted for swimming underwater. Depending on size, alcids may feed on small fish, and invertebrates such as euphausiids (Zusi 2015).

3.2.2.2.c Order Falconiformes

The order Falconiformes includes raptors such as eagles, condors, ospreys, and hawks. These birds are most active during the day, feeding on other animals, found alive or dead (Gill and Brown 2008). Many species hunt from perches, while others hunt on the wing, soaring or hovering at up to 328 ft (100 m) above the ground or water. Most Falconiformes do not migrate and sleep at night. Most species build nests of sticks either on trees, ledges of cliffs, or, rarely, on the ground (Gill and Brown 2008).

3.2.2.2.d Order Gaviiformes

This order of long, necked, low-bodied diving birds includes loons. Birds in the order of Gaviiformes have a dagger-like bill and short, strong legs with webbed feet. While excellent divers, they are clumsy on land, so nesting within 3 ft (1 m) of the water is a priority (del Hoyo et al. 1992). Nests are typically piles of plant matter on the ground. Prey is hunted underwater at depths from 6.5—33 ft (2—10 m). They feed primarily on fish, but also prey on frogs, crustaceans, mollusks, and fish spawn. Underwater, propulsion comes from their feet. Migrations for these species are often long. For almost all of these species, take-off and landing occurs on the water's surface (del Hoyo et al. 1992).

3.2.2.3 Marine Bird Hearing

Dooling (2002) provided a complete summary of what is known about basic in-air hearing capabilities of a variety of bird species. Birds hear best in-air at frequencies between 1 and 5 kHz, with absolute sensitivity often approaching 0 to 10 decibels (dB) referenced to 20 micropascals (µPa) at the most sensitive frequency, which usually is in the region of 2 to 3 kHz. A recent study of diving birds (ducks, gannets, and loons) showed best in air hearing between 1 and 3 kHz (Crowell et al. 2015). On average, the spectral limit of "auditory space" available for a bird to vocally communicate in-air extends from approximately 0.5 to 6 kHz (Dooling 2002). Dooling (2002) and Beason (2004) also noted that birds do not hear well at either high or low frequencies when compared to most mammals, and do not hear at frequencies greater than 15 kHz. Diving birds may not hear well under water because of adaptations to protect their ears from pressure changes during diving (Dooling and Therrien 2012). Currently, the only underwater auditory threshold to be measured in a diving bird species was for the long-tailed duck. The greatest in-air sensitivity for the long-tailed duck was measured at 2 kHz and this species was also recorded responding to underwater sound stimuli with frequencies between 0.5 and 2.86 kHz at underwater stimuli greater than 117 decibels referenced at 1 micropascal at 1 meter (dB re 1 µPa at 1 m) (Therrien 2014). Common murres (*Uria aalge*) avoided gill nets with acoustic deterrent devices emitting a 1.5 kHz tone at 120 dB re 1µPa at 1 m (Melvin et al. 1999).

3.2.3 **Fish**

Many factors impact the abundance and distribution of marine fish in the proposed action area. In Arctic waters, the highest number and diversity of fish typically occur where the habitat is most diverse, including structural complexity (such as the deep ocean habitat of the Canada Basin and the continental shelf in the Bering Sea portion of the proposed action area), biological productivity (areas of nutrient upwelling), and a variety of physical and chemical conditions (water flow, nutrients, dissolved oxygen, and temperature) (Bergstad et al. 2008; Helfman 2009; Moyle and Cech Jr. 2004; Parin 1984; United States Environmental Protection Agency 2004). The early life stages (e.g., eggs and larvae) of many fish may be widely distributed even when the adults have relatively small ranges. The distribution and specific habitats in which an individual of a single fish species occurs may be influenced by its developmental stage, size, sex, reproductive condition, and other factors. Some of the marine fish that occur in the coastal zone, such as salmon and eels, migrate between marine and freshwater habitats (Helfman 2009). No ESA-listed fish species occur within the proposed action area.

3.2.3.1 Major Fish Groups

Marine fish can be broadly categorized into horizontal and vertical distributions within the water column. The primary distributions of fish that occur in the marine environment of the proposed action area are within the water column near the surface. As reviewed by Bluhm et al. (2011), habitat preference in bottom-oriented fishes is primarily driven by sediment type, bottom salinity, and bottom temperature, while water-column temperature and salinity characterize ichthyoplankton distribution patterns much like they influence zooplankton communities. Many temperate fishes are intolerant to the low temperatures of bottom waters in ice-covered regions, and thus the sea ice extent with its inter-annual and decadal scale variability reasonably corresponds in spatial extent to the boundary between arctic and subarctic demersal and benthic fish communities (Mecklenburg et al. 2011; Wyllie-Echeverria and Wooster 1998). Higher trophic level predators such as ringed seals (*Phoca hispida*) prey on fish species that are closely associated with sea ice, such as arctic (*Arcotgadus glacialis)* and polar cod (*Boreogadus saida*) (Lønne and Gabrielsen 1992). There are multiple major fish groups inhabiting the proposed action area (Table 3-4). The federally managed species within the proposed action area are: the Chinook salmon (*Oncorhynchus tshawytscha*), chum salmon (*O. keta*), coho salmon (*O. kisutch*), pink salmon (*O. gorbuscha*), sockeye salmon (*O. nerka*), Alaska plaice (*Pleuronectes quadrituberculatus*), Arctic cod, Arrowtooth flounder (*Atheresthes stomias*), Atka mackerel (*Pleurogrammus azonus*), Dover sole (*Solea solea*), dusty rockfish (*Sebastes ciliatus*), flathead sole (*Hippoglossoides elassodon*), Greenland turbot (*Reinhardtius hippoglossoides*), northern rockfish (*Sebastes polyspinis*), Pacific cod (*Gadus macrocephalus*), Pacific ocean perch (*Sebastes alutus*), rex sole (*Glyptocephalus zachirus*), rock sole (*Lepidopsetta bilineata*), saffron cod (*Eleginus gracilis*), sablefish (*Anoplopoma fimbria*), sculpin (*Cottus* sp.), shortraker and rougheye rockfish (*Sebastes borealis and Sebastes aleutianus*), skate (*Raja* sp. and *Bathyraja* sp.), thornyhead rockfish (*Sebastolobus macrochir*), walleye pollock (*Gadus chalcogrammus*), yelloweye rockfish (*Sebastes ruberrimus*), and yellowfin sole (*Limanda aspera*). These species are federally protected under the MSA. Federally managed species within the proposed action area are discussed in Section 3.2.4.

Table 3-4. Major Groups of Marine Fish Present in the Proposed Action Area

Group Name	Common Species Present in the Proposed Action Area	General Distribution
Order Anguilliformes and Saccopharyngiformes	Eels	Bathypelagic
Order Aulopiformes	Lancetfish, daggertooths, barracudina, pearleyes	Wide range
Class Chondrichthyes	Sharks, skates, rays	Wide range
Order Cleupiformes	Pacific herring, American shad	Open ocean, coastal
Order Esosiformes	Pike	Shallow, coastal
Order Gadiformes	Arctic cod, polar cod	Open ocean, under ice
Order Gastersteiformes	Sticklebacks, sand lances	Salt or brackish water
Order Lampridiformes, Beryciformes, and Zeiformes	Opahs and ribbon fish	Open ocean, bathydemersal
Order Lophiiformes	Anglerfish, goosefish, frogfish, batfish	Bathydemersal
Order Myxiniformes and Petromyzontiformes	Hagfish, Pacific lamprey	Bathydemersal
Order Osmeriformes	Capelin, eulachon, pond smelt, and rainbow smelt	Anadromous; open ocean, coastal
Order Perciformes	Glacial eelpout	Benthic or pelagic
Order Pleuronectiformes	Flatfish, pacific halibut	Benthic
Order Salmoniformes	Chum salmon, pink salmon, trout, whitefish, Dolly Varden, sheefish, Arctic char	Anadromous
Order Scorpaeniformes	Gelatinous seasnail	Benthic or pelagic
Order Stephanoberyciformes	pricklefishes, bigscales, gibberfishes, and whalefishes	Bathydemersal
Order Stomiiformes, Myctophiformes, and Ophidiiformes	Cusk eels, myctophids	Deep water pelagic
Order Tetradontiformes	triggerfish, filefish, puffers, and ocean sunfish	Pelagic

3.2.3.1.a Order Anguilliformes and Saccopharyngiformes

The Anguilliformes (eels and morays) are bathypelagic and found as deep as 20,000 ft (6,000 m). Eels generally feed on fish or on small bottom-dwelling invertebrates, but will also take larger organisms (Helfman 2009). Saccopharyngiformes are the group of deep sea eels. Examples of Saccopharyngiformes in the proposed action area are the bobtail eel (*Cyema atrum*) and pelican eel (*Eurypharynx pelecanoides*). Bobtail eels are deep ocean (1083–17,000 ft [330–5,100 m]) mid-water planktivores and the least modified members of this order. The pelican eel is a bathypelagic fish inhabiting deep ocean areas (1,640–25,000 ft [500–7,620 m]) that can swallow prey larger than itself due to the mouth and pharynx being extremely large and distensible.

3.2.3.1.b Order Aulopiformes

The order Aulopiformes includes a diverse group of fish characterized by both primitive features (adipose fin, abdominal pelvic fins, rounded scales, and absence of fin spines) and advanced features (unique swim bladder and jawbone) (Paxton and Eschmeyer 1998). They are common from estuarine and coastal waters to the deep ocean. Aulopiformes primarily occur over the continental shelf, where they rest on the bottom and ambush smaller prey fish and invertebrates (Paxton and Eschmeyer 1998). Lancetfish (Alepisauridae), daggertooths (Anopteridae), waryfishes (Notosudidae), barracudina (Paralepididae), and pearleyes (Scopelarchidae) are primarily mid-water column fish, but are known from the surface to deep water below 4,600 ft (1,400 m).

3.2.3.1.c Class Chondrichthyes

The cartilaginous (non-bony) marine fish of the class Chondrichthyes are distributed throughout the world's oceans, occupying all areas of the water column (Paxton and Eschmeyer 1998). This group is mainly predatory, and contains many of the top predators found in the ocean, although some species are filter-feeders (Helfman 2009).

Species from Hexanchiformes (cow sharks), Lamniformes (mackerel sharks), Squaliformes (dogfish), and Rajiformes (skates) can be found in the Bering Sea. The Bering Sea chondrichthyans are mostly bottom-dwelling batoids (skates and rays) that inhabit relatively great depths, including the slopes of the Aleutian and Commander Basins (Lynghammar et al. 2013). The Chukchi Sea, however, is devoid of batoids, and only a single specimen of shark (spiny dogfish [*Squalus acanthias*]) has been taken in this area (Mecklenburg et al. 2011).

3.2.3.1.d Order Clupeiformes

This order includes more than 400 species of fish, including herring, anchovies, sardines, and alewife. Pacific herring (*Clupea pallasii*) and American shad (*Alosa sapidissima*) are the most abundant clupeiform fish present in the proposed action area (Kaschner et al. 2013; Mecklenburg et al. 2011). Most fish in this order are small, measuring less than 12 in (30 cm) in length and inhabit the open ocean, though often close to the coast, residing in large schools. Many clupeids are anadromous. Eggs are typically pelagic and floating. Most clupeid fish feed on pelagic protozoans (diatoms and flagellates), copepods, larvae, euphausiids, and amphipods.

3.2.3.1.e Order Esociformes

This order of fish includes species of pike and mudminnows. Pikes are closely related to the salmonids. The northern pike may reach lengths of 5 ft (1.5 m), though the average size is 28—47 in (70—120 cm). Pike prefer highly vegetated shallow habitats where prey, mainly smaller fish, can be ambushed. Young northern pike feed on small crustaceans and insects, while larger young pike eat smaller fish. Adult northern pike eat other fishes (mostly whitefishes but also suckers, burbot, smaller northern pike and juvenile salmon). Large adults can eat voles, shrews, red squirrels, and small waterfowl (FishBase 2017a).

3.2.3.1.f Order Gadiformes

The three major species of cod within the proposed action area are Arctic cod, polar cod, and saffron cod. Cods are generally found near the bottom in these continental shelf areas, feeding on benthic organisms (Paxton and Eschmeyer 1998). Fish inhabiting the water column of oceanic waters seaward of the 656-ft (200-m) isobath comprise this assemblage; most species exhibit some preference of bathymetric stratification.

Arctic cod is the northernmost-occurring fish species and is widespread throughout Arctic seas (Mecklenburg et al. 2013). Arctic cod are both cryopelagic (live in cold, deep water) and epontic (live on the underside of ice). They use sea ice for shelter, to capture prey, and to avoid predators. Arctic cod often occur in ice holes, cracks, hollows, and cavities in the lower surface of the ice and are most common near the ice edge or among broken ice. As the ice thaws at these margins, plankton grow and provide a food source. They occur in the open-ocean waters of the proposed action area from the surface to depths of 1,300 ft (400 m). The primary offshore food sources of Arctic cod are epibenthic mysids, amphipods, copepods, and fish (Cohen et al. 1990). It is possible that they also feed on the amphipod-diatom ice community inhabiting the lower ice layer. This species moves and feeds in different groupings, dispersed in small and very large schools throughout the water column (Welch et al. 1993). In a recent otter trawl survey in the Chukchi Sea, Arctic cod accounted for 96 percent of the total catch (Mecklenburg et al. 2013).

Polar cod are primarily distributed in the Arctic Ocean (Mecklenburg et al. 2011) and are distributed north of the Bering Strait in the Beaufort Sea, Central Arctic, East Siberian Sea, and Northern Bering-Chukchi Seas. Polar cod are associated with ice and are found mainly in offshore waters, at or beyond the edge of the continental shelf where they are abundant (Mecklenburg et al. 2013). Polar cod are cryptopelagic or epontic with a depth range of 0 to 3,280 ft (0 to 1,000 m). Where the bottom depth is greater than 2,600 ft (800 m), polar cod are not found as much near the bottom as under the sea ice (Mecklenburg et al. 2013).

Saffron cod occur from the surface to 980 ft (300 m) in the open-ocean and coastal waters of the proposed action area. Adults spawn inshore during the winter and feed offshore in the summer. Additionally, Pacific cod and walleye pollock, both common groundfish occurring from the surface to 4,200 ft (1,280 m) in the Bering Sea, have been found in recent surveys of the Chukchi Sea (Norcross et al. 2013).

Cod are an important component in the food web of the Beaufort Sea environment, preying on primary producers such as plankton, and being preyed upon by ringed seal, bearded seal (*Erignathus barbatus*), beluga whale (*Delphinapterus leucas*), narwhal (*Monodon monoceros*), and many marine birds (including gulls and guillemots) (Bluhm and Gradinger 2008; Cohen et al. 1990; Welch et al. 1993).

3.2.3.1.g Order Gasterosteiformes

Fish in this order include sticklebacks, pipefish, sea horses, and sand lances, amongst others. Most of these species are found in brackish water throughout the world and occur in surface, water column, and seafloor habitats (Nelson 2006). Small mouths on a long snout and armor-like scales are characteristic of this group. Most of these species exhibit a high level of male parental care, either through nest-building (sticklebacks) or brooding pouches (seahorses and pipefish), which result in relatively few young being produced (Helfman 2009). The Gasterosteiformes ninespine stickleback (*Pungitius pungitius*) occurs in coastal, brackish and freshwater habitats of the Bering Sea, Chukchi Sea, and Beaufort Sea. Sticklebacks, found within the proposed action area, are small scaleless fish that reach no more than 8 in (20 cm) in length. Two other species also occur in the Bering Sea: the tube snout (*Alorhynchus flavidus*) and threespine stickleback (*Gasterosteus aculeatus*). All three species are benthopelagic and found in waters less than 360 ft (110 m).

3.2.3.1.h Order Lampridiformes, Beryciformes, and Zeiformes

Nineteen species of opahs and ribbonfishes comprise the order Lampridiformes (Nelson 2006). They exhibit diverse body shapes, and some have a protruding mouth that allows for a suction feeding technique while feeding on plankton. Other species, including the crestfish, possess grasping teeth used to catch prey. They occur only in the mid-water column of the open-ocean, and are rarely observed (Nelson 2006). Four pelagic species (king-of-herrings [*Regalecus glesne*], king-of-the-salmon [*Trachipterus altivelis*], opah [*Lampris guttatus*], and slender ribbonfish [*Trachipterus ishikawae*]) occur in the Bering Sea in waters as deep as 3,940 ft (1,200 m).

Fish in the order Beryciformes (squirrelfish) are primarily poorly described nocturnal species. Five species of Beryciformes inhabit the Bering Sea and are usually found in water greater than 330 ft (100 m).

Very little is known about the order Zeiformes (dories) which includes some very rare families, many containing only a single species (Paxton and Eschmeyer 1998). General information on their biology, ecology, and behavior is limited. Three bathydemersal species: oxeye oreo (*Allocyttus folletti*), rosy dory (*Cyttopsis rosea*), and *Zenion hololepis* occur in the Bering Sea at depths 490–2,400 ft (150–730 m).

3.2.3.1.i Order Lophiiformes

The order Lophiiformes includes all of the world's anglerfish, goosefish, frogfish, batfish, and deep water anglerfish, most of which occur in seafloor habitats of all oceans. Females of some deep water anglerfish use highly modified "lures," containing light-emitting organs to attract prey (Helfman 2009; Koslow 1996). The males of these species are small and parasitic, spending their lives attached to the side of the female (Helfman 2009). These fish are also important predators among the deep water seafloor habitats (Nelson 2006). Species of the order Lophiiformes occur in the open-ocean areas and coastal waters of the Bering Sea. Most are bathypelagic, occurring in water as deep as 11,400 ft (3,480 m), though some can be found at the surface.

3.2.3.1.j Order Myxiniformes and Petromyzontiformes

Hagfish (Myxiniformes) are the most primitive fish group (Nelson 2006). In fact, recent taxonomic revisions suggest that Myxiniformes are not fish at all but are a "sister" group to all vertebrates (Nelson 2006). Hagfish inhabit exclusively marine habitats. This group feeds on dead or dying fish, and have few of the external features often associated with fish, such as fins and scales (Helfman 2009). The members of this group are important scavengers that recycle nutrients back through the ecosystem. Two species of hagfish, both bathydemersal, inhabit the Bering Sea. Black hagfish (*Eptatretus deani*) are found in deep water (more than 330 ft [100 m]), while Pacific hagfish (*E. stoutii*) inhabit more shallow depths (50–2,080 ft [16–630 m]).

Lampreys are eel-like fish lacking scales, jaws, and fins that inhabit coastal waters. Lampreys have cartilaginous skeletons and spend their adult lives as parasites in oceanic environments. Reproduction occurs, however, in fresh water. After rearing in rivers and streams for a number of years, they swim downstream to the ocean. Eventually, at the end of their lives, Pacific and arctic lampreys leave the ocean and swim upstream to spawn, back to the same rivers and streams where they were born. The most striking feature of the lampreys is the oral disc mouth, by which they attach themselves to other fish to feed on their blood (Moyle and Cech Jr. 2004; Nelson 2006). Three species of Petromyzontiformes, all anadromous, inhabit the proposed action area. Pacific lamprey (*Entosphenus tridentatus*) inhabit waters from 0 to 3,600 ft (0 to 1,100 m), occupying both open-ocean areas and coastal waters of the Bering Sea. Adults are mesopelagic in marine waters. Arctic lampreys (*Lethenteron camtschaticum*) are found from the surface to 160 ft (50 m) in coastal and estuarine waters throughout the proposed action area.

3.2.3.1.a Order Osmeriformes

This order is comprised of over 200 species, most of which are types of smelts. In the proposed action area, capelin (*Mallotus villosus*), eulachon (*Thaleichthys pacificus*), pond smelt (*Hypomesus olidus*), and rainbow smelt (*Osmerus mordax mordax*) are present. Most Osmeriformes are small fish, ranging in size from 1—28 in (3—70 cm) (FishBase 2017b). These species are anadromous, inhabiting a variety of waters, including rivers, streams, ponds, lakes, shallow inshore marine habitats, and deeper oceanic habitats. Many Osmeriformes in the proposed action area are mid-water (to about 1,000 ft [300 m] in depth) anadromous species while several are deep water bathypelagic species (to about 16,000 ft [5,000 m] in depth). All species spawn in fresh water. Pond and rainbow smelt are seasonally abundant in drainages of the Beaufort Sea as well as south, along the Bering Sea coast. Capelin are widespread and abundant in coastal areas, only moving inshore to spawn from mid-May to late July. Species within the order Osmeriformes feed on arthropods, fish, crustaceans, mollusks, and worms (FishBase 2017b).

3.2.3.1.b Order Perciformes

Perciformes is the most diversified and the largest order of vertebrates, including approximately 40 percent of all bony fish (Nelson 2006). All of the Alaskan species inhabit marine waters (Mecklenburg et al. 2002). Most are marine coastal fish, though many can be expected to be found in the open-ocean. Most species of the order Perciformes are found in the benthic habitats of shallower shelf waters, some species are associated with deep-water marine environments. One such species is the glacial eelpout (*Lycodes frigidus*), which is endemic to the Arctic basins. This species is benthic in water depths up to 9,840 ft (3,000 m) (Mecklenburg et al. 2011). To feed themselves, these species move along the seafloor and use the cartilaginous keels on their lower jaws to stir up prey, such as crustaceans, worms, and fishes (Mecklenburg et al. 2011).

3.2.3.1.c Order Pleuronectiformes

The order Pleuronectiformes includes flatfish (flounders, sand dabs, soles, and tonguefish) in all marine seafloor habitats throughout the world (Nelson 2006). Adult fish in this group have eyes on either the left side or the right side of the head, and are not symmetrical like other fish (Saele et al. 2004). All flounder species are ambush predators, feeding mostly on other fish and bottom-dwelling invertebrates (Drazen and Seibel 2007; Froese and Pauly 2013). This group is demersal, burrowing into the surface sediment to rest and wait for prey. Pleuronectiformes tend to be concentrated in shallow marine waters, although there are species that occur in deep water.

Most species of Pleuronectiformes in the proposed action area are limited to the Bering Sea, although the Arctic flounder (*Liopsetta glacialis*) is found in the Beaufort Sea and Chukchi Sea. Additionally, the Bering flounder (*Hippoglossoides robustus*), starry flounder (*Platichthys stellatus*), and longheaded dab (*Limanda proboscidea*) are found in the Chukchi Sea. The Arctic flounder, starry flounder, and longheaded dab are demersal species, usually found inshore in waters less than 1,100 ft (350 m). The Arctic flounder typically inhabits waters less than 290 ft (90 m). The Bering flounder is found further offshore in waters as deep as 1,500 ft (450 m).

Flatfish typically spawn offshore, but may spawn in estuaries. Females release millions of eggs which either float freely or sink to the bottom. Adults live a benthic existence, feeding on crustaceans, benthic invertebrates, and small fish. All flounder species are ambush predators (Drazen and Seibel 2007).

