UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Alaska Fisheries Science Center
7600 Sand Point Way N.E.
Seattle, Washington 98115-6349

February 14, 2024

Dear Recipient:

In accordance with provisions of the National Environmental Policy Act (NEPA), we announce the availability for review of the **Draft Supplemental Programmatic Environmental Assessment (SPEA) for Fisheries Research Conducted and Funded by the Alaska Fisheries Science Center**.

The proposed action is fisheries and ecosystem research conducted and funded by the Alaska Fisheries Science Center (AFSC) in the North Pacific Ocean and in waters off of Alaska. The purpose of AFSC fisheries and ecosystem research is to produce scientific information necessary for the management and conservation of living marine resources in the NMFS Alaska Region. AFSC's research is needed to promote both the long-term sustainability of the resource and the recovery of certain species, while generating social and economic opportunities and benefits from their use.

The document is accessible electronically through the following website at **fisheries.noaa.gov**. Hard copies of the document may be obtained from the comment coordinator, Rebecca Reuter, at the contact information provided below.

Written comments may be submitted to the NOAA's National Marine Fisheries Service via electronic mail or physical mail to the comment coordinator during the public comment period (the closing date for the public comment period is noted at the above website). When submitting comments, please include the identifier "**Public Comment: Draft AFSC Supplemental Environmental Assessment 2024**" in the subject line.

Comment Coordinator: **Rebecca Reuter**
Environmental Compliance Specialist
Alaska Fisheries Science Center
NOAA Western Regional Center
7600 Sand Point Way NE
Seattle WA 98115
FAX: (206) 526-4118
nmfs.afsc.spea@noaa.gov

Thank you in advance for your input and assistance in finalizing the AFSC SPEA.

Sincerely,

Robert Foy, Ph.D.
Science and Research Director
Alaska Fisheries Science Center

DRAFT

SUPPLEMENTAL PROGRAMMATIC ENVIRONMENTAL ASSESSMENT for FISHERIES RESEARCH CONDUCTED AND FUNDED by the ALASKA FISHERIES SCIENCE CENTER and the INTERNATIONAL PACIFIC HALIBUT COMMISSION

March 2024

Prepared For:
National Marine Fisheries Service

Prepared by:

ECO49 Consulting LLC
907-903-9714
www.ECO49.com

This page intentionally left blank.

TABLE OF CONTENTS

List of Tables

List of Figures

List of Appendices

ACRONYMS AND ABBREVIATIONS

ABL	Auke Bay Laboratory
ADF&G	Alaska Department of Fish and Game
AFSC	Alaska Fisheries Science Center
ANCSA	Alaska Native Claims Settlement Act
ARO	NMFS Alaska Regional Office
AUV	Autonomous Underwater Vehicle
BiOp	Biological Opinion
BSAIRA	Bering Sea/Aleutian Islands Research Area
CA/OR/WA	California/Oregon/Washington
CCBSP	Convention on the Conservation and Management of Pollock Resources in the Central Bering Sea
Centers	Fisheries Science Centers
CDQ	Community Development Quota
CFR	Code of Federal Regulations
cm	centimeter
CPUE	catch per unit effort
CS	Chief Scientist
CSBSRA	Chukchi Sea/Beaufort Sea Research Area
CTD	Conductivity, Temperature, and Depth
D	Depleted under the MMPA
DAS	days at sea
dB	decibels
dB re 1 µPa at 1 m	decibels referenced at 1 microPascal at 1 meter
DPS	Distinct Population Segment
E	Endangered under the ESA
EBS	Eastern Bering Sea
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
ENP	Eastern North Pacific
EO	Executive Order
ESA	Endangered Species Act
ESU	Evolutionary Significant Unit
EVOS	Exxon Valdez Oil Spill
FAA	Federal Aviation Administration
FISS	IPHC Fishery Independent Setline Survey
fm	fathom
FMA	Fisheries Monitoring and Analysis Division
FMP	Fishery Management Plan
FONSI	Finding of No Significant Impact
FR	Federal Register