3.2.3.1.d Order Salmoniformes

This order consists of salmon, trout, whitefish, and char, amongst others. Within the proposed action area, several types of cisco and salmon are present, in addition to Dolly varden (*Salvelinus malma*) and sheefish (*Stenodus leuchicthys*). These species are anadromous, spawning in freshwater but spending much of their lives in marine habitats. Four Salmoniformes occur primarily north of the Bering Sea: Arctic cisco (*Coregonus autumnalis*), lake whitefish (*C. clupeaformis*), broad whitefish (*C. nasus*), and sardine cisco (*C. sardinella*). In addition to these species, pink salmon, Arctic char (*Salvelinus alpinus alpinus*), and Dolly Varden occur in the Bering and Chukchi Seas. In the Bering Sea, Arctic cisco, Dolly Varden, sardine cisco (*Coregonus sardinella*), steelhead trout (*Oncorhynchus mykiss*) can be found. There are five species of federally managed salmon species: Chinook, chum, coho, sockeye, and pink salmon. Salmoniformes typically occur in depths from the surface to 820 ft (250 m) and inhabit the open-ocean and coastal waters of the proposed action area. Salmon support important traditional, commercial, and recreational fisheries in the proposed action area and have long been an integral part of the Native American culture (North Pacific Fishery Management Council 2012a). Salmon are extremely important as a food source to both marine and terrestrial ecosystems (Gende et al. 2002).

3.2.3.1.e Order Scorpaeniformes

This group contains the scorpionfish, waspfish, rockfish, velvetfish, pigfish, sea robins, gurnards, poachers, sculpins, snailfish, and lumpfish (Paxton and Eschmeyer 1998). Scorpionfish are distinguishable by the well-developed spines on their cheeks, and the distinct ridges or spines on top of the head. Adults of most Arctic species live on the seafloor, but some are both benthic and pelagic. Most occur in depths of less than 330 ft (100 m), but others are found in deep water habitat, at depths to 7,000 ft (2,200 m) (Paxton and Eschmeyer 1998). In the proposed action area, most are found in the Bering Sea, though at least 15 species are found north of the Bering Strait. Nine species that are considered to have a primarily Atlantic distribution were recently found in the Chukchi Sea (Mecklenburg et al. 2013). These fish typically consume small crustaceans, worms, clams, and fish eggs. One example of a scorpionfish that inhabits the proposed action area is the gelatinous seasnail (*Liparis fabricii*), which is both benthic and pelagic, living at depths up to 8,200 ft (2,500 m) (Mecklenburg et al. 2011).

3.2.3.1.f Order Stephanoberyciformes

Stephanoberyciformes are soft, rounded, toothless, deep sea predators that include the pricklefishes, bigscales, gibberfishes, and whalefishes. Highsnout melphid (*Melamphaes lugibris*), crested bigscale (*Poromitra crassiceps*), redmouth whalefish (*Rondeletia loricata*), and *Scopeloberyx opisthopterus* are bathypelagic and found at depths below about 650 ft (200 m) in the Bering Sea. Velvet whalefish (*Barbourisia rufa*) are mesopelagic as juveniles and benthopelagic as adults. They occur in depths between 390 and 6,600 ft (120 and 2,000 m), also in the Bering Sea.

3.2.3.1.g Order Stomiiformes and Mytophiformes, Ophidiiformes

At more than 500 species, the orders Stomiiformes and Myctophiformes make up one of the largest groups of deep water fish, comprising nearly 60 percent of the total biomass in the deep sea (Nelson 2006). Many of the species in these orders are not very well described in the scientific literature (Nelson 2006), nor is their ecological role well understood (Helfman 2009). These fish are known for their unique body forms and light-producing capabilities. Other adaptations to the deep water habitats in which they occur include large mouths, sharp teeth, and sensory systems that allow them to find prey and avoid predators in total darkness (Haedrich 1996; Koslow 1996; Marshall 1996; Rex and Etter 1998; Warrant and Locket 2004).

Species within the Stomiiformes and Myctophiformes orders typically occur at depths from 3,280—16,000 ft (1,000—4,900 m) in the open-ocean of the Bering Sea. Some myctophids occur closer to the surface, where they may become prey for marine mammals. Glacier lanternfish (*Benthosema glaciale*) are mesopelagic myctophids abundant in the North Atlantic with one occurrence record off of Utqiagvik (Barrow), Alaska, the only record from the western Arctic (Mecklenburg et al. 2013).

Ophidiiformes includes cusk-eels and brotulas, both of which have long, eel-like tapering bodies and are distributed in deep water areas throughout the tropical and temperate oceans. The characteristics of Ophidiiformes are similar to those of the other deep water groups, described above. There are several cusk-eel species that are open-ocean or are found on the continental shelves and slopes. One species of Ophidiiformes, *Bassozetus zenkevitchi*, inhabits the Bering Sea and occurs from the surface to 23,000 ft (7,000 m) in depth.

3.2.3.1.h Order Tetradontiformes

The Tetraodontiformes, including the triggerfish, filefish, puffers, and ocean sunfish, are the most highly evolved group of modern bony fish (Nelson 2006). Like the flounders, this group exhibits unusual body shapes with modified spines or other structures to deter predators. The bodies of some species are so boxlike that they cannot swim using the typical body propulsion style, but instead are propelled at slow speeds by rudimentary fins (Wainwright and Richard 1995). While most fish in this group are associated with reef systems, which are not prevalent in the proposed action area, these are primarily oceanic and pelagic species, but may enter estuaries. They are typically found from the surface to 330 ft (100 m) but have been found to 1,575 ft (480 m).

3.2.3.2 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.

3.2.4 **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.

Habitat Areas of Particular Concern (HAPC) are a subset of EFH. Fishery management councils designate HAPC under the MSA. HAPC are identified based on habitat level considerations rather than species life stages which are associated with EFH designations. Several habitat types, identified as HAPC, focus on specific habitat locations such as seamounts and hard corals.

The North Pacific Fishery Management Council (NPFMC) has fishing regulatory jurisdiction over Alaska's 0.89 million mi^2 (2.3 million km^2) 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 2011), Groundfish (North Pacific Fishery Management Council 2017), Salmon (North Pacific Fishery Management Council 2012a), and Scallop (North Pacific Fishery Management Council 2014) FMPs are applicable. 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.

3.2.4.1 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.

3.2.4.2 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.

3.2.4.3 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.

3.2.4.4 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 (Table 3-5). 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. EFH for all species with designated habitat within the proposed action area, along with the relevant life history stages is shown in Table 3-5.

Table 3-5. Essential Fish Habitat (EFH) Present in the Proposed 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
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 and rougheye rockfish	*Sebastes borealis and 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

3.2.4.5 Habitat Areas of Particular Concern

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), 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).

3.2.5 Marine Mammals

Cetaceans and pinnipeds are the two types of marine mammals that may occur in the proposed action area. All marine mammals are protected under the MMPA, and some are offered additional protection under the ESA. NMFS maintains jurisdiction over whales, dolphins, porpoises, seals, and sea lions. The USFWS maintains jurisdiction over certain other marine mammal species, including walruses, polar bears, dugongs, sea otters, and manatees. This document covers all marine mammals under both NMFS' ad the USFWS' jurisdiction.

Twenty-three species of marine mammals (Table 3-6) may occur in the proposed action area.

Table 3-6. Marine Mammals Present in the Proposed Action Area

Common Name	Scientific Name	Stock(s) within the Proposed Action Area	Status
Cetaceans: Mysticetes			
Bowhead whale	*Balaena mysticetus*	Western Arctic stock	Endangered
Fin whale	*Balaenoptera physalus*	Northeast Pacific stock	Endangered
Gray whale	*Eschrichtius robustus*	Eastern North Pacific stock	W. North Pacific Distinct Population Segment (DPS) is Endangered
Humpback whale	*Megaptera novaeangliae*	Western North Pacific stock and Central North Pacific stock	W. North Pacific DPS is Endangered Mexico DPS is Threatened
Minke whale	*Balaenoptera acutorostrata*	Alaska stock	
North Pacific right whale	*Eubalaena japonica*	Eastern North Pacific stock	Endangered, Critical Habitat in proposed action area
Cetaceans: Odonticetes			
Baird's beaked whale	*Berardius bairdii*	Alaska stock	
Beluga whale	*Delphinapterus leucas*	Beaufort Sea stock, Eastern Bering Sea stock, Eastern Chukchi Sea stock, and Bristol Bay stock	
Dall's porpoise	*Phocoenoides dalli*	Alaska stock	
Harbor porpoise	*Phocoena phocoena*	Bering Sea stock	
Killer whale	*Orcinus orca*	Alaska stock	
Pacific white-sided dolphin	*Lagenorhynchus obliquidens*	North Pacific stock	
Sperm whale	*Physeter macrocephalus*	North Pacific stock	Endangered

Stejneger's beaked whale	*Mesoplodon stejnegeri*	Alaska stock	
Pinnipeds: Phocids			
Bearded seal	*Erignathus barbatus*	Alaska stock	Threatened
Harbor seal	*Phoca vitulina*	Alaska stock	
Ribbon seal	*Histriophoca fasciata*	Alaska stock	
Ringed seal	*Phoca hispida*	Alaska stock	Proposed as Threatened, Critical Habitat proposed
Spotted seal	*Phoca largha*	Alaska stock	
Pinnipeds: Otariids			
Northern fur seal	*Callorhinus ursinus*	Eastern Pacific stock	
Steller sea lion	*Eumetopias jubatus*	Western U.S. stock	Western DPS is Endangered, Critical Habitat in area
Pinnipeds: Odobenids			
Pacific walrus	*Odobenus rosmarus*	Alaska stock	Candidate species to list as Threatened
Carnivores			
Polar bear	*Ursus maritimus*	Alaska Southern Beaufort Sea stock, Alaska Chukchi/Bering Sea stock	Threatened, Critical Habitat in area

3.2.5.1 ESA-listed Marine Mammals

3.2.5.1.a Bowhead Whale

The bowhead whale (*Balaena mysticetus*) is an ice-associated whale that lives in all polar regions of the Northern Hemisphere. While the populations are disjunctive and isolated from one-another by the ice, members of these populations are all considered one species. The Western Arctic stock is found within the proposed action area. The bowhead whale is listed as endangered under the ESA, designated as depleted under the MMPA, and is therefore classified as a strategic stock. The Western Arctic bowhead whale stock has been increasing in recent years. No critical habitat is currently designated for the bowhead whale.

The bowhead whale is the northernmost of all whales, inhabiting only regions close to the ice edge. Bowhead whales are found in arctic and subarctic regions (55° N to 85° N) of the North Atlantic and North Pacific oceans (Rice 1998). Their range can expand and contract depending on ice cover and access to Arctic straits (Rugh et al. 2003). These whales are also found in the Bering, Beaufort, and Chukchi Seas, and the Sea of Okhotsk, as well as in the northern parts of Hudson Bay (Canada) (Wiig et al. 2007). Bowheads are one of the most commonly sighted cetaceans in the Chukchi Sea when the ice has receded during warm seasons (Aerts et al. 2013). Although habitat selection varies seasonally, this is clearly the most polar of cetacean species.

In Alaska, bowhead whales are closely associated with sea ice most of the year (Moore and Reeves 1993; Quakenbush et al. 2010). The majority of the Western Arctic stock migrates annually from wintering areas (December to March) in the northern Bering Sea (which are typically areas with 90–100 percent sea ice cover (Quakenbush et al. 2010)), through the Chukchi Sea in the spring (April through May) following fractures in the sea ice around Alaskan coast, generally in the shear zone between the shore-fast and mobile pack ice. Bowhead whales spend most of the summer (June to September) in the Beaufort Sea before returning again to the Bering Sea in the fall (October through December) to overwinter in select shelf waters in all but heavy ice conditions (Braham et al. 1980; Moore 2000; Moore and Reeves 1993; Quakenbush et al. 2010). Summer aerial surveys conducted in the western Beaufort Sea during July and

August of 2012-2014 have had relatively high sighting rates of bowhead whales, including cows with calves and feeding animals (Clarke et al. 2014; Clarke et al. 2013; Muto et al. 2016).

During spring and summer, bowheads occupy high Arctic continental slope waters (relatively ice-free) while feeding on patches of abundant zooplankton (Wiig et al. 2007). Evidence suggests that bowhead whales feed on concentrations of zooplankton throughout their range. Bowheads feed by skimming the surface or sometimes near the seafloor (Rugh and Shelden 2009). Preferred prey include various species of copepods and euphausiids (Budge et al. 2008; Rugh and Shelden 2009; Wiig et al. 2007).

Bowhead whales have been taken for subsistence purposes for at least 2,000 years (Marquette and Bockstoce 1980; Stoker and Krupnik 1993). Subsistence takes are regulated by a quota system under the authority of the International Whaling Commission since 1977. The average annual subsistence take (by the Natives of Alaska, Russia, and Canada combined) from 2009 to 2013 was 44 bowhead whales (Muto et al. 2016). Off the coast of Alaska, the fall bowhead whale hunt takes place from September to November, depending on the village from which the hunting is taking place. The further along the migration route the village, the later in the fall season the hunt occurs. The spring hunt takes place from April to May and the bowhead whale festival, called Nalukataq by the Native communities, takes place in June.

3.2.5.1.b Fin Whale

The fin whale (*Balaenoptera physalus*) is found in all of the world's oceans, and is the second largest species of whale (Jefferson et al. 2008). The fin whale is listed as endangered under the ESA, and is therefore designated as depleted under the MMPA. A final recovery plan was published in July 2010 for fin whales in U.S. waters. For management purposes, three stocks of fin whales are currently recognized in U.S. Pacific waters: (1) Northeast Pacific, (2) California-Washington-Oregon, and (3) Hawaii (Allen and Angliss 2014). The Northeast Pacific stock, found in the proposed action area, is classified as a strategic stock. No critical habitat is currently designated for the fin whale.

Fin whales prefer temperate and polar waters and are rarely seen in warm tropical waters (Reeves et al. 2002a). They typically congregate in areas of high productivity and spend most of their time in coastal and shelf waters but can often be found in waters approximately 6,562 ft (2,000 m) deep (Aissi et al. 2008; Reeves et al. 2002a). Fin whales are often seen closer to shore after periodic patterns of upwelling and the resultant increased krill density (Azzellino et al. 2008). This species is not known to have specific habitat preferences and is highly adaptable, following prey, typically off the continental shelf (Azzellino et al. 2008; Panigada et al. 2008). In the North Pacific, fin whales spend the summer season in waters of the Seas of Japan and Okhotsk, the Bering and Chukchi Seas, and along the west coast of North America to central California (Rice 1998). Fin whales are distributed further south when northern waters cool. During winter months, fin whales have been seen over a wide geographic area from 23° N to 60° N, but winter distribution and location of primary wintering areas is not truly known. During winter, fin whales are found off Taiwan and Korea including the Sea of Japan in the western North Pacific and south to Baja California in the east. Evidence now exists that some animals that summer in the Gulf of Alaska spend the winter off the coast of southern California (Mizroch et al. 2009; Rice 1974). Sighting surveys of the central-eastern and southeastern Bering Sea as well as in coastal waters of the Aleutian Islands and the Alaska Peninsula have provided new insight about the distribution and relative abundance of fin whales in these areas (Moore et al. 2002a; Moore et al. 2000; Zerbini et al. 2006). Fin whale abundance was nearly five times higher in the central-eastern Bering Sea than in the southeastern Bering Sea, and most sightings in the central-eastern Bering Sea were made along the shelf break where productivity was particularly high (Moore et al. 2002a; Moore et al. 2000; Zerbini et al. 2006). Fin whale calls have been detected by hydrophone arrays along the U.S. Pacific coast, in the central North Pacific, and in the western Aleutian Islands during the warm seasons (Moore et al. 1998; Moore et al. 2006; Stafford et al. 2007; Watkins et al. 2000). Calls were also detected in the southeast Bering Sea. Highest levels of fin whale call rates along the U.S. Pacific coast began in August/September and lasted through February, suggesting that these may be important winter feeding areas. Fin whale calls detected in the southeast Bering Sea peaked during two distinct periods: (1) from September through November and (2) from February through March (Stafford et al. 2010).

This species preys on small invertebrates such as copepods, as well as squid and schooling fishes, such as capelin, herring, and mackerel (Goldbogen et al. 2006; Jefferson et al. 2008). There are no reported takes of fin whales by Native subsistence hunters in the proposed action area.

3.2.5.1.c Gray Whale

Once common throughout the Northern Hemisphere, the gray whale (*Eschrichtius robustus*) became extinct in the Atlantic by the early 1700s (Fraser 1970; Mead and Mitchell 1984). Gray whales are now found only in the North Pacific. Two genetically distinct populations of Pacific gray whales are currently recognized (Reilly et al. 2008): (1) the Eastern North Pacific stock and (2) the Western North Pacific distinct population segment (Bonner 1986; LeDuc et al. 2002; Weller et al. 2013). Only the Eastern North Pacific stock is expected in the proposed action area. As of 1994, the Eastern North Pacific stock of gray whale was delisted from the ESA (FR 59 (115): 31094-31095, June 16, 1994). Consequently, the Eastern North Pacific stock of gray whales is not classified as a strategic stock. The two populations of gray whales are not completely isolated from one another because mixing of these populations has been documented through photo-identification, genetic analysis (Lang 2010), and telemetry studies (Mate et al. 2011). The Western North Pacific Distinct Population Segment (DPS) is listed as endangered under the ESA and is the only ESA-listed gray whale population with the potential to occur in the proposed action area. No critical habitat is currently designated for the gray whale.

The Eastern North Pacific stock lives along the west coast of North America (Rice 1981; Rice et al. 1984; Swartz et al. 2006). Tagging, photo-identification, and genetic studies show that some whales identified in the Western North Pacific stock off Russia have been observed in the Eastern North Pacific DPS' range, including coastal waters of Canada, the U.S., and Mexico (Lang 2010; Mate et al. 2011; Mate et al. 2015; Urbán et al. 2013; Weller et al. 2012). In combination, studies have recorded a total of 27 gray whales observed in both the Western North Pacific and Eastern North Pacific. Gray whale occurrence is primarily in shallow waters over the continental shelf. Breeding and calving are seasonal and closely synchronized with migratory timing. Gray whale migration typically follows the coastline (within 1.1 nm [2 km] of the coast), except when crossing major bays, straits and inlets from southeastern Alaska to the eastern Bering Sea. The northbound migration from low latitude winter calving grounds begins about mid-February (Rice and Wolman 1971). During summer and fall, most whales in the Eastern North Pacific stock feed in the Chukchi and Beaufort Seas, between 174° E and 130° W, and northwestern Bering Sea south to Mys Olyutorskiy, Russia (Rice 1998). Western North Pacific gray whales typically feed during summer and fall in the Okhotsk Sea off northeast Sakhalin Island, Russia, and off southeastern Kamchatka in the Bering Sea (Burdin et al. 2013; Tyurneva et al. 2010; Vertyankin et al. 2004; Weller et al. 2002; Weller et al. 1999). Gray whales are among the most commonly observed cetaceans in the Chukchi Sea during summer (Aerts et al. 2013). A small number of whales (approximately 200), known as the "Pacific Coast Feeding Group," also summer along the Pacific coast between Kodiak Island, Alaska, and northern California (Calambokidis et al. 2002; Calambokidis et al. 2012; Darling 1984; Gosho et al. 2011). By late November, the southbound migration is underway as whales begin to travel from summer feeding areas to winter calving areas off the west coast of Baja California, Mexico, and the southeastern Gulf of California (Rugh et al. 2001; Swartz et al. 2006). Migrating whales move southward through the Unimak Pass and follow a shoreline route to the winter grounds (Rice 1998).

Gray whale feeding grounds are generally in waters less than 223 ft (68 m) in depth as they are demersal feeders. Prey of gray whales consists primarily of swarming mysids, and polychaete tube worms, and amphipods in the northern parts of their range (Jefferson et al. 2008). They will also take crabs, baitfish, and other food opportunistically.

Subsistence hunters in Russia and the United States have traditionally harvested whales from the Eastern North Pacific gray whale stock in the Bering Sea, although only the Russian hunt has persisted in recent years (Huelsbeck 1988; Reeves 2002). No subsistence hunting of Western North Pacific gray whales is expected in the proposed action area as only the Makah Tribe has requested the right to hunt gray whales, using fishing grounds off Washington State.

3.2.5.1.d Humpback Whale

Humpback whales (*Megaptera novaeangliae*) are found in all oceans of the world. Humpback whales have been classified into 14 DPS. Of these, in the proposed action area, the Mexico DPS, which is listed as threatened under the ESA, overlaps with the endangered Western North Pacific DPS on feeding grounds. Under the MMPA, the depleted Central North Pacific stock overlaps with the Western North Pacific stock within the proposed action area. Critical habitat has not been designated for humpback whales.

Humpback whales are distributed worldwide in all major oceans and most seas. They typically are found during the summer on high-latitude feeding grounds and during the winter in the tropics and subtropics around islands, over shallow banks, and along continental coasts, where calving occurs. Most humpback whale sightings are in nearshore and continental shelf waters; however, humpback whales frequently travel through deep oceanic waters during migration (Calambokidis et al. 2001; Clapham and Mattila 1990).

Humpback feeding habitats are typically shallow banks or ledges with high seafloor relief (Hamazaki 2002; Payne et al. 1990). The historic summer feeding range of humpback whales in the North Pacific encompassed coastal and inland waters around the Pacific Rim from Point Conception, California, north to the Gulf of Alaska, Bering Sea, and through the Bering Strait, and west along the Aleutian Islands to the Kamchatka Peninsula (Russia) and into the Sea of Okhotsk (Johnson and Wolman 1984; Nemoto 1957; Tomlin 1957; Zenkovich 1954). Recent observations during summer months demonstrate that humpback whales range as far north as the Beaufort Sea (Hashagen et al. 2009).

The Hawaii DPS consists of humpback whales that breed within the main Hawaiian Islands. From this breeding ground, about half of the whales migrate to Southeast Alaska and Northern British Columbia. The Mexico DPS feeds across a broad geographic range from California to the Aleutian Islands, with concentrations in California and Oregon, northern Washington and southern British Columbia, and northern and western Gulf of Alaska and Bering Sea feeding grounds. The migratory destination of western North Pacific humpbacks is not completely known. Specifically, whales from the Aleutian Islands have an unusually low re-sighting rate in low latitude winter areas compared to whales from other feeding areas (Calambokidis et al. 2008). Although, to a lesser extent, this is also true of whales from the Gulf of Anadyr in Russia and the Bering Sea. Movement of whales between Ogasawara and Okinawa wintering grounds and feeding areas in the Bering Sea, the southern side of the Aleutian Islands, and the Gulf of Alaska has been documented (Nishiwaki 1966; Ohsumi and Masaki 1975; Omura and Ohsumi 1964).

Humpback whales feed on a variety of invertebrates and small schooling fishes. The most common invertebrate prey are krill; the most common fish prey are herring, mackerel, sand lance, sardines, anchovies, and capelin (Clapham and Mead 1999). Feeding occurs both at the surface and in deeper waters, wherever prey is abundant. The humpback whale is the only species of baleen whale that shows strong evidence of cooperation when feeding in large groups (D'Vincent et al. 1985). There are no reported takes of humpback whales by Native subsistence hunters in the proposed action area.

3.2.5.1.e North Pacific Right Whale

In 2006, the North Pacific right whale was elevated to a full species under the name *Eubalaena japonica*. After being elevated to a separate species in 2006, NMFS relisted the North Pacific right whale as endangered (FR 73 (45): 12024-12030, March 06, 2008). Under the MMPA, the North Pacific right whale is classified as depleted and a strategic stock. Two stocks of North Pacific right whales are currently recognized: (1) a Western North Pacific stock and (2) an Eastern North Pacific stock (Brownell Jr. et al. 2001; LeDuc et al. 2012; Rosenbaum et al. 2000). The former is believed to feed primarily in the Sea of Okhotsk and the latter primarily in the southeastern Bering Sea. Only the Eastern North Pacific stock is located within the proposed action area.

In 2006, NMFS issued a final rule designating two areas as northern right whale critical habitat; one in the Gulf of Alaska and one in the Bering Sea (FR 71 (129): 38277-38297, July 06, 2006). Critical habitat in the Bering Sea is located approximately 35 nm (65 km) north of King Cove in the Aleutian Islands. The Bering Sea was designated as critical habitat due to the high annual prey concentration in the area. After the designation of two critical habitat areas and the designation of the North Pacific right whale as a separate species, NMFS re-designated the same two areas as critical habitat under the newly recognized species name.

Historically, concentrations of North Pacific right whales were found in the Gulf of Alaska, eastern Aleutian Islands, south-central Bering Sea, Sea of Okhotsk, and Sea of Japan (Braham and Rice 1984). Although whaling records initially indicated that right whales ranged across the entire North Pacific from 35° N to as far south as 20° N (Scarff 1986, 1991), recent analysis shows a pronounced longitudinally bimodal distribution (Josephson et al. 2008). Sightings have been reported as far south as central Baja California in the eastern North Pacific, as far south as Hawaii in the central North Pacific, and as far north as the subarctic waters of the Bering Sea and Sea of Okhotsk in the summer (Berzin and Doroshenko 1982; Brownell Jr. et al. 2001; Herman et al. 1980). The majority of sightings now occur in the Bering Sea and adjacent areas of the Aleutian Islands (Brownell Jr. et al. 2001). Since 1996, North Pacific right whales were consistently observed during most summers in a portion of the southeastern Bering Sea, an area thought to be important foraging grounds (Goddard and Rugh 1998). North Pacific right whales appear to remain in the southeastern Bering Sea from May through February with peak call detection in September (Munger and Hildebrand 2004), through most right whales leave the area by December. Use of this habitat may intensify by mid-summer and continue through early fall. Most whales in the southeastern Bering Sea appear to intermittently pass-through the middle shelf (less than 328 ft [100 m] depth) and typically do not remain longer than a few days (Munger and Hildebrand 2004; Munger et al. 2008). North Pacific right whales were not observed outside the localized area in the southeastern Bering Sea when fishery management surveys were conducted over a much a broader area including Bristol Bay and the Bering Sea (Moore et al. 2002b; Moore et al. 2000).

The population in the southeastern Bering Sea was estimated to be only about 31 whales with a statistical minimum of 25.7 animals (Wade et al. 2011). Right whales feed on copepods and other small invertebrates. Their preferred copepod prey is *Calanus finmarchicus* (Reeves et al. 2002b). To forage effectively, they require dense concentrations that form as patches at or near the surface. There are no reported takes of North Pacific right whales by Native subsistence hunters in the proposed action area.

3.2.5.1.f Sperm Whale

For management, three stocks of sperm whales are currently recognized in U.S. waters: (1) Alaska (North Pacific stock), (2) California/Washington/Oregon, and (3) Hawaii. The North Pacific stock is the only stock within the proposed action area. The sperm whale has been listed as an endangered species since 1970 under the precursor to the ESA (National Marine Fisheries Service 2009). Consequently, the three stocks are automatically considered as depleted and strategic under the MMPA. Critical habitat is not designated for sperm whales. A Recovery Plan for sperm whales was finalized in 2010 (National Marine Fisheries Service 2010).

The sperm whale is one of the most widely distributed of any marine mammal species with a range that may only be exceeded by the killer whale (Rice 1989). Sperm whales are found throughout the world's oceans in deep waters to the edge of the ice at both poles (Leatherwood and Reeves 1983; Rice 1989; Whitehead 2002).

Typically, sperm whale concentrations correlate with areas of high productivity. These areas generally have strong currents and steep topography (Gannier and Praca 2007; Jefferson et al. 2008). Sperm whale distribution is typically associated with waters over the continental shelf break, over the continental slope, and into deeper waters (Rice 1989; Whitehead 2003). However, in some areas, adult males are reported to consistently frequent waters with bottom depths less than 330 ft (100 m) and as shallow as 131 ft (40 m) (Jefferson et al. 2008; Romero et al. 2001).

Sperm whales are widely distributed across the entire North Pacific and into the southern Bering Sea in summer, but the majority are thought to be south of 40° N in winter (Gosho et al. 1984; Miyashita et al. 1995; Rice 1974; Rice 1989). The northernmost boundary of their range extends from Cape Navarin (62° N) across the Bering Sea to the Pribilof Islands (Omura 1955). Surveys conducted between 2001 and 2006 during summer have found sperm whales to be the most frequently sighted large cetacean in the coastal waters around the central and western Aleutian Islands (Allen and Angliss 2013). Sperm whales also occupy the Gulf of Alaska and Aleutian Islands throughout the year although they appear to be more common in summer than in winter (Mellinger et al. 2004) consistent with the hypothesis that sperm whales migrate to higher latitudes in summer and migrate to lower latitudes in winter (Whitehead and Arnbom 1987).

Sperm whales throughout the world exhibit a geographic social structure where females and juveniles of both sexes occur in mixed groups and inhabit tropical and subtropical waters. Males, as they mature, initially form bachelor groups but eventually become more socially isolated and more wide-ranging, inhabiting temperate and polar waters as well (Whitehead 2003). Whaling catch data from the North Pacific shows males and females concentrated seasonally in the subtropical frontal zone (28–34° N) and the subarctic frontal zones (40–43° N) where sea surface temperatures are greater than 59 °F (15 °C).

Although females and young sperm whales were thought to remain in tropical and temperate waters year-round, whaling catch records show that females move into the Gulf of Alaska and western Aleutian Islands seasonally, with catch concentrations in the western Aleutians above 50° N (Mizroch and Rice 2006). Males also concentrated seasonally near the Aleutian Islands and along the Bering Sea shelf edge. Males move into the Gulf of Alaska and Bering Sea around the Aleutian Islands during summer to feed (Kasuya and Miyashita 1988).

Sperm whales feed mainly on squid, but also consume other cephalopods, bottom-dwelling fish and invertebrates (Davis et al. 2007; Marcoux et al. 2007; Rice 1989). Jaquet and Gendron (2009) suggest that site-specific ecological factors, such as prey availability, influences fundamental aspects of sperm whale social organization. Sperm whales socialize for predator defense, mating, foraging, and within bachelor herds. There are no reported takes of sperm whales by Native subsistence hunters in the proposed action area.

3.2.5.1.g Bearded Seal

Two subspecies of bearded seal have been described: (1) *Erignathus barbatus barbatus* and (2) *E. b. nauticus*. The subspecies *E. b. nauticus*—the subspecies of bearded seals which occurs within the proposed action area—is known from portions of the Arctic Ocean adjacent to the Bering Sea including the Sea of Okhotsk (Heptner et al. 1976; Manning 1974; Ognev 1935; Scheffer 1958).

With evidence for ecological uniqueness among bearded seals in the Sea of Okhotsk, the *E. b. nauticus* subspecies was further divided by NMFS into two stocks: the Okhotsk distinct population segment and the Beringia distinct population segment. NMFS issued a final determination to list the Beringia and Okhotsk distinct population segments of the *E. b. nauticus* subspecies of the bearded seal as threatened under the ESA in 2012 (FR 77 (249): 76739-76739, December 28, 2012). The listing of bearded seals as threatened under the ESA automatically classifies the population as depleted under the MMPA and qualifies it as a strategic stock. No critical habitat is currently designated for this species.

Bearded seals are found in the Northern Hemisphere with a circumpolar distribution that does not extend farther north than 80° N (Reeves et al. 2002b). Bearded seals are distributed along the ice edge of northern Eurasia and North America (Burns 1967; Burns 1981a; Burns and Frost 1979; Fedoseev 1965; Johnson et al. 1966; Kelly 1988a; Smith 1981). Their normal range extends from the Arctic Ocean south to Sakhalin Island (45° N) in the Pacific, and south to Hudson Bay (55° N) in the Atlantic (Allen 1880; King 1983; Ognev 1935). Bearded seals inhabit the seasonally ice-covered seas of the Northern Hemisphere where they whelp and rear their pups, and molt their coats on the ice in the spring and early summer. In order to feed on the seafloor, bearded seals commonly occupy shallow waters (Fedoseev 2000; Kovacs 2002). The preferred depth range is often described as less than 656 ft (200 m) (Allen and Angliss 2014; Fedoseev 2000; Jefferson et al. 2008; Kovacs 2002), though adults have been known to dive to around 984 ft (300 m) (Cameron and Boveng 2009; Kovacs 2002).

Bearded seals along the Alaskan coast tend to prefer areas where sea ice covers 70–90 percent of the surface and are more abundant 20–100 nm (37—185 km) offshore than inshore during the spring season (Bengston et al. 2000; Bengtson et al. 2005; Simpkins et al. 2003). An exception to these general trends is the area to the south of Kivalina where bearded seals concentrate in nearshore waters. In spring, bearded seals may also concentrate in nearshore pack ice habitats, where females give birth on the most stable areas of ice (Reeves et al. 2002b). While molting between April and August, bearded seals spend substantially more time hauled out then at other times of the year (Reeves et al. 2002b). Some of the seals that winter in the Bering Sea move north through the Bering Strait from late April through June to summer grounds along the ice edge in the Chukchi Sea (Burns 1967; Burns 1981a). Other individuals that do not follow the ice northward remain in open-water areas of the Bering and Chukchi Seas (Burns 1967; Burns 1981a; Heptner et al. 1976; Nelson 1981). During late fall and winter, some of the population moves southward toward the Bering Sea from the Chukchi Sea. During the cold season, bearded seals move away from shore (Burns 1967).

Bearded seals feed on a variety of small invertebrates that live in the substrate or on its surface. They may also opportunistically supplement a mainly invertebrate diet which includes crab, shrimp, mollusks, and octopus (Reeves et al. 2002b). Prey also includes with demersal fish such as Arctic and saffron cod, flatfish and sculpins (Jefferson et al. 1993; Reeves et al. 2002b). Feeding on demersal fish cause them to be closely linked to areas where the seafloor is shallow (less than 656 ft [200 m]).

Bearded seals are an important resource for Alaska Native communities. Approximately 64 Native communities in western and northern Alaska, from Bristol Bay to the Beaufort Sea, regularly harvest ice seals. Based on the harvest data from these 12 communities, a minimum estimate of the average annual harvest of bearded seals taken from 2009 to 2013 is 441 seals (Ice Seal Committee 2016). These twelve communities include Point Lay, Kivalina, Noatak, Buckland, Deering, Emmonak, Scammon Bay, Hooper Bay, Tununak, Quinhagak, Togiak, and Twin Hills (Muto et al. 2016).

3.2.5.1.h Pacific Walrus

The walrus is not listed as threatened or endangered under the ESA; however, in February 2011, the USFWS announced their determination that listing the Pacific walrus under the ESA as threatened or endangered is warranted. Due to other listing priorities the USFWS did not list the walrus, but designated it as a Candidate species for listing. Additionally, the Pacific walrus within the U.S. EEZ is not designated as depleted under the MMPA, but is classified as strategic because the level of human-caused mortality exceeds the rate of reproduction and survival required for a stable population. The walrus is managed by the USFWS under the Department of the Interior.

Walruses have a circumpolar distribution in the Arctic Ocean and are associated with pack ice everywhere they are found, at least during winter. Walruses are known to stay fairly close to land for most of their lives and make shallow dives inshore (depths of roughly 98 ft [30 m]) (Kastelein 2002) from the continental shelf and slope, so they do not regularly occur in deep oceanic waters. Walruses haul out on ice floes and sandy beaches or rocky shores, along remote stretches of mainland coastlines or islands (Jefferson et al. 2008; Kastelein 2009). Walruses haul out on land to a greater extent during years with reduced pack ice. The movements of walruses generally follow the movements of pack ice. However, some individuals do travel far from pack ice during summer. Pacific walruses range throughout the continental shelf waters of the Bering and Chukchi Seas, occasionally moving into the East Siberian Sea and the Beaufort Sea. A significant proportion of the Pacific walrus population migrates into the Chukchi Sea region each summer.

The shallow, productive, ice covered waters of the eastern Chukchi Sea are considered particularly important habitat for female walrus and their dependent young. Several thousand animals (primarily adult males) aggregate near coastal haulouts in the Gulf of Anadyr and Kamchatka Peninsula (Russia), Bering Strait region, Bristol Bay, Sea of Okhotsk, and Honshu Island (Japan). During the late winter breeding season, most walruses are found in two major Bering Sea concentration areas where open leads, polynyas, or thin ice allows open water access (Fay et al. 1984). While the specific location of these groupings can vary annually and seasonally depending upon the extent of the sea ice, one group will generally range from the Gulf of Anadyr into a region southwest of St. Lawrence Island (northern Bering Sea), and the second group will aggregate somewhere in the southeastern Bering Sea from the south of Nunivak Island to northwestern portions of Bristol Bay.

Walrus feed on bottom-dwelling invertebrates and slow-moving fish to depths of roughly 98 ft (80 m) (Kastelein 2002). Some of the favorite prey are clams, snails, shrimp and slow-moving fish (Jefferson et al. 1993). Walruses have also been seen to prey on seabirds, seals, and Northern sea lions (Reeves et al. 2002b). Walruses are known to consume between 88 and 176 pounds (40 and 80 kilograms) of food per day (Jefferson et al. 2008; Kastelein and Wiepkema 1989).

Eighty percent of the annual subsistence hunting of walruses occurs in three communities along the Bering Sea: Little Diomede, Gambell, and Savoonga. Walrus harvesting peaked in the 1980s and since, has continued to decline. From 1992 to 2002, the walrus harvest from these three communities has ranged from 600 walruses to 1,500 walruses (Garlich-Miller et al. 2006). All walrus harvests have been reported to the USFWS and the Eskimo Walrus Commission since 1992.

3.2.5.1.i Ringed Seal

Most taxonomists currently recognize five subspecies of ringed seals: (1) *Phoca hispida hispida* in the Arctic Ocean and Bering Sea, (2) *P. h. ochotensis* in the Sea of Okhotsk and northern Sea of Japan, (3) *P. h. botnica* in the northern Baltic Sea, (4) *P. h. lagodensis* in Lake Ladoga, Russia, and (5) *P. h. saimensis* in Lake Saimaa, Finland. Ringed seals in the Baltic Sea and the Sea of Okhotsk minimally, if at all, exchange genes with the Arctic subspecies (Kelly et al. 2009; Palo 2003; Palo et al. 2001). Although the ringed seal Arctic subspecies (*P.h hispida*) is not currently listed under the ESA, it was proposed for listing on December 10, 2010 (75 FR 77476). On July 25, 2014, the U.S. District Court for the District of Alaska issued a memorandum decision in a lawsuit challenging the listing of ringed seals under the ESA, thus vacating the previous decision to list the Arctic subspecies of ringed seals as a threatened species. On October 17, 2016, the Ninth Circuit Court of Appeals concluded that the District Court's decision should be reversed and NMFS' decision to list the Arctic ringed seal should be upheld. On November 1, 2016, the Intervenor-Defendant requested that the Court reverse the District Court's judgment and uphold NMFS' rule to list the Arctic subspecies of ringed seal as threatened under the ESA. The Court has not issued its Opinion on this case. However, due to the timing of the Proposed Action and possible court decisions that could change the listing status of the ringed seal, the Coast Guard considers the Arctic subspecies of ringed seal as threatened under the ESA for this analysis. While no critical habitat is currently designated, it has been proposed for the ringed seal. Proposed critical habitat includes sea ice habitat suitable for the formation and maintenance of subnivean lairs used for sheltering pups during whelping and nursing, sea ice habitat suitable as a platform for basking and molting (defined as 15 percent or more in concentration), and primary prey resources to support Arctic ringed seals (defined as Arctic cod, saffron cod, shrimps, and amphipods). Additionally, the Arctic/Bering Sea subspecies is listed as depleted and strategic under the MMPA. The Alaska stock of ringed seals is the portion of the subspecies *P. h. hispida* population that occurs within the U.S.EEZ of the Beaufort, Chukchi, and Bering Seas.

Ringed seals are the most common pinniped in the proposed action area and have wide distribution in seasonally and permanently ice-covered waters of the Northern Hemisphere (King 1983). Throughout their range, ringed seals have an affinity for ice-covered waters and are well adapted to occupying both shore-fast and pack ice (Kelly 1988c). Ringed seals can be found further offshore than other pinnipeds since they can maintain breathing holes in ice thickness greater than 6.6 ft (2 m) (Smith and Stirling 1975). Breathing holes are maintained by ringed seals sharp teeth and claws on their foreflippers. They remain in contact with ice most of the year and use it as a platform for pupping and nursing in late winter to early spring, for molting in late spring to early summer, and for resting at other times of the year.

In Alaskan waters, during winter and early spring when sea ice is at its maximal extent, ringed seals are abundant in the northern Bering Sea, Norton and Kotzebue Sounds, and throughout the Chukchi and Beaufort Seas. They occur as far south as Bristol Bay in years of extensive ice coverage but generally are not abundant south of Norton Sound except in near-shore areas (Frost 1985). Although details of their seasonal movements have not been adequately documented, it is generally considered that most ringed seals wintering in the Bering and Chukchi Seas migrate north in spring as the seasonal ice melts and retreats (Burns 1970) and spend summer in the pack ice of the northern Chukchi and Beaufort Seas, as well as in nearshore ice remnants in the Beaufort Sea (Frost 1985). During summer, ringed seals travel hundreds to thousands of kilometers to forage along ice edges or in highly productive open-water areas (Freitas et al. 2008; Kelly et al. 2010). With the onset of the fall freeze, ringed seal movements become increasingly restricted and seals that have summered in the Beaufort Sea are thought to move west and south with the advancing ice pack, with many seals dispersing throughout the Chukchi and Bering Seas while some remain in the Beaufort Sea (Frost and Lowry 1984). Many adult ringed seals return to the same small home ranges they occupied during the previous winter (Kelly et al. 2010).

All ringed seals use ice as pupping habitat. The Arctic/Bering Sea subspecies pup exclusively on stable fast ice, while the pack ice is used for pupping in the western Arctic. Ringed seals excavate subnivean (birthing) lairs in drifts over their breathing holes in the ice, in which they rest, give birth, and nurse their pups for 5–9 weeks during late winter and spring (Chapskii 1940; McLaren 1958; Smith and Stirling 1975). Snow depths of at least 20–26 in (50–65 cm) are required for functional birth lairs (Kelly 1988a; Lukin et al. 2006; Lydersen 1998; Lydersen and Gjertz 1986; Smith and Stirling 1975), and such depths typically are found only where 8–12 in (20–30 cm) or more of snow has accumulated on flat ice and then drifted along pressure ridges or ice hummocks (Hammill 2008; Lydersen et al. 1990; Lydersen and Ryg 1991; Smith and Lydersen 1991). Most ringed seals are born early April on shore-fast ice. About a month after parturition, mating begins in late April and early May.

In general, ringed seals consume fish, including Arctic cod, saffron cod, redfish (*Sebastes* spp.), capelin, and herring (Holst et al. 2001; Lowry et al. 1980), and invertebrates, including amphipods (e.g., *Themisto libellula*), euphasiids (e.g., *Thysanoessa inermis*), mysids (e.g., *Mysis oculata*), shrimps (e.g., *Pandalus* spp., *Eualus* spp., *Lebbeus polaris*, and *Crangon septemspinosa*), and cephalopods (e.g., *Gonatus* spp.). Ringed seals are known to consume up to 72 different species in their diet; their preferred prey species is the polar cod (Jefferson et al. 2008).

Ringed seals are hunted by Alaska coastal Natives from Bristol Bay to Kaktovik for food and oil. Current harvest is unknown. The Ice Seal Committee and the Alaska Department of Fish and Game survey a sample of coastal villages to document and monitor the harvest of ringed seals. A minimum estimate of the average annual harvest of ringed seals from 32 communities for which that data is available (from 1999 to 2014) is 587 seals (Ice Seal Committee 2016). Indications are that, although the harvest is substantial, it is sustainable and harvest was not considered to be a factor in the pending ESA action to list the species as threatened (Muto et al. 2016).

3.2.5.1.j Steller Sea Lion

All Steller sea lions (*Eumetopias jubatus*) are considered a single species. Two subspecies of *E. jubatus* of are recognized: the western distinct population segment, *E. j. jubatus*, and the eastern stock, *E. j. monteriensis*. The entire population of Steller sea lions was listed as threatened under the ESA in 1990. In 1997, NMFS reclassified Steller sea lions as two subpopulations, listing the western distinct population segment as endangered under the ESA, while maintaining the threatened status for the eastern stock (FR 62 (86): 24345-24355, May 5, 1997). A revised Recovery Plan reviewing threats to the eastern and western U.S. stocks and proposing actions and guidelines for recovery was released by NMFS in March 2008 (National Marine Fisheries Service 2008). After scientific review and public input, NMFS found that the eastern distinct population segment of Steller sea lions has recovered and can be removed from the list of threatened species under the ESA effective December 4, 2013 (FR 78 (213): 66140-66199, November 4, 2013). Although these sea lions do not migrate, individuals disperse widely outside the breeding season. They are known to travel long distances between the eastern and western population breeding sites and potentially intermix with animals from other areas (Angliss and Outlaw 2005; Raum-Suryan et al. 2004). Therefore, animals from the eastern stock may also occur in the Bering Sea along with members from the western distinct population segment. Designated critical habitat includes a 20 nm buffer around all major haulout sites and rookeries; associated terrestrial, air, and aquatic zones; and three large offshore foraging areas in Alaska (FR 62 (86) 24345-34355 May 5, 1997).