FSV	Fisheries Survey Vessel
ft	feet
GOA	Gulf of Alaska
GOARA	Gulf of Alaska Research Area
HAPC	Habitat Areas of Particular Concern
HMS	Highly Migratory Species
hr	hour
HSUS	Humane Society of the U.S.
Hz	hertz
in.	inch
IPHC	International Pacific Halibut Commission
kg	kilogram
kHz	kilohertz
km	kilometers
km^2	square kilometers
kts	knots
LOA	Letter of Authorization
LOF	List of Fisheries
m	meters
µm	micron
µPa	microPascal
MBTA	Migratory Bird Treaty Act
min	minutes
mm	millimeter
MMPA	Marine Mammal Protection Act
MML	Marine Mammal Laboratory
MMVM	Marine Mammal Visual Monitor
MPA	Marine Protected Area
MSA	Magnuson-Stevens Fishery Conservation and Management Act
M/SI	Mortality/Serious Injury
mt	metric tons
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
nm	nautical mile
NMFS	National Marine Fisheries Service
NMS	National Marine Sanctuary
NMSA	National Marine Sanctuaries Act
NOAA	National Oceanic and Atmospheric Administration
NPFMC	North Pacific Fishery Management Council
ONMS	Office of National Marine Sanctuaries
OOD	Officer on Deck
OR	Oregon
PBF	physical and biological features

PBR	Potential Biological Removal
PCE	Primary Constituent Element
PEA	Programmatic Environmental Assessment
PFMC	Pacific Fishery Management Council
PNW	Pacific Northwest
PSIT	Protected Species Incidental Take
PSO	Protected Species Observer
PTS	Permanent Threshold Shift
RACE	Resource Assessment and Conservation Engineering Division
REFM	Resource Ecology and Fisheries Management Division
RKC	Red King Crab
RFFAs	Reasonably Foreseeable Future Actions
rms	root mean square
ROV	Remotely Operated Vehicle
R/V	Research Vessel
§	Section(s)
SAR	Stock Assessment Report
SHPO	State Historic Preservation Offices
SIRCCA	Science-Industry Rockfish Research Collaboration in Alaska
SPEA	Supplemental Programmatic Environmental Assessment
SRKW	Southern Resident Killer Whales
SSWS	Sea Star Wasting Syndrome
TAC	Total Allowable Catch
TSMRI	Ted Stevens Marine Research Institute
TTS	Temporary Threshold Shift
UAS	Uncrewed Aerial systems
UME	Unusual Mortality Event
U.S.	United States
USFWS	U.S. Fish and Wildlife Service
USV	Uncrewed Surface Vehicles
UxS	Uncrewed System
WBAT	Wide-Band Autonomous Transceiver
WDC	Whale and Dolphin Conservation
WNP	Western North Pacific
Y-K Delta	Yukon-Kuskokwim Delta
yr	year

This Environmental Assessment (EA) is being prepared using the 2020 Council on Environmental Quality National Environmental Policy Act Regulations, as modified by the Phase I 2022 revisions. The effective date of the 2022 revisions was May 20, 2022 (87 Federal Register [FR] 23453); therefore, reviews begun after this date are required to apply the 2020 regulations as modified by the Phase I revisions, unless there is a clear and fundamental conflict with an applicable statute. The current Final Rule for Taking and Importing Marine Mammals; Taking Marine Mammals Incidental to AFSC [Alaska Fisheries Science Center] Fisheries Research (84 FR 46788) expires October 7, 2024. This Supplemental Programmatic Environmental Assessment (SPEA) was initiated in April of 2023 and was triggered by the need to request a new final rule for the period 2024-2029. This SPEA will also evaluate potential direct, indirect and cumulative effects of new research or changes in research since 2019 that were not analyzed in the 2019 *Final Programmatic Environmental Assessment (PEA) for Fisheries and Ecosystem Research Conducted and Funded by the Alaska Fisheries Science Center* (NMFS 2019c). This SPEA includes the latest available information on proposed research planned for the period 2024 – 2029 and tiers from the original 2019 PEA, and accordingly proceeds under the 2020 regulations, as modified by the Phase I revisions.