Steller sea lions range along the North Pacific Rim from southern California through the Aleutian and Pribilof Islands (Bering Sea) to the Kuril Islands (Russia in the North Pacific Ocean) and Sea of Okhotsk (Kenyon and Rice 1961; Loughlin et al. 1984), with centers of abundance and distribution in the Gulf of Alaska and Aleutian Islands. The distribution is continuous yet there is a high degree of natal site fidelity and low exchange rate of breeding animals between rookeries (less than 10 percent). Steller sea lions regularly occur in the Bering Sea and Aleutian Islands year-round. Peak abundance on land occurs during the summer breeding season. Steller sea lions are widely distributed along the shelf break and coastal waters but are also found offshore in waters greater than 6,562 ft (2,000 m) deep (Bonnell et al. 1983; Fiscus 1983; Kajimura and Loughlin 1988; Kenyon and Rice 1961). They are frequently found in large numbers near the 656 ft (200 m) isobath throughout the year (Consiglieri et al. 1982). Individuals range further offshore during winter months, probably due to seasonal changes in prey availability near haulout sites and rookeries (Merrick et al. 1997). Adult females may travel far offshore in waters deeper than 3,283 ft (1,000 m) in the winter (Merrick and Loughlin 1997). Specifically, females tagged at Chirikof Island (south of the Aleutian Islands near the Gulf of Alaska) traveled more than 324 nm (600 km) east to the Patton Seamount area in the center of the Gulf of Alaska and foraged there for long periods of time (Merrick et al. 1997). Members of the western distinct population segment breed on the Pribilof and Aleutian Islands (Schusterman 1981). The eastern stock breeds at rookeries located in southeast Alaska, British Columbia, Oregon, and California. During summer, the area of primary occurrence for the Steller sea lion is within a 20 nm (37 km) radius around haulout sites and rookeries (with females generally foraging within 11 nm [20 km] (Merrick et al. 1997)) and inshore of the 3,281 ft (1,000 m) isobath.

Major haulout sites and rookeries are centered in the Aleutian Islands and at islands and mainland sites in the Gulf of Alaska (Loughlin et al. 1984). Seal Rocks, which is near the entrance to Prince William Sound, is the northernmost rookery (Reuter 2010). The southernmost rookery is on Año Nuevo Island off central California (Reuter 2010). Foraging habitat is primarily shallow, nearshore, and continental shelf waters; however, some Steller sea lions feed in freshwater rivers (Reeves et al. 1992; Robson 2002). Steller sea lions are also known to feed in deep waters seaward of the shelf break. Steller sea lions in the Bering Sea regularly haul out on pack ice near the ice front during winter. Pack ice offers close proximity to prey and protection from terrestrial predators (Reidman 1990). Other haulout and rookery sites are located on isolated islands, rocky shorelines, sandy beaches, and jetties throughout their range (Ban 2005; Call and Loughlin 2005; Jeffries et al. 2000). Most rookeries in Alaska consist of rock/slab or cobble beach substrate (Call and Loughlin 2005).

This summer area of primary occurrence takes into consideration that sea lions often feed 4—13 nm (7—24 km) offshore on a variety of fish species such as capelin, cod, herring, mackerel, pollock, rockfish, salmon, and sand lance (Fiscus et al. 1976). They also prey upon squid, octopus, bivalves, and gastropods.

Information on the subsistence harvest of Steller sea lions comes via two sources: the Alaska Department of Fish and Game and the Ecosystem Conservation Office of the Aleut Community of St. Paul. The mean annual subsistence take from this stock for all areas except St. Paul in 2004-2008 (172), combined with the mean annual take for St. Paul in 2010-2014 (29), was 201 Western Steller sea lions (Muto et al. 2016).

3.2.5.1.k Polar Bear

The polar bear, *Ursus maritimus*, belongs to the Order Carnivora and is a member of the bear Family Ursidae. No subspecies of polar bear are identified; different breeding stocks of polar bears are evident. The USFWS designated the polar bear as threatened throughout its range under the ESA on May 15, 2008. A final rule designating polar bear critical habitat was published in 2010. Polar bear critical habitat includes barrier islands used by polar bears for denning; sea ice habitat (in waters less than 984 ft [300 m]) used for hunting, feeding, breeding, and resting; and terrestrial denning habitat.

Polar bears are circumpolar in their distribution in the Northern Hemisphere. They occur in several largely discrete stocks or populations (Harington 1968). Polar bear movements are extensive and individual activity areas are enormous (Amstrup et al. 2000; Garner et al. 1990).

The Chukchi/Bering Sea stock is widely distributed on the pack ice in the Chukchi Sea and northern Bering Sea and adjacent coastal areas in Alaska and Russia. The northeastern boundary of the Chukchi/Bering Seas stock is near the Colville Delta in the central Beaufort Sea (Amstrup 1995; Amstrup et al. 2005; Garner et al. 1990) and the western boundary is near Chauniskaya Bay in the eastern Siberian Sea. The southern boundary of Chukchi/Bering Sea stock extends into the Bering Sea and is determined by the annual extent of pack ice (Garner et al. 1990). Historically, polar bears ranged as far south as St. Matthew Island (Hanna 1920) and the Pribilof Islands (Ray 1971) in the Bering Sea. An extensive area of overlap between the Southern Beaufort Sea stock and the Chukchi/Bering Seas stock occurs between Utqiagvik (Barrow) and Point Hope, centered near Point Lay (Amstrup 2000; Garner et al. 1994; Garner et al. 1990).

The Southern Beaufort Sea population spends the summer on pack ice and moves toward the coast during fall, winter, and spring (Durner et al. 2004). Polar bears in the Southern Beaufort Sea concentrate in shallow waters less than 984 ft (300 m) deep over the continental shelf and in areas with greater than 50 percent ice cover in all seasons except summer to access prey such as ringed and bearded seals (Durner et al. 2004; Durner et al. 2006b; Durner et al. 2009; Stirling et al. 1999). The eastern boundary of the Southern Beaufort Sea stock occurs south of Banks Island and east of the Baillie Islands, Canada (Amstrup et al. 2000). The western boundary of the Southern Beaufort Sea stock is near Point Hope, Alaska. Polar bears from this population have historically denned on both the sea ice and land. Therefore, the southern boundary of the Southern Beaufort Sea stock is defined by the limits of terrestrial denning sites inland of the coast, which follows the shoreline along the North Slope in Alaska and Canadian Arctic (Bethke et al. 1996). The main terrestrial denning areas for the Southern Beaufort Sea population in Alaska occur on the barrier islands from Utqiagvik (Barrow) to Kaktovik and along coastal areas up to 25 mi (40 km) inland, including the Arctic National Wildlife Refuge to Peard Bay, west of Utqiagvik (Barrow) (Amstrup et al. 2000; Amstrup and Gardner 1994; Durner et al. 2001, 2006a). Mating occurs in late March through early May. In November and December, females dig maternity dens in fast ice, drifting pack ice, or land along the coast. Females give birth between December and January and stay in their dens with their cubs until spring (Reeves et al. 2002b).

Polar bear diet mainly consists of ringed and bearded seals. Polar bears lie motionless for hours on the ice surface in the vicinity of ringed seal breathing holes waiting on seals to surface. On some occasions, adults have been known to take down a walrus or kill a beluga whale trapped by ice. When prey are unavailable, a polar bear will eat other things including carrion.

Polar bears are harvested for subsistence by 15 coastal villages in the Bering, Chukchi, and southern Beaufort Seas. Polar bear are listed as the tenth most important subsistence species on the Arctic coast of Alaska, according to Wolfe (2004).

3.2.5.2 Other marine mammals

3.2.5.2.a Baird's Beaked Whale

Baird's beaked whale (*Berardius bairdii*) is the only member of its genus present in the Northern Hemisphere. Baird's beaked whales are not listed as threatened or endangered under the ESA. Additionally, it is not listed as depleted or classified as strategic under the MMPA. The Alaska stock of Baird's beaked whale is the only stock that occurs in the proposed action area.

Baird's beaked whales are the largest of beaked whales, reaching 66 ft (12 m) in length. They are social animals and can be found in groups of five to 20 whales or more. Their large size and gregarious nature likely makes them more noticeable than other related species, which results in the Baird's beaked whales being the most commonly seen beaked whales within their range. Baird's beaked whales are found in deep oceanic waters (3,281 ft [1,000 m] or greater in depth) of the North Pacific Ocean and Bering Seas in the proposed action area. Within the North Pacific Ocean, Baird's beaked whales have been sighted in areas north of 30° N in waters over the continental shelf, particularly in regions with submarine escarpments and seamounts (Kasuya 2002; Kasuya and Ohsumi 1984; Ohsumi 1983). The southern extent of their range extends to the Gulf of California in the eastern Pacific. The northern extent of the range is near the St. Matthew and the Pribilof islands in the Bering Sea and the northern Gulf of Alaska (Kasuya 2002; Rice 1986; Rice 1998). An apparent break in distribution occurs from the middle of the Gulf of Alaska eastward. More numerous sightings have been recorded from the mid-Gulf and westward, including the Aleutian Islands and southern Bering Sea (Forney and Brownell Jr. 1996; Kasuya and Ohsumi 1984; Moore et al. 2002a). Their primary habitats appear to be waters over the continental slope and nearby seamounts (Jefferson et al. 1993). Baird's beaked whales are migratory, arriving in northern continental slope waters during summer when surface water temperatures are the highest and remain through the fall season (Dohl et al. 1983; Kasuya 2002). In the Bering Sea, Baird's beaked whales arrive between April and May, become numerous during the summer, and decrease in numbers by October (Kasuya 2002; Tomlin 1957). While in the Bering Sea, they are commonly found around the continental slope and rarely found in offshore waters. Their winter distribution is currently unknown (Kasuya 2002). Based on commercial harvest records, the calving peaks in March and April prior to migration north.

Baird's beaked whales feed primarily on deep-water and bottom-dwelling fish (e.g., mackerel, sardines, and saury), cephalopods (e.g., squid and octopus), and crustaceans (Jefferson et al. 1993).

3.2.5.2.b Beluga Whale

The beluga, *Delphinapterus leucas*, is an Arctic and subarctic cetacean. In the U.S. and Canada, individual populations have been assessed for status under the applicable conservation statutes. Five stocks of beluga whales are recognized within U.S. waters: (1) Cook Inlet, (2) Bristol Bay, (3) Eastern Bering Sea, (4) Eastern Chukchi Sea, and (5) Beaufort Sea. All stocks except for the Cook Inlet population are found in the proposed action area. Beaufort Sea, Eastern Chukchi Sea, Eastern Bering Sea, and Bristol Bay stocks of beluga whales are not listed as threatened or endangered under the ESA. Additionally, they are not listed as depleted or classified as strategic under the MMPA. Critical habitat has been designated for Cook Inlet belugas whales only, which are not found within the proposed action area.

The majority of belugas are distributed discontinuously in and around the Arctic Ocean and adjacent seas, primarily on the shallow continental shelf and near coasts around North America, Russia, and Greenland (Rice 1998). Beluga whales are found primarily in shallow coastal waters, as shallow as 3–10 ft (1–3 m), but can be found in waters deeper than 2,625 ft (800 m) (Jefferson et al. 2012; Richard et al. 2001). Beluga whales are distributed throughout seasonally ice-covered arctic and subarctic waters of the Northern Hemisphere (Gurevich 1980). Specifically within the proposed action area, beluga whales may spend summer in both offshore and coastal waters, with concentrations in Bristol Bay, Norton Sound, Kasegaluk Lagoon (north slope of Alaska), and the Mackenzie Delta (in the Beaufort Sea) (Hazard 1988). Most beluga whales from these summering areas overwinter in the Bering Sea, excluding those found in the northern Gulf of Alaska (Shelden 1994). Belugas are both migratory and residential (non-migratory), depending on the population. Migratory populations move between seasonal ranges. During winter, migratory belugas can be found foraging around the arctic ice. When the sea ice melts in summer, they move to warmer river estuaries and coastal areas for molting and calving. These annual migrations can span over thousands of kilometers. The residential populations participate in short distance movements within their range throughout the year. Seasonal distribution is affected by ice cover, tidal conditions, prey availability, temperature, and human interaction (Lowry 1985). Belugas are closely associated with open leads and polynyas in ice-covered regions (Hazard 1988).

Eastern Chukchi Sea stock: Eastern Chukchi Sea belugas move into coastal areas along Kasegaluk Lagoon in late June and remain in the area until mid-July (Frost and Lowry 1990; Frost et al. 1993). Telemetry tags attached to belugas within Kaseguluk Lagoon in June and July of 1998 showed that whales traveled 594 nm north of the Alaska coastline and to the Canadian Beaufort Sea within three months (Suydam et al. 2001), which indicated an overlap in distribution with the Beaufort Sea stock of beluga whales. Adult males appear to use deep waters rather than shallow shelf areas and remain in these deep waters for the duration of the summer. All belugas that moved into the Arctic Ocean (north of 75° N) were males that can travel through 90 percent pack ice cover to reach deeper waters of the Beaufort Sea and Arctic Ocean (approximately 79–80° N) by late July/early August, while the adult and immature females remain at or near the shelf break of the Chukchi Sea. After October, the remaining females in the Chukchi Sea migrate south through the Bering Strait into the northern Bering Sea north of Saint Lawrence Island. Evidence exists that some belugas that summer in the eastern Chukchi Sea overwinter in the waters north of Saint Lawrence Island (Suydam 2009).

Beaufort Sea stock: The Eastern Beaufort Sea beluga whale stock range includes the Alaska north coast and the Canadian Arctic Archipelago northward to the pack-ice (Fisheries and Oceans 2000). Eastern Beaufort Sea belugas congregate in the Mackenzie estuary in early summer. Later in summer, belugas move eastward toward Amundsen Gulf and Viscount Melville Sound (Canada). By mid-August and early September, belugas begin their migration westward along the Alaska coast and far offshore to the pack-ice. Individuals from the east Beaufort Sea stock have been followed as far as Wrangel Island (Russia in the Chukchi Sea) and into the Bering Sea. The winter range is thought to include the offshore areas of the Chukchi and Bering Seas.

Eastern Bering Sea stock: The east Bering Sea is a region that includes the Norton Sound and Yukon Delta areas. The Eastern Bering Sea beluga stock summers in the Norton and Pastol Sound areas and nearby Yukon River delta near Nome, Alaska (Lowry et al. 1999). Whales were seen from shortly after ice breakup (usually May) until freeze-up (usually November). Belugas are not generally observed to the west of the Norton Sound. After pack-ice forms, a few belugas remain in the Sound near Stuart Island where open leads in the ice allow for whales to breathe.

Bristol Bay stock: During summer (May to August), Bristol Bay belugas use the shallow upper portions of Kvichak and Nushagak Bays (Quakenbush 2003), and have remained in the nearshore waters of Bristol Bay through the months of September and October (Quakenbush and Citta 2006). Some belugas remained in Nushagak and Kvichak Bays through December and January suggesting that an unknown number of belugas do not leave the nearshore waters of Bristol Bay during the winter, while other beluga whales winter in the Bering Sea (Shelden 1994).

Belugas are opportunistic feeders that vary their diets according to their location and the season. Fish (eulachon, salmon, capelin, cod, herring, smelt, flounder, sole, lamprey and lingcod), crustaceans (crab, clams, mussels and shrimp) and other deep-sea invertebrates (octopus and squid) are the main prey.

Subsistence harvest of beluga whales has been important to the Alaska Native subsistence hunter community. A cooperative agreement for the co-management of western Alaska beluga whales was signed between the Alaska Beluga Whale Commission (ABWC) and NMFS in 1999. A harvest is not allowed if the previous 5-year average abundance is less than 350 belugas. The subsistence take of beluga whales from the Beaufort Sea stock within U.S. waters is reported by the ABWC. The annual subsistence take by Alaska Native hunters averaged 65.6 belugas during the 5-year period from 2008 to 2012. The subsistence take of beluga whales from the Eastern Chukchi Sea stock is provided by the ABWC. Given these data, the annual subsistence take by Alaska Native hunters averaged 57.4 belugas landed during the 5-year period 2008-2012 based on reports from ABWC representatives and on-site harvest monitoring. Belugas harvested in Kuskokwim villages are included in the total harvest for the Eastern Bering Sea beluga stock. The annual subsistence take by Alaska Natives averaged 181 belugas landed from the Eastern Bering Sea stock during the 5-year period 2008-2012. The annual subsistence take by Alaska Natives averaged 24 belugas from the Bristol Bay stock during the 5-year period 2008-2012.

3.2.5.2.a Dall's Porpoise

Two subspecies of Dall's porpoise (*Phocoenoides dalli*) are located within the North Pacific. The more widely distributed subspecies, *P. d. dalli*, is found in both western and eastern portions of the North Pacific including the Bering Sea. The Alaska stock is the only stock of Dall's porpoise within the proposed action area. Dall's porpoise are not listed as depleted under the MMPA or listed as threatened or endangered under the ESA. The Alaska stock of Dall's porpoise is not classified as a strategic stock.

Dall's porpoise are widely distributed in temperate and subarctic waters across the entire North Pacific Ocean as far north as 65° N (Buckland et al. 1993), and as far south as 28° N in the eastern North Pacific (Leatherwood and Fielding 1974). They are typically found in waters colder than 64 °F (18 °C) (Miyashita and Kasuya 1988). These porpoise are found over the continental shelf and slope, as well as in oceanic waters deeper than 8,202 ft (2,500 m) (Hall 1979), but can also be found in narrow channels and fjords in the western North Pacific (Jefferson 1988; Rice 1998). Where Dall's porpoise are most abundant in the central-eastern and southeastern Bering Sea, they are consistently found in deeper water than the harbor porpoise (Moore et al. 2002b). In Alaska, the only gaps in distribution appear to be in the upper Cook Inlet and the shallow eastern flats of the Bering Sea.

Dall's porpoise are present during all months of the year throughout most of the eastern North Pacific. Seasonal onshore-offshore movements have been noted along the U.S. west coast, and winter movements out of the Bering Sea, Prince William Sound and the Gulf of Alaska have been observed (Hall 1979; Leatherwood and Fielding 1974; Loeb 1972). Calves are born during spring and summer (Jefferson et al. 1993).

Dall's porpoise feed opportunistically and take a range of near-surface and mid-water fish and squid (Jefferson et al. 1993). Small schooling fish such as anchovies, herring, and hake, and mid- and deepwater fish such as myctophids and smelt are also common prey. Crabs and shrimp are occasional prey. Dall's porpoise can dive 500 m in depth to hunt.

3.2.5.2.b Harbor Porpoise

Although all harbor porpoise are described as a single species (*Phocoena phocoena*) world-wide, the Pacific subspecies that occupies the waters of the proposed action area is *P. p. vomerina*. Three stocks of harbor porpoise are recognized in Alaska: (1) the Southeast Alaska stock from the northern border of British Columbia to Cape Suckling, Alaska, (2) the Gulf of Alaska stock from Cape Suckling to Unimak Pass, and (3) the Bering Sea stock, found throughout the Aleutian Islands and all waters north of Unimak Pass to Utqiagvik (Barrow) in the Arctic Ocean (Allen and Angliss 2014). Harbor porpoise in Alaska are not listed as threatened or endangered under the ESA. Additionally, harbor porpoise is not designated as depleted under the MMPA, but the Bering Sea Stock of harbor porpoise is classified as strategic because the abundance estimates are at least 13 years old and information on incidental mortality in commercial fisheries is sparse.

Harbor porpoise are found in the Northern Hemisphere where cool temperate and subarctic water temperatures are less than 60 °F (15 °C) (Jefferson et al. 1993). Harbor porpoise are ordinarily restricted to coastal and continental shelf environments and are often found in fjords, bays, harbors, estuaries, and large rivers. Although these porpoise are mainly found in relatively shallow water, they will occasionally utilize offshore waters during periods of travel and during winter. In the eastern North Pacific Ocean, the harbor porpoise ranges from Utqiagvik (Barrow), along the western Alaskan coast including the Aleutian

Islands, and southward along the west coast of North America to Point Conception, California (Gaskin 1984). Harbor porpoise primarily frequent coastal waters less than 328 ft (100 m) deep (Dahlheim et al. 2009; Dahlheim et al. 2000; Hobbs and Waite 2010). Harbor porpoise have been sighted during nearshore and offshore seismic surveys in the Chukchi Sea between July and November from 2006 to 2010 (Aerts et al. 2011; Funk et al. 2010; Funk et al. 2011; Reiser et al. 2011). Harbor porpoise were the third most frequently sighted cetacean species in the Chukchi Sea, after gray and bowhead whales, with most of those sightings made during September and October (Funk et al. 2011; Reiser et al. 2011). Six more sightings totaling 11 harbor porpoise were also reported in the Beaufort Sea. The recent sightings in both the Chukchi and Beaufort Seas suggest that harbor porpoise are regularly present, but in small numbers (Funk et al. 2011).

Harbor porpoise feed on fish such as cod, herring, pollock, sardines, and whiting, as well as squid and octopus. They ordinarily will feed independently, consuming up to 10 percent of their body weight each day (Reeves et al. 2002b).

3.2.5.2.c Harbor Seal

The Pacific harbor seal is co-managed by NMFS and Alaska Native Harbor Seal Commission. Twelve separate stocks of harbor seals were defined in 2010 based largely on unique genetic structure of local populations. This new stock definition represented a significant increase from the three stocks previously recognized (i.e., Bering Sea, Gulf of Alaska, and Southeast Alaska). Of the 12 stocks, only three can be found within the proposed action area: (1) the Aleutian Islands, (2) Pribilof Islands, and (3) and Bristol Bay stocks (Allen and Angliss 2013). The remaining stocks are found in the Gulf of Alaska and southeast Alaska regions. Within the proposed action area, the harbor seal is not listed as threatened or endangered under the ESA. Additionally, it is not listed as depleted or classified as strategic under the MMPA.

The harbor seal is one of the most wide-ranging pinnipeds, found in all nearshore waters of the Northern Hemisphere northward of 30º N including the Arctic region (Burns 2008; Desportes et al. 2010). In the eastern North Pacific, harbor seals inhabit coastal and estuarine waters off Baja California, north along the western coasts of the U.S., British Columbia, and Southeast Alaska, west through the Gulf of Alaska and Aleutian Islands, and in the Bering Sea north to Cape Newenham and the Pribilof Islands.

Harbor seals are a coastal species (rarely spotted more than 7 nm [13 km] from shore) (Baird 2001) which generally are not known to migrate (Lowry et al. 2001; Small et al. 2003; Swain et al. 1996) although individuals can range over several hundred kilometers between seasonal localities. While at sea, they remain in coastal or continental shelf and slope waters. Harbor seals are gregarious at haulout sites where they aggregate mainly around low tide. When at sea, harbor seals are solitary or form small groups in areas with prey concentrations. Their localized movements are influenced by such factors as tides, weather, season, food availability, and reproduction (Bigg 1969, 1981; Fisher 1952; Hastings et al. 2004; Scheffer and Slipp 1944). Strong fidelity of individuals for haulout sites during the breeding season has been documented in several populations (Härkönen and Harding 2001), including in Alaska (Pitcher and McAllister 1981; Small et al. 2005). The harbor seals breeding season is from February to October, with pupping occurring from April to July (Jefferson et al. 2008).

Harbor seals feed on a variety of fish, cephalopods and crustaceans found in surface, mid-water, and benthic habitats. Pups feed on bottom-dwelling crustaceans during their first few weeks of foraging. Sand eels are the main prey for individuals foraging in the south of their range, while cod is the main prey for other geographic areas. No seasonal variation in prey species exists, with the exception of capelin and herring which are more numerous in the fall and winter (Hauksson and Bogason 1997; Jefferson et al. 2008; Reeves et al. 1992).

3.2.5.2.d Killer Whale

Killer whales (*Orcinus orca*) in the Northern and Southern Hemisphere are of the same species; no subspecies have been described to date. Eight killer whale stocks are now recognized within the U.S. Pacific EEZ. Three may be present within the proposed action area: Alaska Resident stock occurring from southeastern Alaska to the Aleutian Islands and Bering Sea and the Gulf of Alaska, Aleutian Islands, and Bering Sea Transient stock occurring mainly from Prince William Sound through the Aleutian Islands and Bering Sea, and the offshore stock occurring from California through Alaska. None of the stocks found within the proposed action area are listed as threatened or endangered under the ESA. Additionally, they are not listed as depleted or classified as strategic under the MMPA.

Killer whales are found in all oceans and contiguous seas, from the tropics to polar pack-ice zones of both hemispheres (Rice 1998). These whales are most numerous in coastal waters and cooler regions of high productivity, including bays, inshore channels, and deep oceanic basins. Although killer whales are also found in tropical waters and the open ocean, they are generally most numerous in coastal waters and at higher latitudes (Dahlheim and Heyning 1999).

In the North Pacific, killer whales can be found as far north as the Beaufort Sea. Within their range, many unique killer whale stocks exist and some overlap geographically. Furthermore, several studies provide evidence that the ‘Resident’, ‘Offshore’, and ‘Transient’ ecotypes are genetically distinct in both behavior and mtDNA and nuclear DNA (Barrett-Lennard 2000; Hoelzel et al. 1998; Hoelzel and Dover 1991; Hoelzel et al. 2002). Genetic differences have also been found between populations within the ‘Transient’ and ‘Resident’ ecotypes (Barrett-Lennard 2000; Hoelzel et al. 1998; Hoelzel et al. 2002). Alaska Resident whales are found from southeastern Alaska to the Aleutian Islands and Bering Sea. Intermixing of Alaska residents have been documented among the three areas. Recent studies have documented movements between the Bering Sea and Gulf of Alaska (Allen and Angliss 2014). This stock occupies the proposed action area year-round. The Gulf of Alaska, Aleutian Islands, and Bering Sea Transient stock occupies a range that includes the entire U.S. EEZ in Alaska, though few individuals from this population have been seen in southeastern Alaska. The Gulf of Alaska, Aleutian Islands, and Bering Sea Transient stock occurs mainly from Prince William Sound through the Aleutian Islands and into the Bering Sea. This stock can be found within the proposed action area from late spring to summer (Alaska Fisheries Science Center 2014).

Killer whales are apex predators and feed on a variety of prey, including bony fishes, elasmobranchs (a class of fish composed of sharks, skates, and rays), cephalopods, seabirds, sea turtles, and other marine mammals (Fertl et al. 1996; Jefferson et al. 2008). Some populations are known to specialize in specific types of prey (Jefferson et al. 2008; Krahn et al. 2004; Wade et al. 2009). For example, resident killer whales are known to be fish eaters, while transient whales have only been observed feeding on marine mammals.

In the eastern North Pacific, fish eating killer whales prey upon salmonids, specifically Chinook salmon and chum salmon. Transient populations prey includes harbor seals, Dall’s porpoises, harbor porpoises, gray whale calves, Steller sea lions, and minke whales. Killer whales have also been seen to feed occasionally on sea turtles and marine birds (Jefferson et al. 2008).

3.2.5.2.e Minke Whale

Minke whales (*Balaenoptera acutorostrata*) are classified as a single species with three recognized subspecies. The North Pacific subspecies *B. a. scammoni* is found within the proposed action area. The Alaska stock of this subspecies occurs within the proposed action area. Minke whales are not listed as threatened or endangered under the ESA or as depleted under the MMPA.

Minke whales have a cosmopolitan distribution in temperate and tropical waters and generally inhabit waters over the continental shelf, including inshore bays and even occasionally estuaries. However, records from whaling catches and research surveys worldwide indicate minke whales may have an open ocean component to their habitat (Ingram et al. 2007; Jefferson et al. 2008). They have an extensive distribution in polar, temperate, and tropical waters in the northern and southern hemispheres (Jefferson et al. 2008; Perrin and Brownell 2008); they are less common in the tropics than in cooler waters. Minke whales generally participate in annual migrations between low-latitude breeding grounds in the tropics and subtropics (including Brazil and the Caribbean (Reeves et al. 2002b)) in the winter and high-latitude feeding grounds in the summer (Kuker et al. 2005). Migration paths of the minke whale show they follow patterns of prey availability (Jefferson et al. 2008). In the northern part of their Pacific range, minke whales are believed to be migratory (Dorsey et al. 1990). Minke whales are even known to penetrate loose ice during the summer; some individuals travel north of the Bering Strait (Leatherwood et al. 1982). Minke whales are relatively common in the Bering and Chukchi Seas as well as the inshore waters of the Gulf of Alaska (Mizroch 1992) while not considered abundant in any other part of the eastern Pacific (Brueggeman 1990; Leatherwood et al. 1982). Minke whales have been sighted most frequently in waters 328—656 ft (100—200 m) deep in the central-eastern Bering Sea, the north side of the Alaska Peninsula, and around the Aleutian Islands (Moore 2000). Sightings in the southeastern Bering Sea occurred near the Pribilof Islands (Moore et al. 2002a). The majority of the sightings in the North Pacific occurred in water shallower than 200 m along the Aleutian Islands rather than in the Gulf of Alaska.

Minke whales prey on small invertebrates and schooling fishes, such as capelin, haddock, sand eels, pollock, herring, and cod (Jefferson et al. 2008; Kuker et al. 2005; Lindstrom and Haug 2001; Reeves et al. 2002b). Similar to the other rorquals, minke whales are lunge feeders, often plunging through patches of shoaling fish or krill (Hoelzel et al. 1989; Jefferson et al. 2008).

3.2.5.2.f Northern Fur Seal

Two stocks of northern fur seals are recognized within U.S. waters under the MMPA (Dizon et al. 1992). The Eastern Pacific stock is mainly derived from Bering Sea rookeries while a separate San Miguel Island (California) stock is also recognized. Both stocks have been designated as depleted under the MMPA since 1988 because population levels had declined to less than 50 percent of levels observed in the late 1950s (FR 53 (96): 17888-17899, May 18, 1988). Due to this designation, the Eastern Pacific stock of northern fur seal is classified as strategic. A Conservation Plan for the Eastern Pacific stock was released in December of 2007 (National Marine Fisheries Service 2007). This Plan reviews known and potential threats to the recovery of northern fur seals in Alaska. The northern fur seal is not listed as threatened or endangered under the ESA.

Northern fur seals are widely distributed across the North Pacific Ocean, Sea of Okhotsk and Bering Sea. The southernmost range includes California in the east and Japan's Honshu Island in the west. Northern fur seals are mainly oceanic and spend most of their time at sea except for the time spent at rookeries during the breeding seasons of summer and fall. They are usually sighted 38—70 nm (70—130 km) from land along the continental shelf and slope, seamounts, submarine canyons, and sea valleys, where upwelling of nutrient-rich water occurs.

The vast majority of the population breeds during the summer at the Pribilof Islands in the southern Bering Sea and to a lesser extent the Commander Islands, while the remaining animals use rookeries either at Russia's Bogoslof Island located in the southern Bering Sea or at San Miguel Island in the Channel Islands off southern California (Lander and Kajimura 1982; National Marine Fisheries Service 1993). During the reproductive season, adult males usually are on shore during the four month period from May to August, though some may be present until November. Adult females are ashore up to six months between June and November (Allen and Angliss 2014).

Following their respective times ashore, seals of both genders then move south and remain at sea until the next breeding season (Roppel 1984). Adult females and pups from the Pribilof Islands move through the Aleutian Islands into the North Pacific Ocean and sometimes move to the waters offshore of Oregon and California. Adult males generally move only as far south as the Gulf of Alaska in the eastern North Pacific (Kajimura 1984) and the Kuril Islands in the western North Pacific (Loughlin et al. 1999). Nonbreeding northern fur seals may occasionally haul out on land at other locations along coastlines in Alaska, British Columbia, and on islets along the U.S. west coast (Fiscus 1983). Many juvenile animals migrate southward to California and Japan. At sea, northern fur seals are most likely encountered alone or in pairs but, at times, form groups of three or more. While at sea northern fur seals spend much time rafting at the surface to groom and sleep.

Northern fur seals forage on a variety of epipelagic and vertically migrating fish and squid including pollock, Pacific sand lance, Pacific herring, northern smoothtongue, Atka mackerel, and Pacific salmon (Zeppelin and Ream 2006). Some historically important prey items have disappeared entirely from fur seal diet (e.g., capelin) while dependence on pollock has increased (Antonelis et al. 1997; Sinclair et al. 1994; Sinclair et al. 1996). Adult female fur seals spend up to eight months in varied regions of the north Pacific Ocean during winter, and forage in areas associated with eddies and the subarctic-subtropical transition region (Ream et al. 2005). Foraging dives take place mainly at night and average 197—230 ft (60—70 m) deep and can last up to 2.5 minutes.

3.2.5.2.g Pacific White-sided Dolphin

The Pacific white-sided dolphin (*Lagenorhynchus obliquidens*) is not listed as threatened or endangered under the ESA. Additionally, it is not listed as depleted nor is the Alaska stock considered strategic under the MMPA.

Pacific white-sided dolphins are found in temperate waters of the North Pacific from the continental shelf to the deep ocean. Largely pelagic, this species ranges from the Gulf of California to the Gulf of Alaska and is rarely encountered in the southern Bering Sea. In Alaska, this species is common both on the high seas and along the continental margins and animals are known to enter inshore passes (Carretta et al. 2015; Ferrero and Walker 1996). Seasonal movements of Pacific white-sided dolphins are not very well understood in most areas. Off the California coast, there appear to be resident groups that are joined by animals coming from other areas during the fall through spring. In the summer, animals may travel as far north as Kodiak Island, and have been seen in the Bering Sea and Aleutians. Whether these individuals are members of the local North Pacific stock, or have migrated in from the California/Oregon/ Washington stock, is unclear (Clark 2008).

Pacific white-sided dolphins prey on squid and schooling fish, such as lanternfish, anchovies, mackerel, and hake, and are capable of diving for more than six minutes to feed. However, many of their prey species travel vertically at night, limiting the necessity of diving to forage (Stroud et al. 1981).

3.2.5.2.h Ribbon Seal

The ribbon seal (*Histriophoca fasciata*) does not have any subspecies and is therefore considered a single species throughout its range. Ribbon seals are not listed as threatened or endangered under the ESA, although the species is a Species of Concern. Species of Concern are those species which NMFS has concern regarding status and threats but available information is insufficient to indicate a need for listing under the ESA. On 20 December 2007, NMFS received a petition to list ribbon seals under the ESA, primarily due to concern about threats to the species' habitat from climate change and loss of sea ice. NMFS found the petition presented sufficient information to consider listing and initiated a conservation status review of ribbon seals (FR 73 (61): 16617-16619, March 28, 2008). After the status review of the ribbon seal was complete (Boveng et al. 2008), NMFS determined that listing ribbon seals was not warranted (FR 73 (250): 79822-79828, December 30, 2008).

The ribbon seal's range includes the Sea of Okhotsk, Bering Sea, and southern Chukchi Sea (Reeves et al. 2002b). Their range stretches throughout the Bering Sea, including the Aleutian Islands, the western Pacific around the Kamchatka Peninsula and Kuril Islands (Russia), as well as the Sea of Okhotsk. The southern distribution within their effective range is strongly associated with the extent of ice formation in the Bering Sea and Sea of Okhotsk, which can drive large numbers of these seals further south in some years with heavy ice. The inverse is also true when years of light ice formation causes greater numbers of seals to remain further north.

Ribbon seals are found in the open sea and on the free-floating pack ice rather than shore-fast ice (Kelly 1988b). From late March to early May, ribbon seals inhabit the Bering Sea ice front (Braham et al. 1984; Burns 1970, 1981b) and are most abundant in the central and western parts of the Bering Sea along the southern edge of the ice front (Burns 1970, 1981b). As the ice front recedes, most seals move further north in the Bering Sea between May and mid-July, using the ice edge or ice remnants to haul out (Burns 1970, 1981b; Burns et al. 1981). The Bering Sea and Sea of Okhotsk are the principal breeding grounds for this species (Reeves et al. 2002b). During summer, from July through October, these seals do not occur near shore, nor do they migrate northward to the fringe of polar ice as do bearded and ringed seals. Although their distribution is not completely understood, the most likely explanation is that they spend the summer at sea. A recent study using satellite telemetry has shown that animals tagged near the eastern coast of the Kamchatka Peninsula (Russia) spent the summer and fall in the Bering Sea and Aleutian Islands, while others moved from the central Bering Sea to the Bering Strait, Chukchi Sea, or Arctic Basin as the seasonal ice receded (Boveng et al. 2008). In Alaskan waters, ribbon seals range northward from Bristol Bay in the Bering Sea into the Chukchi and western Beaufort Seas. Little is known about the range of ribbon seals during the rest of the year.

Ribbon seals in the Bering Sea and Sea of Okhotsk consume 35 different species of fish and invertebrates (Jefferson et al. 2008). Pollock and Arctic cod are among the prey species known for the ribbon seal (Reeves et al. 2002b). Juvenile ribbon seals feed on euphausiids after weaning until they reach one year of age when they feed predominantly on shrimp for one year (Jefferson et al. 2008). In the Bering Sea, 65 percent of the ribbon seals diet consists of squid and octopus.

3.2.5.2.i Spotted Seal

The spotted seal (*Phoca largha*) is not listed as threatened or endangered under the ESA. Additionally, it is not listed as depleted nor is the Alaska stock considered strategic under the MMPA.

Spotted seals are widespread in the Sea of Okhotsk, Yellow, Japan, and Bering Seas. Spotted seals are closely related to and are often mistaken for Pacific harbor seals. The two species are often seen together and are partially sympatric with range overlap in the southern part of the Bering Sea (Quakenbush 1988). The key difference between the two species is spotted seals breed earlier than harbor seals and they are noticeably less social during the breeding season. Additionally, spotted seals are strongly associated with pack ice whereas harbor seals are not (Quakenbush 1988; Shaughnessy and Fay 1977).

Spotted seals inhabit the southern edges of the pack ice in the Chukchi Sea from winter to early summer. Spotted seals also overwinter in the Bering Sea, tending to remain associated with the ice edge and moving in an east to west direction (Lowry et al. 1998). To the south, and along the west coast of Alaska, spotted seals can be found at the Pribilof Islands (in the Bering Sea), in Bristol Bay, and along the eastern Aleutian Islands. As mentioned above, a large percent of haul outs are associated with pack ice and their movements tend to remain associated with ice. Breeding takes place on pack ice from January to mid-

April, with the peak of pups born in mid to late March. Eight offshore breeding areas have been described; three in the Bering Sea, two in the Sea of Okhotsk, and one in each of the following areas: Tatar Strait, Peter the Great Bay, and Po Hai Sea (Shaughnessy and Fay 1977). The seals remain at the breeding sites until the end of the breeding season which coincides with the break-up of ice in spring. As ice begins to break up in the Bering Sea, seals follow the retreating ice edge and disperse northward along the shores of Alaska and Siberia (Bigg 1981).

During spring, spotted seals tend to prefer the small, broken up floes (i.e., less than 66 ft [20 m] in diameter) and remain at the southern margin of the ice in areas where the water depth does not exceed 656 ft (200 m). Once the sea ice retreats in early summer, seals move to coastal habitats including river mouths where they remain until the fall (Fay 1974; Lowry et al. 2000; Shaughnessy and Fay 1977; Simpkins et al. 2003). In the summer and fall, spotted seals occupy coastal haulouts regularly using sand bars and beaches (Frost et al. 1993; Lowry et al. 1998), and can be found as far north as 69–72° N in the Chukchi and Beaufort Seas (Porsild 1945; Shaughnessy and Fay 1977). When the cold season begins, some seals in the northeastern Chukchi Sea move south in October and pass through the Bering Strait during November (Porsild 1945; Shaughnessy and Fay 1977).

Spotted seals feed opportunistically on a variety of fish, cephalopods, and crustaceans (Bigg 1981). While juveniles and adults eat a variety of schooling fish (pollock, capelin, arctic cod and herring), epibenthic fish (especially flounder, halibut, and sculpin), crabs, and octopus at depths up to 1,000 ft (300 m) (Reeves et al. 2002b), pups feed on small amphipods found around ice floes.

3.2.5.2.j Stejneger's Beaked Whale

Stejneger's beaked whale (*Mesoplodon stejnegeri*) is one of 22 recognized *Mesoplodon* species, and is the only *Mesoplodon* species present in the proposed action area. Stejneger's beaked whales are not listed as depleted under the MMPA or listed as threatened or endangered under the ESA. Additionally, the Alaska stock is not classified as strategic under the MMPA. The Alaska Stejneger's beaked whale stock is present in the proposed action area.

The distribution of Stejneger's beaked whale has been inferred from stranded specimens because sightings of living animals are so rare that they shed no light on its range limits (Loughlin et al. 1982; Mead 1989; Walker and Hanson 1999), although sightings have been recorded around the Aleutian Islands (52° N) (Loughlin et al. 1982; Rice 1986). Stranding records include the Gulf of Alaska (approximately 55° N) (Willis and Baird 1998), the Aleutian Islands (approximately 52° N) (Mead 1989; Walker and Hanson 1999), and northern Russia (57° N) (Moore 1963). The southernmost records are strandings from central California (approximately 36° N) (Henshaw et al. 1997) and the southern coast of Japan (approximately 35° N) (MacLeod et al. 2006). These stranding records indicate that the northern range limit lies principally between 50° and 60° N and extends south to about 45° N in the eastern Pacific along the west coast of North America and to about 40° N near Honshu in the Sea of Japan in the western Pacific (Loughlin and Perez 1985; Moore 1963; Moore 1966). Occurrence within the proposed action area is rare, but possible.

Stejneger's beaked whale is an oceanic species that prefers waters of the North Pacific Basin, Sea of Japan, and deep waters of the southwest Bering Sea where it is an endemic species. Primary observations have been made in the deep, offshore waters (2,500–5,000 ft [750–1,500 m]), beyond the continental slope (Reeves et al. 2002b). The species is not known to enter the Arctic Ocean (Mead 1989). Scars from the cookie cutter shark and a strong peak in strandings in the Sea of Japan in winter and spring suggest that this species migrates north in the summer months (Reeves et al. 2002b).

Stejneger's beaked whale is known to feed on deep-water squid (Jefferson et al. 1993) primarily from the Gonatidae and Cranchiidae families (Jefferson et al. 2008; Reeves et al. 2002b).

3.2.5.3 Marine Mammal Hearing

All marine mammals studied use sound to forage, orient, socially interact with others, and detect and respond to predators. 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.

The hearing mechanism for marine mammals is similar to that of terrestrial mammals. It is comprised of an outer ear, a fluid-filled inner ear with a frequency-tuned membrane interacting with sensory cells, and an air-filled middle ear, which provides a connection between the outer ear and inner ear (Nedwell et al. 2004). Cetaceans found in the proposed action area can be separated into low-, mid-, and high-frequency functional hearing groups based on behavioral pyschophysics, evoked potential audiometry, auditory morphology (Southall et al. 2007).

Potential acoustic impact or harm of transmissions to ESA-listed marine mammals could include non-recoverable physiological effects, recoverable physiological effects, and behavioral effects. Criteria and thresholds for measuring these effects induced from underwater acoustic energy have been established for marine mammals. PTS in hearing is the criteria used to establish the onset of non-recoverable physiological effects, while TTS in hearing is the criterion used to establish the onset of recoverable physiological effects, and a behavioral response function is used to determine non-physiological behavioral effects. The MMPA describes Level A harassment as potential injury and Level B harassment as potential disturbance.

3.2.5.3.a Mysticete Hearing

Anatomical and paleontological evidence suggests that the inner ears of mysticetes (baleen whales) are well adapted for hearing at lower frequencies (Ketten 1998; Richardson et al. 1995). Functional hearing in low-frequency cetaceans is conservatively estimated to be between about 7 Hz and 22 kHz (Southall et al. 2007). Erbe compiled much of the previously conducted research on mysticete whale hearing (2002).

3.2.5.3.b Odontocete Hearing

Odontocete hearing is very broad, with species having the ability to detect low-, mid-, and high-frequencies. Functional hearing in mid-frequency cetaceans is conservatively estimated to be between 150 Hz and 160 kHz; functional hearing in high-frequency cetaceans is conservatively estimated to be between 200 Hz and 180 kHz (Southall et al. 2007).

In general, odontocetes produce sounds across a wide band of frequencies. Mid-frequency cetaceans produce sounds ranging from a few hundreds of Hz to tens of kHz (Southall et al. 2007) with source levels in the range of 118–236 dB re 1 μPa at 1 m (Richardson et al. 1995). Sounds produced by high-frequency cetaceans range from approximately 100 Hz to 200 kHz with source levels of 120–150 dB re 1 μPa at 1 m (Madsen et al. 2005; Richardson et al. 1995; Verboom and Kastelein 2003; Villadsgaard et al. 2007). Odontocetes also generate specialized clicks used in echolocation at frequencies above 100 kHz. Echolocation is used to detect, localize, and characterize underwater objects, including prey items (Au 1993). Source levels can be as high as 229 dB re 1 μPa at1 m for echolocation clicks (Au et al. 1974).

3.2.5.3.c Pinniped and Polar Bear Hearing

Pinnipeds are divided into three functional hearing groups, otariids (sea lions and fur seals), phocid seals (true seals), and odobenids (walrus), with different in-air and in-water hearing ranges. The proposed action area contains all three types of pinnipeds. Measurements of hearing sensitivity have been conducted on species representing all of the families of pinnipeds (Phocidae, Otariidae, Obodenidae) (Kastelein et al. 2012; Kastelein et al. 2002b; Moore and Schusterman 1987; Schusterman et al. 1972; Terhune 1988; Thomas et al. 1990; Turnbull and Terhune 1990; Wolski et al. 2003).