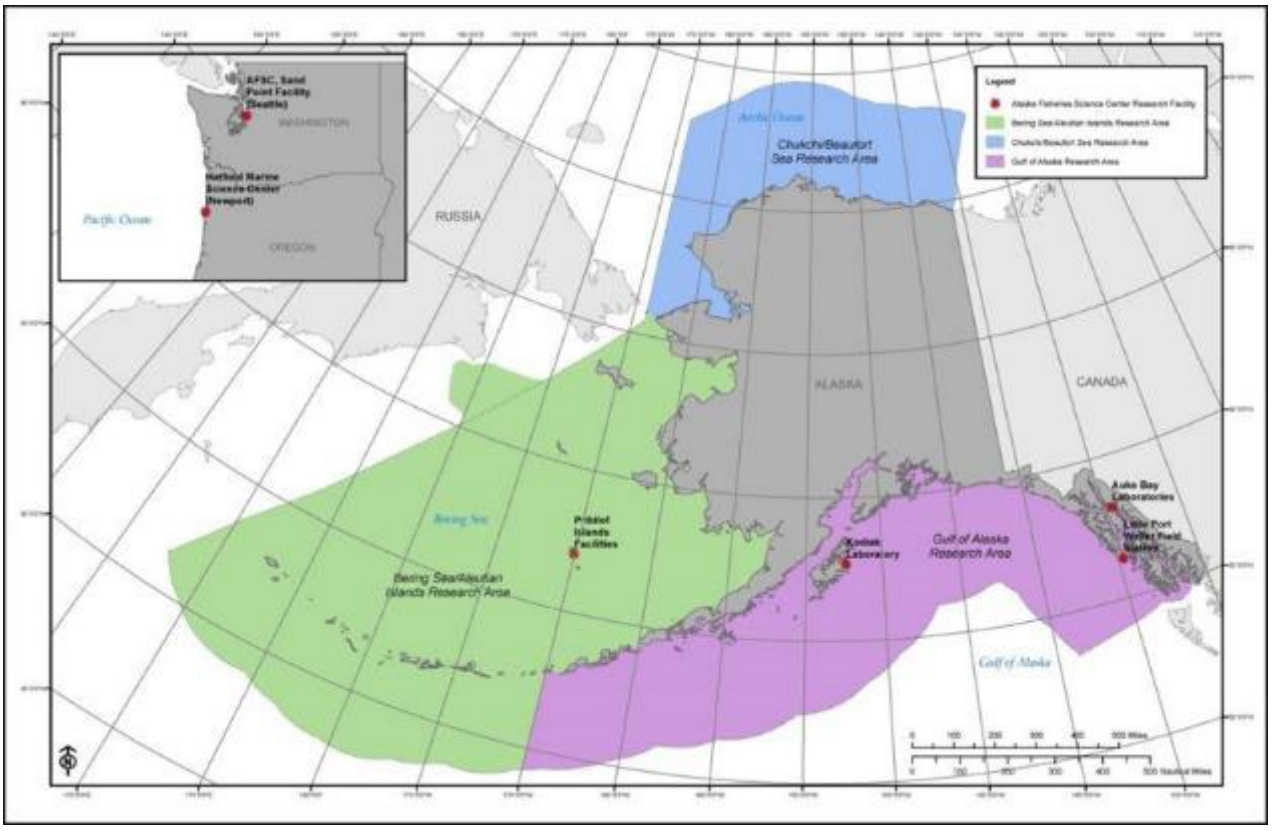
1 INTRODUCTION AND PURPOSE AND NEED

1.1 NOAA's Resource Responsibilities and Role in Fisheries Research

Congress has enacted several statutes authorizing federal agencies to manage and protect living marine resources. Under the Magnuson-Stevens Fishery Conservation and Management Act, the United States (U.S.) government has jurisdiction over the living marine resources in waters of the Exclusive Economic Zone (EEZ), from the seaward boundary of state jurisdiction to 200 nautical miles (nm) from the U.S. shoreline, and the National Oceanic and Atmospheric Administration (NOAA) is responsible for protecting marine finfish and shellfish species and their habitats. Within NOAA, the National Marine Fisheries Service (NMFS) is responsible for conducting science-based management, conservation, and protection of living marine resources.