Pinnipeds produce sounds both in air and water that range in frequency from approximately 100 Hz to several tens of kHz and it is believed that these sounds only serve social functions (Miller 1991) such as male-male vocal boundary displays, mother-pup recognition, and reproduction. Source levels for pinniped vocalizations range from approximately 95 to 190 dB re 1 µPa at 1 m (Richardson et al. 1995).

Phocid hearing limits are estimated to be 75 Hz–30 kHz in air and 50 Hz—86 kHz in water (National Marine Fisheries Service 2016; Southall et al. 2007). Sills et al. (2014) reported that northern or ice seals (e.g. ringed and spotted seals) have more sensitive hearing than previously reported and more sensitive than southern phocids (e.g. elephant or monk seals) or otariids. A recent study has shown that a harbor seal may be able to detect high frequency underwater sounds up to 140 kHz (Cunningham and Reichmuth 2016).

Hearing in otariid seals is adapted to low frequency sound and less auditory bandwidth than phocid seals. Kastelein et al. (2005) found that the range of best underwater hearing for two Steller sea lions tested was from 1 to 19 kHz, though sounds were detected as high as 25 kHz. However, the otariids' hearing ranges of 50 Hz–75 kHz in air and 50 Hz–50 kHz in water were based on studies done with California sea lions and Northern fur seals (Kastak and Schusterman 1998; Moore and Schusterman 1987; Schusterman et al. 1972; Southall 2005).

The walrus is the only extant odobenid pinniped and may be found within the proposed action area. The walrus is adapted to low-frequency sound with a range of best hearing in water from 1 to 12 kHz and maximum hearing sensitivity around 12 kHz; its hearing ability falls off sharply at frequencies above 14 kHz (Kastelein et al. 2002b; Kastelein et al. 1996). The walrus hearing sensitivity is most similar to otariids, and therefore the walrus is assigned the same functional hearing range as for otariids for this analysis. Functional hearing limits are conservatively estimated to be 50 Hz–35 kHz in air and 50 Hz–50 kHz in water (Southall et al. 2007).

Hearing in odobenids and polar bears are both very similar to that of otariids. Hearing in polar bears has a range of best hearing from 50 Hz–50 kHz in water and 50 Hz–35 kHz in air (Southall et al. 2007).

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 2017b). It stretches from its boundary at Cape Newenham with the Bristol Bay area to the border with Canada on the Arctic Ocean. The Yukon River, with the fifth largest drainage in North America, lies within this management region. The Kuskokwim River is second in size next to the Yukon. With the exception of Fairbanks, Bethel, and Nome, this is a region of villages. Salmon and herring are the most important fisheries resources in this region (Alaska Department of Fish and Game 2017b). 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 2017b).

3.3.1.1.a The Arctic Management Area

The Arctic Management Area includes Utqiagvik (Barrow) and encompasses all waters of Alaska north of the latitude of the western most tip of Point Hope and west of 141° W, including those waters draining into the Arctic Ocean and the Chukchi Sea. The area consists of 91,000 mi^2 (235,689 km^2) and the largest river system, the Colville River, drains 29 percent of the North Slope (Alaska Department of Fish and Game 2017b). A commercial fishery for freshwater finfish has existed in the Colville River delta since 1964 primarily harvesting *Coregonus* spp. Historically, commercial fishing took place during late June and July for broad and humpback whitefish, and October through early December for Arctic and least cisco. Around 1990, the commercial fishing effort shifted to October and November for Arctic and least cisco using set gillnets operated under the ice (Alaska Department of Fish and Game 2017b). In 2009, the Council approved, and NMFS implemented, a FMP for the Fish Resources of the Arctic Management Area (North Pacific Fishery Management Council 2009). This plan stated that all Federal waters of the U.S. Arctic will be closed to commercial fishing for any species of finfish, mollusks, and crustaceans. The Arctic FMP does not regulate subsistence or recreational fishing or State of Alaska-managed fisheries in the Arctic. Salmon is the most valuable commercial fishery managed by the State of Alaska; however, there is no commercial salmon fishery in the Arctic Management Area.

3.3.1.1.b The Norton Sound and Kotzebue Management Area

Kotzebue, Kivalina, and Nome are part of the 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. These management districts encompass over 65,000 mi^2 (168,349 km^2). Approximately 17,000 people, primarily Alaska Natives, reside in 30 small communities within these management districts (Alaska Department of Fish and Game 2017b). Nearly all local residents are dependent to varying degrees on fish and game resources for their livelihood. Chum and pink salmon are abundant in Norton Sound and smaller populations of sockeye, coho, and Chinook salmon are also present. Only chum salmon are found in sufficient abundance to support commercial fishing in Kotzebue Sound. Small, isolated populations of salmon are found north of Kotzebue Sound (Alaska Department of Fish and Game 2017b). Herring are present in all three management districts; Norton Sound has the largest abundance of herring in the region. The remote location of these herring stocks, and their later timing relative to other herring stocks, makes attracting buyers difficult for these fisheries. Since 1997, no more than 91 tons of herring were sold annually as food and bait. In 2012 there was no sac roe fishery due to late ice breakup and in 2013, less than 500 tons of sac roe herring was harvested. In 2014, only 1 ton of bait was harvested because ice prevented tenders from reaching Norton Sound. Since 2001, little (less than 1 ton) or no harvest has occurred from either the *Macrocystis* kelp or wild *Fucus* spawn-on-kelp fisheries (Alaska Department of

Fish and Game 2017b). 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. In 2010, due to concern over lack of stock status information, the NPFMC closed the Bering Strait area above Cape Prince of Wales to crabbing. Only state waters (within 3 miles of shore) were open to crabbing north of the latitude of Cape Prince of Wales (Alaska Department of Fish and Game 2017b).

There are 5 species of Pacific salmon indigenous to the area; however, chum and pink salmon historically are the most abundant. Chum and Chinook salmon are found as far north as Utqiagvik (Barrow), but they are less common north of the Kotzebue Sound drainages. The northernmost large concentrations of chum salmon are found within Kotzebue Sound drainages, but large numbers of Chinook and coho salmon are not found north of Norton Sound. In Kotzebue Sound, the commercial harvest figure of 400,417 chum salmon was the seventh highest in the 55-year history of the fishery (Alaska Department of Fish and Game 2017c). Pink salmon have been observed by aerial survey in increasing numbers in rivers north of Point Hope to Utqiagvik (Barrow). Small numbers of chum, pink, sockeye, and Chinook salmon have been reported by subsistence fishermen along the Arctic coast. Currently, most commercial fishermen and many buying station workers are resident Alaska Natives (Yupik, Inupiat, and Siberian Yupik) (Alaska Department of Fish and Game 2017c). Commercial fishermen operate set gillnets from outboard powered skiffs, and all commercial caught salmon are harvested in coastal marine waters. The commercial fishery in the Kotzebue District includes both Kotzebue and Kivalina. Their harvests consist primarily of chum salmon, although limited amounts of Dolly Varden; sheefish; whitefish; and Chinook, sockeye, pink, and coho salmon are harvested during the fishery (Alaska Department of Fish and Game 2017c).

Sport anglers commonly fish for Chinook salmon, coho salmon, pink salmon, sockeye salmon, chum salmon, Arctic grayling, rainbow trout, lake trout, Arctic char, Dolly Varden, Arctic grayling, sheefish, Northern pike, and burbot. Occasionally anglers take least cicsco, humpback whitefish, round whitefish, and broad whitefish (Alaska Department of Fish and Game 2017a). The North Slope sport fish population is slow growing and can support minimal harvest. Statewide, the Alaska Sport Fishing Survey reports that, from 2006 through 2015, an average total of 643 pounds of salmon were caught in the Arctic-Yukon-Kuskokwim region (Alaska Department of Fish and Game 2017a).

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). 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, stimulating demand (and thus, shipment) for goods and construction materials. In addition to the oil and gas fields off the coast of Alaska, a number of very large mines in the Arctic produce commodities such as nickel, zinc, and other ores. The Red Dog mine is both near to the coast and one of the world's largest zinc mines. Ship activity involving bulk transport of ore, oil, and gas, is likely where the most growth will be witnessed in the near future (Arctic Council 2009). In Alaska, the area of greatest oil extraction is the North Slope Borough, while the coastal area of greatest mineral extraction is the Seward Peninsula near the Port of Nome. Nearly all passenger vessel activity in the Arctic takes place in ice-free waters in the summer season; the vast majority of it is for marine tourism. Finally, icebreakers, government, and research vessels represent a relatively small proportion of the total vessel traffic in the Arctic but are invaluable for surveying, oceanographic research, vessel escort in ice, salvage, pollution response, and SAR. According to the tracking of all vessel traffic in 2004, the greatest amount of vessel traffic occurs in the proposed action area between the Alaskan Archipelago and the Bering Strait (Arctic Council 2009). 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. The number of vessels travelling north of the Bering Strait along the northern Alaskan coast diminishes quickly (Arctic Council 2009). As governments look to capitalize on new resources and sea routes in the melting Arctic Ocean, figures show that the number transits through the Bering Strait was 220 in 2008 and has increased to 540 in 2015. Further south, in the Aleutian Islands, Unimak Pass recorded 3,491 transits in 2006, which increased to 4,615 in 2012 (Nuka Research and Planning Group and Pearson Consulting 2014).

Current Arctic marine shipping is mainly intra-Arctic. Trans-Arctic marine shipping can take place by means of various routes and combinations of routes. Two of these routes are the Northwest Passage and the Northern Sea Route. Since 2000, a small number of trans-Arctic voyages have occurred in summer for science and tourism purposes across the Northwest Passage and the Northern Sea Route (Molenaar and Corell 2009). All trans-Arctic marine shipping must pass through the Bering Strait, thus making it a ‘choke point’. The Northwest Passage is the shipping route most commonly used within the proposed action area. This passage is the name given to the various marine routes between the Atlantic and Pacific oceans along the northern coast of North America. In the western approaches, ships proceed through the Bering Sea, Bering Strait, the Chukchi Sea, and the Beaufort Sea before determining which route to follow through the Canadian Arctic. In general, the operating season is short—from late July to mid-October, depending on the route and year (Molenaar and Corell 2009). In the Bering Sea, some of the vessels are involved in shipping along the North Pacific Great Circle Route through the Aleutian Islands, but most of the ship traffic is bulk cargo ships serving the Red Dog mine, fishing vessels, and coastal community re-supply vessels (Arctic Council 2009).

Kotzebue is a major distribution and transshipment point for heavy equipment, fuel, building materials, food, and other supplies that arrive from Seattle, Washington on deep draft freight vessels during the approximately 100 days when the Kotzebue Sound is navigable, usually early July to early October (NANA Regional Corporation 2016b). Due to river sediments deposited by the Noatak River four miles above Kotzebue, the harbor is too shallow to allow large freighters to approach closer than 15 miles offshore. From there, cargo loads must be lightered by shallow draft barges to shore and warehoused. The city is examining the feasibility of developing a deep-water port. Kotzebue residents use small boats for recreation and subsistence activities as well as transporting small cargo loads to villages upriver (NANA Regional Corporation 2016b). In Utqiagvik (Barrow), the main shipment of goods is by plane. Utqiagvik (Barrow) is home to Wiley Post-Will Rogers Memorial Airport. Nome has the only public seaport infrastructure, north of Dutch Harbor, and functions as the major distribution and transshipment point for heavy equipment, fuel, building materials and household goods, as well as serving as a the largest rock and gravel export facility in the region. The Port of Nome is used by cargo/fuel barges, research vessels, cruise ships, fuel tankers, and both domestic and foreign government vessels. The City Dock is equipped with marine headers to handle distribution of the region's bulk cargo/fuel commodities. The West Gold Dock is exclusively used to export all rock/gravel materials, and the new Middle Dock serves as an overflow dock for all vessel types, and effectively accommodates all loading and unloading of rolling stock with the 10% concrete loading ramp. The Port of Nome supports 450 seafood harvesters and processors (City of Nome Alaska 2016). Port traffic increased from 160 vessels in 2000 to 751 in 2016, with a growing number of commercial and private vessels transiting the nearby Bering Strait. Annually, the port handles an average of 53,000 tons of rock, sand, and gravel; 34,000 tons of freight; and 13.1 million gallons of refined products (City of Nome Alaska 2016). Nome is the largest port north of Dutch Harbor, which is located in the Aleutian Islands. To Kivalina, the Northland Services barges fuel, automobiles, groceries, household goods, and general supplies to Kivalina during the narrow annual window of July and August (NANA Regional Corporation 2016a).

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. Many of the communities within the proposed action area are not accessible by roads from other parts of Alaska (NANA Regional Corporation 2016a). The basic modes of transportation to and from Kivalina, for example are plane, small boat, and snow machine.

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). In the Arctic region of Alaska, the food harvest averages out to roughly 405 pounds per person, while in the western region of Alaska, the harvest is 370 pounds per person. Meanwhile, the harvest in more urban areas, like Anchorage, averages out to 15 pounds per person (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). Migrating waterfowl and their eggs, as well as sheefish, herring, whitefish, and Dolly Varden are also caught in the spring. Late spring and early summer are the season for beluga whales and muskrats. The summer subsistence foods include beluga, bird eggs, greens, berries, salmon, and Dolly Varden. Subsistence hunting in the fall may include caribou, moose, bear, and Dall sheep (Georgette and Loon 1993). As Dall sheep live in the mountains, hunters must travel to participate in these hunts. Also in the fall, waterfowl are hunted, whitefish are caught, and roots and cranberries are gathered. Late fall, and the arrival of sea ice, brings bearded, ringed, and spotted seals to Kotzebue, along with saffron cod. Finally, in the winter, many terrestrial mammals are caught and trapped, including caribou, moose, hare, wolf, wolverine, and fox. Ptarmigans, ringed seals, and sheefish are also taken, if available (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). The community begins the spring season, typically in April, by hunting bowhead whales (and seals as available) in open leads along the Chukchi Sea. The summer and fall months are spent by hunting marine mammals (bearded and ringed seals, and walruses) in the open ocean, concluding with the fall bowhead whale hunt in October. During the late fall and winter months, residents target ringed seals on the ice as well as polar bears closer to shore. Utqiagvik (Barrow) 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. The majority of reported use areas do not extend beyond 60 miles from shore, however (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. Beach seines are used to catch schooling or spawning salmon and other species of fish. The major portion of fish taken during summer months is airdried or smoked for later consumption by residents or occasionally their dogs. Subsistence salmon fishing in the Kotzebue Sound District continues to be important, but fish abundance and fishing activities vary from community to community (Alaska Department of Fish and Game 2017c). Along the Noatak and Kobuk rivers where chum salmon runs are strong, household subsistence activities in middle and late summer revolve around catching, drying, and storing salmon. In southern Kotzebue Sound, fewer salmon are taken for subsistence because of low availability. Some fishermen base their fishing effort out of their village, whereas others move seasonally to fish camps where they stay for several days to several weeks. The predominant species in the district is chum salmon, although small numbers of other salmon species are present. Many subsistence fishers operate gillnets in the rivers and coastal marine waters of the Arctic Area to harvest marine and freshwater finfish. 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 2017c). Arctic cisco and broad whitefish are most commonly used for subsistence purposes along with Dolly Varden, and Arctic grayling.

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		
Invertebrates	No change to baseline	No significant impact or harm
Marine Vegetation	No change to baseline	No significant impact or harm
Marine Birds	No change to baseline	No significant impact or harm
ESA-Listed Marine Birds	No change to baseline	May affect, but is not likely to adversely affect
ESA-Listed Marine Bird Critical Habitat	No change to baseline	Would not result in the destruction or adverse modification of federally-designated critical habitat
Migratory Bird Populations	No change to baseline	Would not result in a significant adverse effect
Fish	No change to baseline	No significant impact or harm
EFH	No change to baseline	No significant impact or harm
EFH under the MSA	No change to baseline	Would not result in adverse effects to EFH
Marine Mammals	No change to baseline	No significant impact or harm
ESA-Listed Marine Mammals	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 helicopter noise. 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 2017 that would operate navigational sonar while underway. Aircraft used would typically be a MH-60 Jayhawk helicopter. 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.

Hearing Thresholds

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.

Behavioral Responses

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 of 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 Underwater Acoustic Transmissions

Active acoustic transmissions discussed in this section are from single beam echosounders. The single beam echosounder is part of the vessel's navigation system that would be on at all times while a vessel is underway (potentially up to 24 hours). While the frequencies (see Table 2-1) can range from 3.5–1,000 kHz, most navigational systems operate from 50–200 kHz, which is the assumed operating frequency for the Proposed Action. Transmitted pulses are of short duration, typically on the order of milliseconds (ms), but are operational for the entire time a vessel is underway. The maximum transmit powers may be as high as 227 dB re 1µPa at 1 m, depending on frequency (the highest levels are used in low-frequency deep-water applications), but during the Proposed Action the source level is not expected to be higher than 205 dB re 1µPa at 1 m. The most common geometry is one conical vertical beam, with sidelobes that generate unwanted energy outside of the main lobe, but are typically 20-30 dB below the main lobe's level. This analysis only evaluated impact or harm from the main lobe since that would represent the highest energy output. The pulse durations are normally about 0.1 percent to 1 percent of the echo reception delay, hence typically between 0.1 ms and 10 ms, with longer pulses corresponding to lower frequencies and deep waters.

Under the Proposed Action, the frequency of the underwater acoustic transmissions would be above invertebrate hearing capabilities, so there would be no impact or harm to invertebrates from underwater acoustic transmissions. The potential impact or harm of underwater acoustic transmissions is analyzed below for marine birds, fish, EFH, marine mammals, and socioeconomic resources.

4.1.1.1 Marine Birds

As addressed in Section 3.2.2.3, birds have been reported to hear best at mid-frequencies (1 to 5 kHz). The echosounder associated with the Proposed Action has an operating frequency range of 3.5—1,000 kHz; thus, marine birds may be able to detect the lowest operating frequencies of the echosounder signals associated with the Proposed Action. NMFS (2003) concluded that, even if some diving birds were able to hear underwater acoustic signals, it is unlikely to significantly impact or harm bird populations because: 1) there is no evidence birds use underwater sound, eliminating the possibility of masking, 2) birds spend a small fraction of time submerged, and 3) birds could rapidly fly away from the area and disperse to other areas if disturbed. Marine birds may be exposed to active acoustics while foraging underwater. Although the impact or harm to birds from underwater acoustic exposures is unknown, if disturbed, the disturbance is likely to result in alerting, avoidance, or other short-term behavioral reactions.

Marine birds could encounter acoustic transmissions within the proposed action area. The potential for a marine bird to be underwater and within receiving distance of an acoustic source is unlikely due to short duration of their dives. However, if a marine bird were to perceive an acoustic source, it is expected to either not react to the source or exhibit short-term behavior responses such as swimming away from the source.

Coast Guard vessels would follow SOPs and BMPs (as outlined in Chapter 6) 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.

Therefore, in accordance with NEPA, acoustic transmissions associated with the Proposed Action would not significantly impact marine birds. In accordance with E.O. 12114, acoustic transmissions associated with the Proposed Action would not result in significant harm to marine birds. Under the ESA, acoustic transmissions associated with the Proposed Action may affect, but are not likely to adversely affect the ESA-listed short-tailed albatross, spectacled eider, or Steller's eider, nor result in the destruction or adverse modification of federally-designated critical habitat for the spectacled eider or Steller's eider. Pursuant to the MBTA, acoustic transmissions associated with the Proposed Action would not result in a significant adverse effect on migratory bird populations.

4.1.1.2 Fish

As discussed in Section 3.2.3.2, most fish species can hear sounds between 50 and 1,000 Hz. Most marine fish are hearing generalists and are unable to perceive sounds above 1,000 Hz. Thus, hearing generalist fish are not expected to detect signals emitted by the echosounder associated with the Proposed Action, as its operating frequency range of 50–200 kHz is outside the hearing range of these fish. Fish species that are hearing specialists, which include Clupeiformes and Gadiiformes fish like cod and shad, are able to detect sounds from 0.2 to 180 kHz (Mann and Popper 1997) while herring is able to detect sounds from 100—5,000 Hz (Mann et al. 2005). Potential impact or harm to hearing specialist fish that may detect the signals from underwater acoustic transmissions includes TTS, behavioral reactions, and auditory masking.

The TTS effect has been demonstrated in several fish species where investigators used exposure to either long-term increased background levels (Smith et al. 2004) or short-term, intense sounds (Popper et al. 2005). Coast Guard vessels would be continually moving throughout the proposed action area in order to fulfill mission responsibilities. As a result, a long-term increase in background noise levels is not expected as a result of the Proposed Action. As vessels pass over fish and emit echosounder signals, this may be considered a short-term sound, but is much less intense than a high-energy source like an air-gun (McCauley et al. 2003). Therefore, no TTS is expected in fish as a result of the Proposed Action.

Another issue relevant to the Proposed Action is the effect of human-generated sound on the behavior of wild fish, and whether exposure to the sounds would alter the behavior of a fish in a manner that would affect its way of living (e.g. where it tries to locate food or how well it can locate a potential mate). Behavioral responses to loud noise could include a startle response, such as the fish swimming away from the source, the fish "freezing" and staying in place, or scattering (Popper 2003). Studies documenting behavioral responses of fish to vessels show that Barents Sea capelin (*Mallotus villosus*) may exhibit avoidance responses to engine noise, sonar, depth finders, and fish finders (Jorgensen et al. 2004). Avoidance reactions are quite variable depending on the type of fish, its life history stage, behavior, time of day, and the sound propagation characteristics of the water (Schwartz 1985). Fish with hearing specializations include those from the Clupeiformes and Gadiiformes orders. The Proposed Action may result in behavioral reactions by these hearing specialist fish caused by the echosounder signals, with fish exhibiting a startle response and/or vacating the area of increased noise; however, due to the low intensity of the sound, fish would likely return to normal behavior and the area soon after exposure.

Auditory masking refers to the presence of a noise that interferes with a fish's ability to hear biologically relevant sounds. Fish use sounds to detect both predators and prey, and for schooling, mating, and navigating (Popper 2003). Masking of sounds associated with these behaviors could impact or harm fish by reducing their ability to perform these biological functions. Any noise (i.e., unwanted or irrelevant sound, often of an anthropogenic nature) detectable by a fish can prevent the fish from hearing biologically important sounds including those produced by prey or predators (Popper 2003). Masking can impede the flight response of fish from predators or may not allow fish to detect potential prey in the area. The frequency of the sound is an important consideration for fish because many marine fish are limited to detection of the particle motion component of low frequency sounds at relatively high sound intensities

(Amoser and Ladich 2005). Medium frequency sound, such as that of the echosounder, has a limited potential for propagation, owing to greater attenuation. Therefore, detection of the signal is only local or regional (Hildebrand 2009). Additionally, most biological sounds within the ocean environment are in the low frequency band of noise. Thus, masking of biological sounds by the echosounder is not expected as a result of the Proposed Action.