The headquarters of the Alaska Fisheries Science Center (AFSC) is located at the Sand Point Facility in Seattle. AFSC also includes the Auke Bay Laboratories at the Ted Stevens Marine Research Institute at Lena Point, Little Port Walter Field Station, Kodiak Laboratory at the Kodiak Fisheries Research Center, Pribilof Islands Facilities, Dutch Harbor Field Office, Anchorage Field Office, and the Hatfield Marine Science Center in Newport, Oregon (Figure 1-1). AFSC is one of six Regional Fisheries Science Centers (Centers) that direct and coordinate the collection of scientific information required for resource protection and fisheries management.

Figure 1-1. AFSC Research Areas



Source: NMFS (2019c)

AFSC scientists conduct fishery-independent research using NOAA-owned and operated vessels or chartered vessels. AFSC research occurs primarily in U.S. marine waters of Alaska in three specific research areas: 1) Gulf of Alaska (GOA) Research Area (GOARA); 2) Bering Sea/Aleutian Islands Research Area (BSAIRA); and 3) Chukchi Sea/Beaufort Sea Research Area (CSBSRA) (see Figure 1-1).

AFSC contributes scientific data for fisheries and marine resource management issues to a variety of domestic management organizations and stakeholder groups, including: NMFS Alaska Regional Office; North Pacific Fishery Management Council (NPFMC), which has jurisdiction for developing fishery recommendations that cover non-treaty fisheries in the EEZ off Alaska; the State of Alaska; Alaskan coastal subsistence communities; U.S. representatives participating in international fishery and marine mammal negotiations; and the commercial fishing industry and its constituents. AFSC also coordinates fisheries and marine mammal research with other federal and state agencies, academic institutions, and foreign nations, and generates and communicates scientific information to support: recovery of protected species (marine mammals and species listed under the Endangered Species Act); establishment of Marine Protected Areas (MPAs); marine spatial planning; and understanding the impacts of climate change on marine ecosystems.

In addition to providing information for domestic fisheries management, AFSC provides scientific advice to support international fisheries councils, commissions, and conventions including: the Convention on the Conservation and Management of Pollock Resources in the Central Bering Sea; the Central Arctic Ocean Fisheries Agreement; the North Pacific Anadromous Fish Commission; the International Whaling Commission; and the International Pacific Halibut Commission (IPHC). Details regarding these international entities can be found in the 2019 *Final Programmatic Environmental Assessment (PEA) for Fisheries Research Conducted and Funded by the Alaska Fisheries Science Center* (see Section 1.2 for additional information on the PEA) (NMFS 2019c).

AFSC research efforts are divided among five research divisions. Additional details regarding these divisions and their specific missions can be found in Section 1.2 of the 2019 PEA (NMFS 2019c):

- Auke Bay Laboratories (ABL) conducts scientific research on fish stocks, fish habitats, and the chemistry of marine environments. The headquarters of ABL is the Ted Stevens Marine Research Institute located at Lena Point, north of Juneau, Alaska. The Institute serves as the hub for six other ABL facilities: three in Juneau at Auke Bay, Auke Creek, and downtown; one on Baranov Island southeast of Sitka; and two on the Pribilof Islands. ABL facilities include fresh and saltwater laboratories, genetics and biology laboratories, offices, dive and docking facilities, a permanent fish weir and hatchery, and boat repair and storage facilities.
- The Resource Assessment and Conservation Engineering Division (RACE) conducts fishery surveys to measure the distribution and abundance of approximately 40 commercially important fish and crab stocks. The Kodiak Laboratory in the Kodiak Fisheries Research Center is the primary facility for the RACE Shellfish Assessment Program and the division also includes the Fisheries Behavioral Ecology Program at the Hatfield Marine Science Center in Newport, Oregon.