If an individual fish comes in contact with acoustic transmissions and are able to perceive the transmissions, they are expected to exhibit short-term behavioral reactions, when initially exposed to acoustic emissions, which would not significantly alter breeding, foraging, or populations. Therefore, in accordance with NEPA, acoustic transmissions associated with the Proposed Action would not result in significant impacts to fish. In accordance with E.O. 12114, acoustic transmissions associated with the Proposed Action would not result in significant harm to fish. There are no ESA-listed fish within the proposed action area.

4.1.1.3 Essential Fish Habitat

Acoustic transmissions could impact or harm EFH due to the increase in ambient sound level during the transmissions. However, this potential reduction in the quality of the acoustic habitat would be localized to the area of the Proposed Action, due to the attenuation of mid-frequency sonar noise, 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 Habitat would be restored to normal levels immediately following the departure of vessels. Secondary effects to federally managed fish species (e.g., Arctic cod, coho salmon) are considered in Section 4.1.1.2 above.

Since the quality of the water column as EFH would only be impacted locally and temporarily, acoustic transmissions associated with the Proposed Action would not result in adverse effects to EFH under the MSA. In accordance with NEPA, acoustic transmissions associated with the Proposed Action would not result in significant impacts to EFH. In accordance with E.O. 12114, acoustic transmissions would not result in significant harm to EFH.

4.1.1.4 Marine Mammals

Marine mammal hearing is outlined in Section 3.2.5.3. In assessing the potential impact or harm to marine mammal species from the Proposed Action, a variety of factors must be considered, including source characteristics, animal presence and hearing range, duration of exposure, and thresholds for impact or harm to species that may be present. The potential impact or harm 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 4-1). 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 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 NOAA's various statutes, such as the MMPA. Table 4-1 provides the resultant TTS onset auditory acoustic thresholds for non-impulsive sounds[5] from NMFS' technical guidance (National Marine Fisheries Service 2016). Impulsive sources are not listed since no impulsive sources would be used during Arctic Shield 2017. In addition, Table 4-1 provides PTS onset auditory thresholds derived from TTS for non-impulsive sounds, utilizing NMFS' technical guidance (National Marine Fisheries Service 2016).

Table 4-2. Onset of PTS and TTS Thresholds for Marine Mammals for Underwater Non-Impulsive Sounds

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

[1] Determined from minimum value of exposure function and the weighting function at its peak
[2] The SEL_{cum} metric accounts for the accumulated exposure (i.e., SEL_{cum} 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 2016)

The source level associated with the echosounder is not expected to cause any injury to mysticetes, odontocetes, pinnipeds, or otariids and polar bears that may be within the proposed action area because any received levels would be below onset of TTS and PTS for each hearing group (see Chapter 9Appendix A). 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 (Table 2-1) associated with the Proposed Action would not be expected to cause any non-auditory physiological effects or injuries to mysticetes, odontocetes, pinnipeds, or carnivores that may be within the proposed action area. In addition, SOPs and BMPs, which are detailed in Chapter 6, would minimize the impact or harm 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.

The echosounder's system operates in a wide range of frequencies (between 50 and 200 kHz). Although there is a lack of audiometry data, based on anatomical studies and analysis of sounds that they produce,

[5] Definition of Non-impulsive: produce sounds that can be broadband, narrowband or tonal, brief or prolonged, continuous or intermittent) and typically do not have a high peak sound pressure with rapid rise/decay time that impulsive sounds do (American National Standards Institute (ANSI) 2001; National Institute for Occupational Safety and Health (NIOSH) 1998).

most baleen whales hear best at low frequencies, from seven Hz to 35 kHz (National Marine Fisheries Service 2016; Southall et al. 2007). Watkins (Watkins 1986) stated that humpback whales often react to frequencies from 15 Hz to 28 kHz, 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 frequencies above 36 kHz (Watkins 1986). Therefore, mysticetes are unlikely to detect or react to any frequency used by echosounders. Similarly, sea lions and fur seals 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 echosounders.

Most phocids can hear frequencies between 50 Hz and 86 kHz (National Marine Fisheries Service 2016; 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 a bearded or ringed seal could detect or react to an echosounder if it was swimming within or near the echosounder's 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 actually 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 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 2-1). Beluga whales have been found to have quite sensitive hearing, 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). 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). The sperm whale is the only ESA-listed odontocete that may be present in open ocean areas of the proposed action area. However, the northern most boundary of the sperm whale's range is near the Pribilof Islands, which are at the southernmost extent of the Arctic Shield 2017 proposed action area; therefore, the likelihood that ESA-listed sperm whales would be observed within the proposed action area is low. 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 fishfinder 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 and BMPs (Chapter 6) to minimize the impact or harm 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. However, 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 and BMPs in Chapter 6, vessel crew 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 marine mammal locations, avoiding sudden changes in speed and direction, or, if a swimming marine mammal is spotted, attempting to parallel the course and speed of the moving animal so as to avoid crossing its path, and avoiding approaching sighted marine mammals head-on or directly from behind. Coast Guard vessels will 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 will minimize the impact or harm 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.

In accordance with the ESA, the acoustic transmissions in the Proposed Action may affect, but are not likely to adversely affect ESA-listed marine mammals, including the bowhead whale, fin whale, gray whale, humpback whale, North Pacific right whale, sperm whale, bearded seal, ringed seal, Steller sea lion, polar bear, or candidate species Pacific walrus. The Proposed Action is not expected to result in the destruction or adverse modification of federally-designated critical habitat of the North Pacific Right whale, Steller sea lion, polar bear, or the proposed critical habitat of the ringed seal. In accordance with NEPA, acoustic transmissions from the Proposed Action are not likely to significantly impact marine mammals. In accordance with E.O. 12114, acoustic transmissions from the Proposed Action are not likely to significantly harm marine mammals.

4.1.1.5 Socioeconomic Resources

Sections 4.1.1.1 through 4.1.1.4 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.

4.1.2 **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 impact or harm 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; National Research Council 2003; 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 area include 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 (see Table 2-1). 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 (National Research Council 2003). Other vessels may be found widely distributed outside of ports and shipping lanes. These include military craft in fleet exercises, fishing vessels, single vessels, and recreational craft. The vessels participating in the Proposed Action may be in the proposed action area at any given time for any given amount of time and would overlap spatially and temporally with the other vessels described above.

Vessel operations could create a zone of masking in the water for marine species. The zone of masking is the area in which noise may interfere with the detection of other sounds, including communication calls, prey sounds, and other environmental sounds. The potential impact or harm from vessel noise from auditory masking (a sound that interferes with the audibility of another sound) is missing biologically relevant sounds (vocalizations or sounds of prey or predators) that marine organisms may rely on, as well as eliciting behavioral reactions such as an alert, avoidance, or other behavioral reaction (National Research Council 2003, 2005; Williams et al. 2015). The impact or harm 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) (National Research Council 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 (National Research Council 2003, 2005).

The potential impact or harm of vessel noise is analyzed below for invertebrates, marine birds, fish, EFH, marine mammals, and socioeconomic resources.

4.1.2.1 Invertebrates

As addressed in Section 3.2.1.4, hearing capabilities of invertebrates is not widely studied, although they are not expected to hear sources above 3 kHz (Lovell et al. 2005; Popper 2008). Impacts to invertebrates from vessel noise is relatively unknown, but it is likely that some species would be able to perceive the low frequency sources generated from the vessels (see Table 2-1) used during the Proposed Action, which could result in masking acoustic communication in invertebrates such as crustaceans (Staaterman et al. 2011). Masking of important acoustic cues used by invertebrates during larval orientation and settlement may lead to maladaptive behavior that could reduce successful recruitment (Simpson et al. 2011).

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 area, but are not expected to change current ambient sound levels. Vessel noise associated with the Proposed Action would be short-term and temporary as the vessel moves through an area; this short-term noise may affect invertebrates within the proposed action area via masking. Vessel noise is not expected to result in more than a temporary behavioral reaction of marine invertebrates in the vicinity of the vessel noise. It is expected that invertebrates would return to their normal behavior shortly after exposure. Vessel noise, if perceived by an invertebrate, would likely result in temporary behavioral reactions and would not result in any population level impact or harm.

Therefore, in accordance with NEPA, vessel noise associated with the Proposed Action would not result in significant impacts to invertebrates. In accordance with E.O. 12114, vessel noise associated with the Proposed Action would not result in significant harm to invertebrates. There are no ESA-listed invertebrates within the proposed action area.

4.1.2.2 Marine Birds

Auditory masking related to marine bird hearing would not impact or harm marine birds, as they spend a limited amount of time underwater and it is not thought that they use underwater sound related to their biologically relevant sounds. However, vessel noise could elicit short-term behavioral (startle response, swimming away, looking up) or physiological responses (increased heart rate), but are not likely to disrupt major behavior patterns, such as migrating, breeding, feeding, and sheltering, or to result in serious injury to any seabirds. Beason (2004) found that a wide range of acoustic sound devices (used for bird deterrence) varied in effectiveness. They were either ineffective at dispersing birds or caused the birds to flush. Those birds that did respond due to the deterrence device did return back to their original behavior within minutes of the disturbance. By comparison, vessel noise from the Proposed Action is not expected to be as high as the acoustic devices in this study. Therefore, the maximum behavioral impact or harm from vessel noise is expected to be temporary flushing.

Vessel noise associated with the Proposed Action may affect marine birds within the proposed action area; however, any responses would most likely be temporary behavioral reactions not resulting in population level impact or harm.

Therefore, in accordance with NEPA, vessel noise associated with the Proposed Action would not result in significant impacts to marine birds. In accordance with E.O. 12114, vessel noise associated with the Proposed Action would not result in significant harm to marine birds. Under the ESA, vessel noise 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, nor result in the destruction or adverse modification of federally-designated critical habitat. Pursuant to the MBTA, vessel noise associated with the Proposed Action would not result in a significant adverse effect on migratory bird populations.

4.1.2.3 Fish

Vessel noise has the potential to expose fish to both sound and general disturbance, which could result in short-term behavioral or physiological responses (e.g., avoidance, stress, increased heart rate). Noise from the vessels associated with the Proposed Action is not expected to impact or harm 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. 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 (United Nations Environment Programme 2012).

It is not anticipated that temporary behavioral reactions (e.g., temporary cessation of feeding) would impact 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). 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. Vessel noise associated with the Proposed Action may affect fish within the proposed action area; however, responses to vessel noise would be short-term and insignificant behavioral reactions.

Therefore, in accordance with NEPA, vessel noise associated with the Proposed Action would not result in significant impacts to fish. In accordance with E.O. 12114, vessel noise associated with the Proposed Action would not result in significant harm to fish. There are no ESA-listed fish within the proposed action area.

4.1.2.4 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.

Secondary effects to federally managed fish species (e.g., Arctic cod, coho salmon) are considered in Section 4.1.2.3 above.

Since the quality of the water column as EFH would only be impacted locally and temporarily, vessel noise associated with the Proposed Action would not result in adverse effects to EFH under the MSA. In accordance with NEPA, vessel noise associated with the Proposed Action would not result in significant impacts to EFH. In accordance with E.O. 12114, vessel noise would not result in significant harm to EFH.

4.1.2.5 Marine Mammals

Marine mammals within the proposed action area may be exposed to vessel noise produced by the high or medium endurance cutters, and a buoy tender that are expected to be used during Arctic Shield 2017. It is difficult to differentiate between behavioral responses to vessel sound and visual cues associated with the presence of a vessel; thus, it is assumed that both play a role in prompting reactions from animals. High levels of vessel traffic are known to elevate background levels of noise in the marine environment. Anthropogenic sources of sound in the proposed action area include 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. Underwater sound from vessels is generally at relatively low frequencies, usually between 5 and 500 Hz (Hildebrand 2009; National Research Council 2003; Urick 1983; Wenz 1962).

Vessel operations could create a zone of masking in the water for mysticetes, odontocetes, and pinnipeds. The zone of masking is the area in which noise may interfere with the detection of other sounds, including communication calls, prey or predator sounds, and other environmental sounds. The potential impact or harm from vessel noise is from auditory masking (sound that interferes with the audibility of another sound) of other biologically relevant sounds (vocalizations or sounds of prey or predators) that marine organisms may rely on, as well as eliciting behavioral reactions such as an alert, avoidance, or other behavioral reaction. 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.

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. 2003), 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. The Coast Guard would follow SOPs and BMPs described in Chapter 6 to minimize impact or harm to marine mammals.

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 actually 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.

Although North Pacific right whales have not been as extensively studied as North Atlantic right whales regarding the potential impact or harm of vessel noise, studies on North Atlantic right whales regarding vessel traffic may be applicable to North Pacific right whales (Hatch et al. 2008; Parks et al. 2007; Parks et al. 2011; Rolland et al. 2012; Vanderlaan et al. 2008). Impact or harm to right whales is expected to be minimized due to the Coast Guard’s SOPs and BMPs (Chapter 6); specifically, Coast Guard would avoid approaching sighted whales head-on, or from directly behind. Distance to all other whales would be no closer than 100 yards (91 m) for whales in general and 500 yards (457 m) for right whales. In the Bering Sea, a whale would be treated as a right whale unless the whale is positively identified as another whale species.

Humpback whales 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 62 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). 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.

Based on these studies of a number of species, mysticetes (such as bowhead, gray, and humpback 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.

In 1997, Henry and Hammill (2001) conducted a study to measure the impact or harm 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.

In 2004, 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 course of 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 pre-disturbance 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).

Polar bears do not appear to be significantly affected by vessel noise. Some polar bears have been observed walking, running, and swimming away from approaching vessels, but these reactions were brief and localized. Other bears have been observed approaching vessels or having no reaction to vessels (Richardson et al. 1995).

The received levels (see Chapter 9Appendix A) from sources and associated source levels (Table 2-1) for the Proposed Action are expected to be below the onset of TTS and PTS (Table 4-1) for all marine mammal groups, including mysticetes, odontocetes, pinnipeds, and otariids or polar bears, that may be within the proposed action area. Underwater noise from the Coast Guard ships participating in Arctic Shield 2017 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 otariids (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 impact or harm to marine mammals from masking is expected to be temporary due to the Coast Guard's SOPs and BMPs (Chapter 6). Odontocetes and pinnipeds are not expected to be impacted or harmed, as mysticetes may be, by the low-frequency noise produced by ships because the noise produced is outside of the typical hearing range for odontocetes and pinnipeds. In addition, the Coast Guard vessels would not purposefully approach marine mammals (Chapter 6) 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.

As described above, vessel noise associated with the Proposed Action would not result in reasonably foreseeable takes under the MMPA. In accordance with NEPA, vessel noise from the Proposed Action is not likely to significantly impact marine mammals. In accordance with E.O. 12114, vessel noise from the Proposed Action is not likely to significantly harm marine mammals. In accordance with the ESA, the vessel noise associated with the Proposed Action would have no effect on sperm whales, bearded seals, ringed seals, Steller sea lions, or polar bears. Vessel noise would have no effect on the ESA candidate species Pacific walrus. Vessel noise may affect, but is not likely to adversely affect the ESA-listed bowhead whale, fin whale, gray whale, humpback whale, and North Pacific right whale. Vessel noise would not result in the destruction or adverse modification of federally-designated critical habitat of the North Pacific right whale, Steller sea lion, polar bear, or the proposed critical habitat of the ringed seal.

4.1.2.6 Socioeconomic Resources

Sections 4.1.2.1 through 4.1.2.5 have determined that there is no impact to marine birds, fish, EFH, or marine mammals as a result of vessel noise associated with the Proposed Action. 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 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, vessel noise from the Proposed Action is not likely to significantly impact socioeconomic resources.

4.1.3 **Aircraft Noise**

Potential effects to species from aircraft could involve acoustic and non-acoustic effects (see Section 4.2.2 for a discussion on aircraft movement) 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. The noise associated with aircraft needs to be considered in multiple ways. Aircraft generate noise in flight, which propagates through the air. This sound can also interact with the ice surface and potentially propagate through ice into the water. Helicopters often produce a low-frequency beating sound from the rotors, and, are known to be audible underwater (Medwin et al. 1973; Richardson et al. 1995).

Transmission of sound from a moving airborne source to a receptor underwater is influenced by numerous factors and has been addressed by 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.

Airborne 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 (Figure 4-1). The intersection of this cone with the surface traces a “footprint” directly beneath the flight path, with the width of the footprint being a function of aircraft altitude. Sound may enter the water outside of this cone due to surface scattering and as evanescent waves, which travel laterally near the water surface.

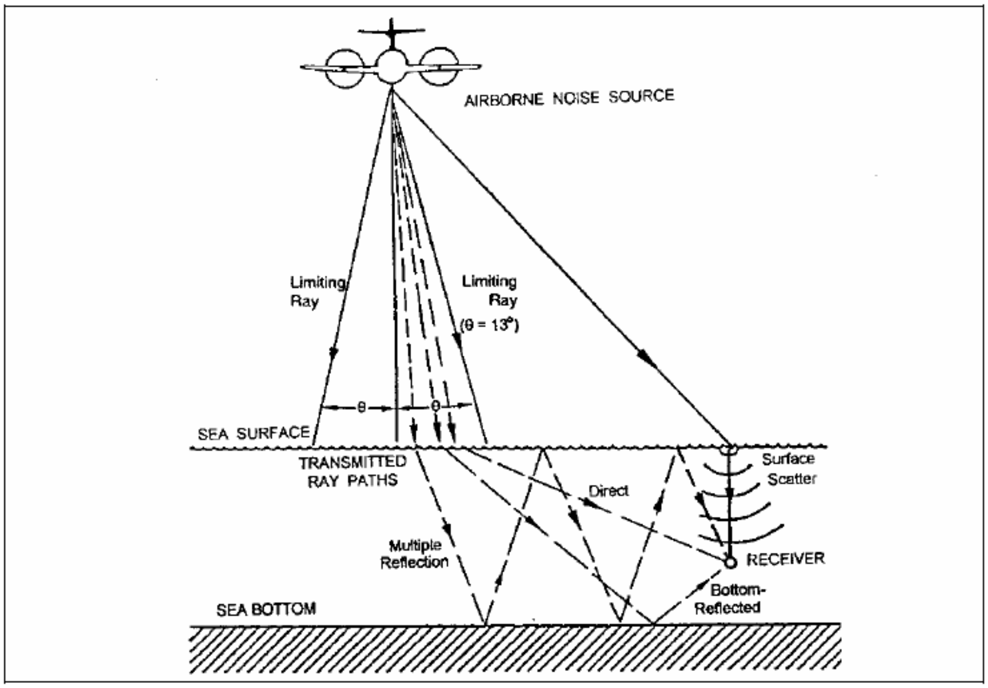

Figure 4-1. Characteristics of Sound Transmission through the Air-Water Interface
(Richardson et al. 1995)

The inhomogeneous nature of salt water 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).

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. According to Richardson et al. (1995) an MH-60 helicopter flying at 50 ft (15 m) produces an in-water maximum received level of 125 dB re 1µPa at a depth of 3.3 ft (1 m). In addition, the dominant tones in noise spectra from helicopters and fixed wing aircraft are typically below 500 Hz (Richardson et al. 1995). Sound generated by aircraft is analyzed for both in-air and in-water effects. Airborne sound levels are normally expressed in dB. The decibel value is given with reference to (“re”) the value and unit of the reference pressure. The standard reference pressures are 1 µPa for water and 20 µPa for air. It is important to note that because of the difference in reference units between air and water, the same absolute pressure would result in different decibel values for each medium. Because animals are not equally sensitive to sounds across their hearing range, weighting functions are used to emphasize ranges of best hearing and de-emphasize ranges of less or no sensitivity. In air, sound levels are frequently “A-weighted” and seen in units of dBA (A-weighted decibels), to account for sensitivity of the human ear to barely audible sounds. Many in-air sound measurements are A-weighted because the sounds levels are most frequently used to determine the potential noise impact or harm to humans. Helicopters often radiate more sound forward than aft. 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. If ice is present, 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, underwater noise would be generally brief in nature.

The MH-60 Jayhawk is an all-weather; medium-range helicopter (specialized for SAR). Normal cruising speed of the MH-60 is 135 to 140 knots (kn; 155 to 161 miles per hour [mph]; 249 to 259 kilometers per hour [km/hr]) and the aircraft is capable of reaching 180 kn (207 mph; 333 km/hr) for short durations. The MH-60 can fly at 140 kn (161 mph; 250 km.hr) for six to seven hours. It can range 700 nautical miles (nm; 1,300 kilometers [km]) with a service ceiling of 5,000 ft (1,520 m) hovering. 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).

Under the Preferred Alternative, no impact or harm to invertebrates, fish, or EFH is expected from aircraft noise as there is a lack of sufficient sound transmission across the air/water interface. The potential impact or harm of aircraft noise to marine birds, marine mammals, and socioeconomic resources is provided below.

4.1.3.1 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 aircrafts 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 Chapter 6) 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.

Noise associated with the MH-60 Jayhawk helicopter may elicit responses in individual birds potentially migrating through or molting and feeding in the proposed action area. However, pursuant to the MBTA, aircraft noise associated with the Proposed Action would not result in a significant adverse effect on migratory bird populations. In accordance with NEPA, aircraft noise associated with the Proposed Action would not result in significant impacts to marine birds. In accordance with E.O. 12114, aircraft noise associated with the Proposed Action would not result in significant harm to marine birds. Under the ESA, aircraft noise 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, nor will it result in the destruction or adverse modification of federally-designated critical habitat of the spectacled or Steller's eider.

4.1.3.2 Marine Mammals

Potential impact or harm to marine mammals from aircraft activity could involve both acoustic and non-acoustic effects and it is uncertain if reactions are due to the sound or physical presence of the aircraft flying overhead. Airborne sound from a low-flying helicopter may be heard by marine mammals while at the surface or underwater. In general, helicopters tend to be noisier than fixed wing aircraft of similar size, and underwater sounds from aircraft are strongest just below the surface and directly under the aircraft. Noise from aircraft would not be expected to cause direct physical effects but has the potential to affect behavior. The primary factor that may influence abrupt movements of animals is engine noise, specifically changes in engine noise. Responses by 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 impact or harm of aircraft overflight over pinniped haulout sites or rookeries, and many of those that exist are specific to military activities (Efroymson and Suter 2001). There are even fewer documented studies of the impact or harm of aircraft overflights to marine mammals at the water's surface.

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 cetaceans could include a decrease in swim speed, change in direction of travel, or a cessation of feeding or mating in response to broadcast sounds. Cetaceans 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 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 react to overflight aircrafts 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. 1985). 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. Patenaude 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 surfacings, immediate dives or turns, vigorous swimming, and breaching. Gray whale reactions to aircraft are variable and mothers with calves seem to be particularly sensitive (Clark 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 of time.

Pinnipeds, otariids, and polar bears, more so than cetaceans, have the potential to be disturbed by 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. 2005; Kastak et al. 2004). 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.

Behaviorally, reactions of hauled out pinnipeds to aircraft flying overhead have been noted, 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 (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). Walruses, for example, have very varied reactions to aircraft overflights from looking upward to diving underwater (Richardson et al. 1995). Spotted seals haul 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 conducted by Born et al. (1999) 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. 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 and Suter 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 will maintain an altitude of 1,500 ft (457 m) (Chapter 6). Aircraft will also stay at or above 3,000 ft (914 m) within a biologically sensitive area in order to avoid disturbances.

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 (U.S. Fish and Wildlife Service 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) (U.S. Fish and Wildlife Service 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 deliberately approach known areas where pinnipeds are expected, therefore, any impact or harm to pinnipeds as a result of proposed Arctic Shield 2017 activities is expected to be considerably less than the above mentioned case studies.

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 and Kelly 1982), aircraft disturbance was temporary and did not cause the animals to leave the general area. In addition, ringed seals may be hauled out on the ice or in the water, but are not expected to occupy subnivean lairs during Arctic Shield 2017.The Coast Guard also does not expect to land on the ice with a helicopter during Arctic Shield 2017. Therefore, Arctic Shield 2017 does not anticipate any effect to ringed seals in subnivean lairs during the Proposed Action.

Polar bears have been seen running away from helicopters at an altitude of less than 656 ft (200 m) or at a distance of less than 1312 ft (400 m) (Richardson et al. 1995). An aircraft approaching close to a polar bear den does not usually cause the polar bear to abandon the den since snow greatly attenuates aircraft noise (Amstrup 1993). It is unlikely that an individual would be exposed repeatedly for long periods of time due to the short duration of the aircraft flights during the Proposed Action, considering the vast size of the polar bear home range. Therefore, the likelihood of a bear being under the flight path for multiple flights would be low. In recent consultations to conduct marine mammal research within the proposed action area, U.S. Fish and Wildlife Service (2015) provided flight requirements (for aircraft not conducting mammal research) and restricted overflights to a minimum of 1,500 ft (457 m) above ground level. The flights for the MH-60 Jayhawk helicopter in the Proposed Action maintain overflights above 1,000 ft (305 m) unless conducting SAR or avoiding inclement weather. Any reactions to aircraft would be short-term, infrequent, and would not be expected to disrupt major behavior patterns such as migrating, breeding, feeding, and sheltering, or seriously injuring any polar bears.

As stated in the Coast Guard SOPs and BMPs Chapter 6, 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, by posting lookouts and training crew members that when a marine mammal is sighted to alert the bridge or pilot, so avoidance measures can be taken. Coast Guard aircraft will 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 will minimize the impact or harm of aircraft noise to marine mammals and federally-designated critical habitat. 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 will continue to post lookouts to sight marine mammals, although sighting conditions may be compromised due to the weather conditions and could alter a lookouts' ability to detect marine mammals. As long as navigational safety is not compromised, Coast Guard will follow SOPs and BMPs to avoid marine mammals. If an unexpected 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. Due to the temporary presence of Coast Guard assets in one area due to unplanned events caused by weather, the long term effect of proposed Arctic Shield 2017 activities on hauled out animals is expected to be insignificant because any response is expected to be temporary and there would be no impact or harm to breeding, feeding, migrating, or sheltering and thus, to the health and fitness of that individual(s).

As described above, aircraft noise associated with the Proposed Action would not result in reasonably foreseeable takes under the MMPA. In accordance with NEPA, aircraft noise from the Proposed Action is not likely to significantly impact marine mammals. In accordance with E.O. 12114, aircraft noise from the Proposed Action is not likely to significantly harm marine mammals. In accordance with the ESA, aircraft noise may affect, but is not likely to adversely affect the ESA-listed species in the proposed action area, including the bowhead whale, fin whale, gray whale, humpback whale, North Pacific right whale, sperm whale, bearded seal, ringed seal, Steller sea lion, polar bear, or candidate species Pacific walrus. The Proposed Action would not result in the destruction or adverse modification of federally-designed critical habitat for the North Pacific right whale, Steller sea lion, or the proposed ringed seal critical habitat.

4.1.3.3 Socioeconomic Resources

Sections 4.1.3.1 and 4.1.3.2 have determined that there is no impact to marine birds or marine mammals as a result of vessel noise associated with the Proposed Action. 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 regards 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 noise from the Proposed Action is not likely to significantly impact socioeconomic resources.

4.2 PHYSICAL STRESSORS

4.2.1 Vessel Movement

The vessels that would be utilized during the Proposed Action are high endurance or medium endurance cutters and a buoy tender. The operational speeds of these vessels vary, depending on the task and the situation. Vessels would not be operating at their maximum speeds unless involved in an emergency situation.

Vessels have the potential to impact or harm resources by altering their behavior patterns or causing mortality or serious injury from collisions. It is difficult to differentiate between behavioral responses to vessel sound and visual cues associated with the presence of a vessel; thus, it is assumed that both play a role in prompting reactions from animals. 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 1995).

The potential impact or harm of vessel movement on invertebrates, marine birds, fish, EFH, marine mammals, and socioeconomic resources are provided below.

4.2.1.1 Invertebrates

Vessels have the potential to impact or harm marine invertebrates either by disturbing the water column (Bishop 2008) or directly striking the organism. Vessel movement may result in short-term and localized disturbances to invertebrates, such as zooplankton and cephalopods, utilizing the upper water column. Propeller wash (water displaced by propellers used for propulsion) from vessel movement can potentially disturb marine invertebrates in the water column and are a likely cause of zooplankton mortality (Bickel et al. 2011). Since most of the macro invertebrates within the proposed action area are benthic and the Proposed Action takes place within the water column, potential for vessel strike of macro invertebrates is extremely low. No measurable effects on invertebrate populations in the water column would occur because the number of organisms exposed to vessel movement would be low relative to total invertebrate biomass. Although some invertebrates could be disturbed or killed by vessel strike, population level effects are not anticipated.

Therefore, in accordance with NEPA, vessel movement associated with the Proposed Action would not result in significant impacts to invertebrates. In accordance with E.O. 12114, vessel movement associated with the Proposed Action would not result in significant harm to invertebrates. There are no ESA-listed invertebrates within the proposed action area.

4.2.1.2 Marine Birds

Marine birds are visually oriented species and, as such, the majority of bird-vessel collisions occur at night when birds become disoriented in the presence of artificial lights from vessels (Glass and Ryan 2013; Huntington et al. 2015; Merkel 2010; Ryan 1991). Bird attraction to light can result in birds circling the light source for a period of time before getting their bearings, birds landing on vessels that generate the light source and remain until the lights are turned off, or birds flying headlong into the vessel's superstructure and are killed upon impact (Ryan 1991).

The probability of a bird colliding with a vessel increases at night and in situations of poor visibility such as snow, rain, or fog (Glass and Ryan 2013; Huntington et al. 2015; Merkel 2010; Ryan 1991). Merkel (2010 conducted a study from October through March of 2006 and 2008 in the offshore waters of southwestern Greenland. Merkel (2010) found that most (93 percent) bird-vessel strikes occurred less than 2 nautical miles (nm) from shore; all bird strikes occurred between 4:00 pm and 5:00 am and significantly more birds were killed when visibility was poor rather than moderate or good. Also, species that fly just over the water's surface at high speeds, such as eiders, petrels, and shearwaters, appear to be more susceptible to vessel strike than slower, higher flying species (Glass and Ryan 2013; Merkel 2010; Ryan 1991).

The Proposed Action would involve vessels moving at speeds of less than 30 kn. Since the Proposed Action would involve slow moving vessels, and marine birds in the area can travel at speeds between 31 and 43 kn (36 and 49 mph; 57and 80 km/hr) (Benvenuti et al. 1998; Croll et al. 1991; Day et al. 2004; Ewins 1986; Mallory et al. 2008), it is likely that marine birds would usually see and avoid the vessels. Coast Guard vessels would follow SOPs and BMPs (as outlined in Chapter 6) to minimize the impact or harm of the Proposed Action. The vessels would not use extraneous lighting during twilight hours reducing the likelihood of attracting marine birds. Additionally, 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.

Pursuant to the MBTA, vessel movement associated with the Proposed Action would not result in a significant adverse effect on migratory bird populations. In accordance with NEPA, vessel movement associated with the Proposed Action would not result in significant impacts to marine birds. In accordance with E.O. 12114, vessel movement associated with the Proposed Action would not result in significant harm to marine birds. Under the ESA, vessel movement 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 of the spectacled or Steller's eider.

4.2.1.3 Fish

Fish species within the proposed action area are distributed throughout the surface, water column, and seafloor. The potential for fish to be struck by a vessel associated with the Proposed Action would be extremely low, because most fish can detect and avoid vessel and in-water device movements. As a vessel approaches a fish, they could have a detectable behavioral or physiological response (e.g., swimming away and increased heart rate) as the passing vessel displaces them. Potential impact or harm from exposure to vessels is not expected to result in substantial changes to an individual's behavior, or population fitness and recruitment, and are not expected to result in any impact or harm at the population-level. Any isolated cases of vessels striking an individual could injure that individual, altering its fitness, but not to the extent that there would be impact or harm to the viability of populations.

The use of vessels may result in short-term and local displacement of fishes in the water column. However, these behavioral reactions are not expected to result in substantial changes to an individual's fitness, or population recruitment, and are not expected to result in any effects at the population-level. Isolated cases of vessel strike would potentially injure or result in the mortality of individuals, but would not result in population-level effects.

Therefore, in accordance with NEPA, vessel movement associated with the Proposed Action would not result in significant impacts to fish. In accordance with E.O. 12114, vessel movement associated with the Proposed Action would not result in significant harm to fish. There are no ESA-listed fish within the proposed action area.

4.2.1.4 Essential Fish Habitat

Vessel movement could impact or harm EFH due to the temporary reduction in the quality of the physical habitat due to the risk of strike to juvenile and larval forms of fish and shellfish. In general, vessel movement is diffuse and spread throughout the proposed action area. It is expected that vessels associated with the Proposed Action, similar to other ships in the area, would also contribute to the temporary decreased quality of physical habitat in the proposed action area, but are not expected to change current habitat quality overall. Regulations and restrictions put in place to protect the EFH primarily involve bottom habitat, which will not be disturbed as a result of surface vessels moving throughout the proposed action area or by any other part of the Proposed Action. The potential reduction in the quality of the physical habitat for EFH 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. Secondary effects to federally managed fish species (e.g., Arctic cod, coho salmon) are considered in Section 4.2.1.3 above.

Since the quality of the water column as EFH would only be affected locally and temporarily, vessel movement associated with the Proposed Action would not result in adverse effects to EFH under the MSA. In accordance with NEPA, vessel movement associated with the Proposed Action would not result in significant impacts to EFH. In accordance with E.O. 12114, vessel movement would not result in significant harm to EFH.

4.2.1.5 Marine Mammals

Interactions between surface vessels and marine mammals have demonstrated that surface vessels represent a source of acute and chronic disturbance for marine mammals (Au et al. 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. 2003; Richter et al. 2008; 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). Another important variable is ship speed, as ship strikes are more likely at higher vessel speeds (Gende et al. 2011; Vanderlaan and Taggart 2007; Wiley et al. 2011). Marine mammals such as dolphins, porpoises, and pinnipeds do not appear to be as susceptible to vessel strikes, though the risk of a strike still exists for these species.

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.

Bowhead whales often begin avoiding vessels from more than 2.2 nm (4 km) away (Richardson 1995). Avoidance by this species usually entails altered headings, faster swimming speeds, and shorter amounts of time spent surfacing. Bowhead whales are more tolerant of vessels moving slowly or moving in directions other than towards them. In most studies, observers noted bowhead whales exhibiting avoidance within 1,640 ft (500 m) of vessels, though avoidance at further distances was not able to be judged by observers on vessels (Richardson 1995). Large delphinids have reactions to vessels ranging from avoidance to bow-riding. Sperm whales react to most vessels by changing course and diving to more shallow depths (Gaskin 1964; Reeves et al. 2002b). Polar bears do not appear to be significantly affected by vessel moment. Some polar bears have been observed walking, running, and swimming away from approaching vessels, but these reactions were brief and localized. Other bears have been observed approaching vessels or having no reaction to vessels (Richardson et al. 1995). Based on these studies, if a mammal were to encounter a vessel, any behavioral avoidance displayed is expected to be short-term and inconsequential. Vessel movement would not be 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.

The speed of the ship is an important factor in predicting the lethality of a strike. 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. Although the maximum speed of the vessels associated with the Proposed Action is 30 kn (35 mph; 56 km/hr) for the Coast Guard cutters and 35 kn (40 mph; 65 km/hr) for small boats, these vessels are expected to operate slower speeds during most of the Proposed Action. However, while slow speed does decrease the chance of a fatal collision, it will not eliminate the chance that a collision would result in fatal injury. Vanderlaan and Taggert (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.

The probability of a vessel encountering a marine mammal is expected to be low, which decreases the likelihood of vessels striking marine mammals. As stated in the Coast Guard SOPs and BMPs (Chapter 6), vessel crew 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 marine mammal locations, avoiding sudden changes in speed and direction, or, if a swimming marine mammal is spotted, attempting to parallel the course and speed of the moving animal so as to avoid crossing its path, and avoiding approaching sighted marine mammals head-on or directly from behind. Coast Guard vessels will 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 will minimize the impact or harm of vessel movement to marine mammals and federally-designated critical habitat. In addition, in the extremely unlikely event of a vessel strike with a marine mammal, the Coast Guard would immediately contact the NFMS Regional stranding coordinator and the NMFS Alaska Regional Office.

If a mammal were to encounter a vessel, any behavioral avoidance displayed is expected to be short-term and inconsequential. Vessel movement would not be 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. Direct vessel strikes could result in injury or mortality to marine mammals. However, vessel strikes are unlikely given lookouts in place and the speeds of the vessels in non-emergency situations.

As described above, vessel movement associated with the Proposed Action would not result in reasonably foreseeable takes under the MMPA. In accordance with NEPA, vessel movement from the Proposed Action is not likely to significantly impact marine mammals. In accordance with E.O. 12114, vessel movement from the Proposed Action is not likely to significantly harm marine mammals. In accordance with the ESA, vessel movement may affect, but is not likely to adversely affect the ESA-listed species in the proposed action area, including the bowhead whale, fin whale, gray whale, humpback whale, North Pacific right whale, sperm whale, bearded seal, ringed seal, Steller sea lion, polar bear, or candidate species Pacific walrus. The Proposed Action would not result in the destruction or adverse modification of federally-designated critical habitat for the North Pacific right whale, Steller sea lion, polar bear, or the proposed ringed seal critical habitat.

4.2.1.6 Socioeconomic Resources

Sections 4.2.1.1 through 4.2.1.5 have determined that there is no impact to invertebrates, marine birds, fish, EFH, or marine mammals as a result of vessel movement associated with the Proposed Action. 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 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, vessel movement from the Proposed Action is not likely to significantly impact socioeconomic resources.

4.2.2 Aircraft Movement

The aircraft utilized during the Proposed Action would be the MH-60 Jayhawk helicopter. 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. 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.

Marine birds and socioeconomic resources are the only resource that may be impacted or harmed by aircraft movement. The potential impact or harm to each is described below.

4.2.2.1 Marine Birds

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.

4.2.2.2 Socioeconomic Resources

Section 4.2.2.1 has determined that there is no impact to marine birds or marine mammals as a result of vessel noise associated with the Proposed Action. 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 regards 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 SCOPE OF CUMULATIVE IMPACTS ANALYSIS

The scope of the cumulative impacts analysis involves both the geographic extent of the effects (i.e., the proposed action area) and the time frame in which the effects could be expected to occur (i.e., mid-May to mid-November of 2017). Another factor influencing the scope of cumulative impacts analysis involves identifying other actions to consider. Beyond determining that the geographic scope and time frame for the actions interrelated to the Proposed Action, the analysis only considers other "reasonably foreseeable" actions. For the purposes of this analysis, public documents prepared by federal, state, and local government agencies form the primary sources of information regarding reasonably foreseeable actions.

PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE ACTIONS

This section focuses on past, present, and reasonably foreseeable future projects at and near the proposed action area outlined in Section 2.1. 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 2017 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 (Council on Environmental Quality 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.

In determining which projects to include in the cumulative impacts analysis, a preliminary determination was made regarding the past, present, or reasonably foreseeable future projects at or near the proposed action area. Specifically, using the first fundamental question included in Section 5.1, it was determined if a relationship exists such that the affected resource areas of the Proposed Action might interact with the affected resource area of a past, present, or reasonably foreseeable action. If no such potential relationship exists, the project was not carried forward into the cumulative impacts analysis. In accordance with CEQ guidance (Council on Environmental Quality 2005), projects included in this cumulative impacts analysis are listed in Table 5-1.

Table 5-1. Projects Included in the Cumulative Effects Analysis

Action	Agency	Level of NEPA/E.O. 12114 Analysis Completed
Arctic Crossroads 2008-2011	USCG	Categorical Exclusion
Arctic Shield 2012-2016	USCG	Environmental Assessment
Outer Continental Shelf Leasing Programs	BOEM	Programmatic Environmental Impact Statement (PEIS) (2012, 2017)
Office of Naval Research Arctic Research	Navy	Environmental Assessment, in progress
Canada Basin Acoustic Propagation Experiment	Navy	Overseas Environmental Assessment (2015, 2016)
Liberty Project	BOEM	EIS in process
Pipeline Projects (Alaska Liquified Natural Gas; Donlin Gold, LLC)	Bureau of Land Management	Future
Arctic Shield	USCG	Future (PEA in process for 2018-2022)
USCG Polar Icebreaker	USCG	Future

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) (U.S. Department of the Interior 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 (Bureau of Ocean Energy Management 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 2017 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 (United States Arctic Research Commision 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 the sea ice in the region. As discussed in Section 3.1, 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 2017 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 2017 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 STANDARD OPERATING PROCEDURES AND BEST MANAGEMENT PRACTICES

6.1 COAST GUARD GUIDANCE

The following Coast Guard directives have been promulgated by the Commandant of the Coast Guard or District 17 (D17) Commander for the purpose of ensuring that actions carried out by Coast Guard vessels and aircraft are not likely to jeopardize the continued existence of, 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 Marine Protected Species Program for the Gulf of Alaska**,** Bering Sea/Aleutian Islands, and Arctic (Coast Guard District 17 Instruction [CGD17INST] 16214.2A) (U.S. Coast Guard 2011) - CGD17INST 16214.2A outlines procedures for avoiding marine mammals and protected species; reporting whale and protected species sightings, strandings, and injuries; and enforcing the MMPA and ESA.
- Vessel Environmental Manual (Command Instruction [COMDTINST] M16455.1):
    - Chapter 11 of the Vessel Environmental Manual 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 step-wise 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.
- Coast Guard Air Operations Manual (COMDTINST M3710.1G) – The Air Operations Manual prescribes measures for protection of wildlife applicable to all Coast Guard air assets. In accordance with this instruction, Commanding officers shall implement SOPs to prevent unnecessary over-flight of sensitive environmental habitat areas, to include, but not be limited to,

critical habitat designated under the ESA, migratory bird sanctuaries, and marine mammal haulouts 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 ft 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.

- Coast Guard Approach, Vessel Speed and Strike Response Guidance (COMPACAREA R142308Z DEC 11) – This guidance prescribes that vessel operators shall use caution, be alert, maintain a vigilant lookout and reduce speeds, as appropriate, to avoid collisions with whales during the course of normal operations. Appropriate reduced speeds should be based on specific factors (see rule 6 [safe speed] of the international/inland navigation rules). During routine operations, when whales are sighted or known to be in the immediate vicinity, operators are required to employ all possible precautions to avoid interactions or collisions with whales, including the following:

  - Reducing 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 from directly behind. Distance to all other whales is no closer than 100 yards and 500 yards for right whales. In the Bering Sea, a whale should be treated as a right whale unless the whale is positively identified as another whale species.

- Maritime Law Enforcement Manual (COMDTINST 16247.1) – In accordance with this manual, 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 or known to be in the vicinity or within five nautical miles of the vessel.
- Protected Living Marine Resources Program (COMDTINST 16475.7) – This instruction outlines Coast Guard actions, during Coast Guard operations, to support the recovery of protected living marine resources through internal compliance with and enforcement of Federal, State, and international laws designed to preserve marine protected species.

6.2 Best Management Practices

BMPs and 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 Arctic Shield 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, 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 M16247.1 in Section A.1).
- 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 haulout 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.
- 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 will 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. 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.

CHAPTER 7 CONCLUSIONS

The Proposed Action is to conduct increased operations and training exercises in the Arctic in summer of 2017 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 (U.S. Coast Guard 2013b) 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, including 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 there would be no significant impact or harm to the physical, biological, or socioeconomic environment, including marine vegetation, invertebrates, marine birds, fish, EFH, marine mammals, and socioeconomic resources.

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

CHAPTER 8 PREPARERS OF THE DOCUMENT

Table 8-1. List of Document Preparers

Name	Organization	Qualifications
Monica DeAngelis	U.S. Navy	M.S. in Biology; 22 years marine mammal research; 16 years environmental planning experience.
Jason Krumholz	McLaughlin Research Corporation	Ph.D. in Oceanography; 13 years research experience; 2 years environmental planning experience
Tara Moll	U.S. Navy	M.S. in Biological Sciences; 14 years environmental research; 11 years environmental planning experience.
Erin Roach	McLaughlin Research Corporation	B.S. in Marine Biology; 3 years environmental research experience; 5 years environmental planning experience.
Phil Thorson	McLaughlin Research Corporation	Ph.D. in Biology; 30 years environmental research experience; 20 years environmental planning experience.
Mark Ridgway	U.S. Coast Guard	22 years environmental planning experience; USCG Department of Homeland Security Interim NEPA Warrant holder

CHAPTER 9 AGENCIES CONSULTED

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

Table 9-1. List of Persons and Agencies Consulted

Name	Agency
Kathryn Ott	USFWS
Jordan Carduner	NMFS
Sadie Wright	NMFS
Alicia Bishop	NMFS

CHAPTER 10 REFERENCES

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APPENDIX A

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

RL=SL-TL

where RL is the received level in dB re 1 μPa; and SL is the source level (which depends on transmission angle), expressed in re 1 μPa at 1 m. TL is the transmission loss in dB as:

TL= 20log (R/1 m) + α R

where R is the oblique sonar-receiver range, and α the absorption coefficient in water in dB/m. Table 5 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 + 10log (T_T) = SL-TL + 10 log (T_T)

where T_T is 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, the T_T = 600/10 * 0.01= 0.6 s.

At a range of 1 km, the SEL = 205-20log (1000)-14.9+10log (0.6) = 127.9 dB re 1 μPa ^{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 B

Letter of Concurrence from USFWS