- The Resource Ecology and Fisheries Management Division (REFM) conducts research and collects data to support an ecosystem approach to management of fish and crab resources in the GOARA, BSAIRA and CSBSRA. Division staff conduct research to support management recommendations of the NPFMC and the development of catch quotas implemented by the NMFS Alaska Regional Office. Division staff also are the primary liaison to the U.S. Fish and Wildlife Service (USFWS) regarding seabird bycatch during research activities.
- The Marine Mammal Laboratory (MML) conducts research on marine mammals, with particular attention to issues related to marine mammals off the coasts of Oregon, Washington and Alaska. Much of the research conducted by MML is covered under the Marine Mammal Protection Act (MMPA) section 101 directed research permits, as distinct from permits analyzed in this Supplemental PEA (SPEA), though research biologists from RACE and REFM work closely with MML in the field and on many issues.
- The Fisheries Monitoring and Analysis Division (FMA) monitors groundfish and halibut fishing activities, and conducts research associated with: sampling commercial fishery catches; estimating catch and bycatch mortality; and analyzing fishery-dependent data. The FMA is responsible for training and oversight of observers who collect catch data onboard fishing vessels and processing plants onshore, and for quality control/quality assurance of the data provided by these observers.

AFSC also coordinates fisheries management research with other federal and state agencies such as the U.S. Fish and Wildlife Service (USFWS), state of Alaska, academic institutions, and foreign nations. For example, the U.S. and Canada jointly manage Pacific halibut through the bilateral IPHC. The NMFS Regional Administrator for AKRO sits on the governing body of the IPHC. The IPHC conducts numerous biological and scientific experiments to further the understanding and information about Pacific halibut. Since IPHC research activities occur within the U.S. EEZ and contribute scientific data for understanding, managing, and conserving the region's living marine resources, AFSC is including IPHC activities in the suite of research activities considered in this SPEA.

1.2 Scope of the National Environmental Policy Act (NEPA) Analysis

AFSC previously analyzed the potential environmental effects of fisheries and ecosystem research and in August 2019 published a *Final Programmatic Environmental Assessment (PEA) for Fisheries Research Conducted and Funded by the Alaska Fisheries Science Center* (NMFS 2019c). The 2019 PEA, hereby incorporated by reference, was determined to be sufficient and a Finding of No Significant Impact (FONSI) was signed on March August 27, 2019. Concurrent with the 2019 PEA, AFSC applied to NMFS for regulations and a 5-year Letter of Authorization (LOA) for the incidental taking of marine mammals pursuant to Section 101(a)(5)(A) of the MMPA. NMFS published the final rule on September 5, 2019 (84 Federal Register [FR] 46788) and subsequently issued an LOA authorizing the Taking Marine Mammals Incidental to AFSC Fisheries Research.

The 2019 PEA (NMFS 2019c) provides baseline descriptions of the physical, biological and human environments and analyses of the potential consequences of alternative approaches to fisheries and ecosystem research. The 2019 PEA and final rule provide the analytical framework to evaluate future research activities. Thus, the intent of this SPEA is to evaluate potential direct, indirect and cumulative

effects of new research, or changes in research since 2019 (including discontinued research), that were not analyzed in the PEA. This SPEA includes the latest available information on proposed research planned for the period 2024 – 2029 and tiers from the original 2019 PEA to focus "*on the actual issues ripe for decision, and exclude from consideration issues already decided or not yet ripe*" (40 Code of Federal Regulations [CFR] 1501.11). Where necessary, updates to certain information on species abundance, stock status or other relevant components of the affected environment that may result in different conclusions from the 2019 PEA are presented herein.

This SPEA also provides a basis for compliance with other statutes including the MMPA, Endangered Species Act (ESA), National Marine Sanctuaries Act (NMSA), National Historic Preservation Act (NHPA), Coastal Zone Management Act, Executive Order (EO) 12114 for Environmental Justice, Migratory Bird Treaty Act (MBTA), and Essential Fish Habitat (EFH)/Magnuson-Stevens Fishery Conservation and Management Act (MSA), as well as to support consultation with native tribes within the action area (see Table 1-1). Records of consultations required for NMSA and State Historic Preservation Office (SHPO) during the 2019 effort are provided in the Final 2019 PEA and summarized in Table 1-1. New consultations or re-initiation of consultations required for this SPEA are also summarized in Table 1-1.

1.3 Purpose and Need

The federal action analyzed in this SPEA is the proposed new research and changes to the AFSC fisheries and ecosystem research (including IPHC research sponsored by AFSC). The purpose of AFSC fisheries and ecosystem research is to produce scientific information necessary for the management and conservation of living marine resources in the NMFS Alaska Region as shown in Figure 1-1. AFSC's research is needed to promote both the longterm sustainability of the resources and the recovery of threatened or endangered species, while generating social and economic opportunities and benefits from their use. Each of the research activities requires specific authorizations or permits including an authorization under the MMPA. The issuance of permits and the MMPA authorization are components of the federal action covered under this supplemental NEPA review.

Table 1-1. Compliance Actions For Applicable Laws, Regulations and Treaties

Law	Description	PEA Action Taken	Date	Follow-up Compliance Actions Concurrent with this SPEA
NEPA	Requires federal agencies to evaluate potential environmental effects of major planned federal action and promotes public awareness through disclosure.	1) Draft PEA 2) Final PEA 3) FONSI signed	1) 06/2016 2) 08/2019 3) 08/27/2019	1) Draft SPEA 2) 30-Day public comment period ends 3) Final SPEA 4) FONSI signed
MSA	Authorizes U.S. to manage fishery resources from the seaward boundary of state jurisdiction to 200 nm from shore. 10 national standards promote domestic commercial and recreational fishing under conservation and management principles. Requires preparation and implementation of Fishery Management Plans (FMPs) for stocks in need of conservation and management.	1) EFH Request for concurrence from NMFS Alaska Regional Office (ARO) 2) ARO concurred with determination of minimal and temporary effects to EFH. Consultation concluded	1) 11/30/2017 2) 12/19/2017	No additional or different effects on EFH. Mitigation measures continue to avoid and minimize effects on EFH; no further action required
MMPA	Prohibits take of marine mammals in U.S. waters, by U.S. citizens on the high seas, and the importation of marine mammals and products into the U.S. Allows request for "incidental," not intentional, taking of small numbers of marine mammals. Administered jointly by NMFS and USFWS.	1) Notice of Receipt of LOA application (81 FR 71709) 2) Final Rule Taking and Importing marine Mammals; Taking Marine Mammals Incidental to AFSC Fisheries Research published in Federal Register (84 FR 46788) 3) Final Rule takes effect	1) 10/18/2016 2) 09/05/2019 3) 10/07/2019	1) New LOA application submitted 2) Notice of Receipt 3) Proposed rule 4) Public comment period ends 5) Final rule 6) 30-day wait period 7) LOA issued

Law	Description	PEA Action Taken	Date	Follow-up Compliance Actions Concurrent with this SPEA
ESA	Provides for conservation and recovery of endangered and threatened species of fish, wildlife, and plants. Prohibits take of endangered species and some threatened species with some exceptions and exemptions. Administered jointly by NMFS and USFWS.	1) AFSC prepared Biological Assessment (BA) and initiated formal Section 7 consultation USFWS Endangered Species Branch 2) USFWS issued Letter of Concurrence (LOC) for AFSC's research 3) AFSC prepared BA and initiated formal Section 7 consultation with NMFS Alaska Region Protected Resources Division 4) USFWS issued Biological Opinion (BiOp) and Incidental Take Statement (ITS) 5) NMFS Alaska Region issued BiOp and ITS 6) AFSC submitted supplemental BA to USFWS for short-tailed albatross, Steller's and spectacled eiders 7) AFSC requested formal consultation from USFWS on short-tailed albatross, Steller's and spectacled eiders 8) AFSC reinitiated consultation with NMFS Alaska Region to address humpback and sperm whale takes and newly designated critical habitat for humpback whales, ringed seals and bearded seals 9) AFSC submitted BA to NMFS Alaska region on sperm and humpback whales, and ringed and bearded seals 10) USFWS completed BiOp on short-tailed albatross, Steller's and spectacled eiders, completing consultation 11) AFSC and NMFS Alaska Region agree to address humpback and sperm whales, and seal species as part of SPEA ESA process	1) 09/12/2017 2) 11/03/2017 3) 01/16/2018 4) 03/29/2018 5) 04/05/2019 6) 02/22/2022 7) 03/29/2022 8) 05/18/2022 9) 06/08/2022 10) 08/10/2022 11) 05/18/2023	1) Initiate informal Section 7 consultation with NMFS Alaska Region and USFWS. 2) BAs submitted to NMFS Alaska Region and USFWS to initiate formal consultation. 3) BiOps prepared by NMFS Alaska Region and USFWS; ITS issued.

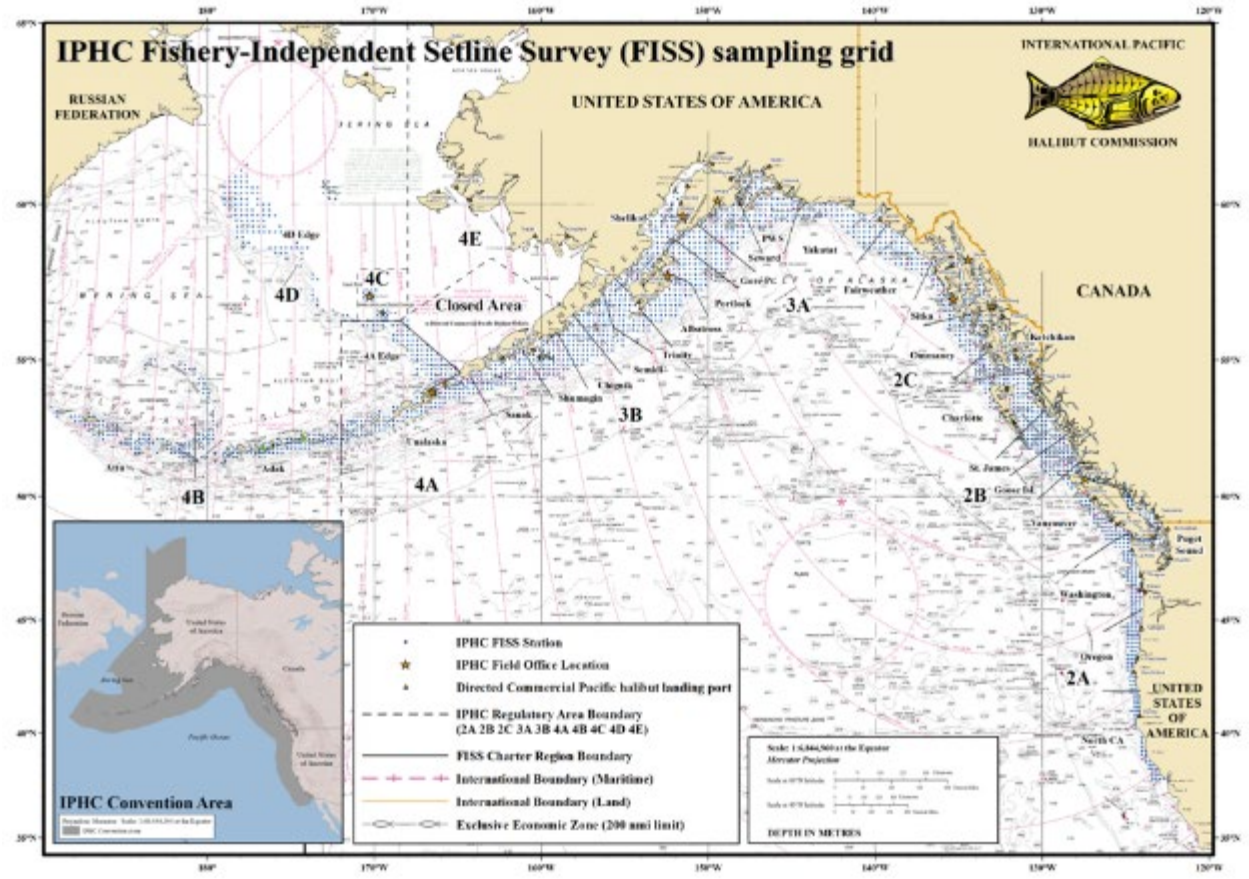
Law	Description	PEA Action Taken	Date	Follow-up Compliance Actions Concurrent with this SPEA
MBTA	Prohibits hunting, pursuing, wounding, killing, possessing, or transporting any migratory bird, nest, egg, or part thereof, unless permitted by regulations. In 2020, USFWS revised the list of birds protected under the MBTA (85 FR 21282).	1) Draft PEA to USFWS. No comments received 2) AFSC received USFWS permit # MB035470 to salvage migratory birds found dead (except ESA-listed species). Permit expires March 31, 2024	1) 06/2016 2) 04/01/2021	1) Draft SPEA provided to USFWS. 2) Migratory Bird Salvage Permit Renewed
Fish and Wildlife Coordination Act	Requires USFWS and NMFS to consult with other state and federal agencies to conserve fish and wildlife populations and habitats in cases where federal actions affect natural water bodies.	Draft PEA sent to relevant state fish and wildlife agencies. No comments received	06/2016	Draft SPEA sent to relevant state and federal agencies.
NMSA	Authorizes designation and protection of marine areas of special national significance as national marine sanctuaries. Section 304(d) requires interagency consultation between NOAA Office of National Marine Sanctuaries (ONMS) and federal action agencies that are "likely to destroy, cause the loss of, or injure a sanctuary resource." The St. George Unangan Heritage site in the Bering Sea was nominated as a National Marine Sanctuary (NMS) in 2017. In 2022 the ONMS determined that the nomination will remain in the inventory for an additional 5 years. The Alaĝum Kanuux̂ site in the Bering Sea was nominated as a NMS in 2021 and added to the inventory of successful nominations on June 8, 2022.	Consultation under NMSA not required; no Sanctuaries within research areas	N/A	N/A
NHPA	Section 106 requires review of any project funded, licensed, permitted, or assisted by the federal government for impact on significant historic properties.	1) Consultation with Alaska SHPO Initiated 2) SHPO concurred with a finding of no adverse effects for research. Consultation complete 3) AFSC confirms mitigation measures with SHPO	1) 01/29/201 2) 02/09/2018 3) 05/14/2018	1) Draft SPEA published 2) AFSC letter to SHPO to requesting concurrence the 2019 consultation is still valid as there are no changes in research resulting in changes to effects on historic or cultural resources

Law	Description	PEA Action Taken	Date	Follow-up Compliance Actions Concurrent with this SPEA
EO 13175, Government to Government Consultation	Requires federal departments and agencies to have an accountable process for meaningful and timely consultation with tribal officials from federally recognized Indian tribal governments when considering policies that would have tribal implications as defined under the EO. NOAA Policy 13175 establishes procedures for Government–to-Government to Consultation with federally recognized Indian tribes and Government-to-Corporation Consultation with Alaska Native corporations established under the Alaska Native Claims Settlement Act (ANCSA) of 1971.	1) AFSC sent letters to 200 potentially affected federally recognized tribal governments, regional and village Alaska Native ANCSA corporations, and Alaska Native co-management groups 2) Draft PEA and Draft NMFS LOA application provided to over 150 Alaskan Native representatives and entities. One comment received indicating a preferred alternative	1) 10/2013 2) 06/2016	1) Engagement with tribes re-initiated concurrent with SPEA 2) Communication Plan updated and transmitted to tribes
EO 12989, Environmental Justice	Directs federal agencies to identify and address disproportionately high and adverse effects of federal projects on the health or environment of minority and low-income populations to the greatest extent practicable and permitted by law.	Final PEA prepared in accordance with this EO	08/2019	Final SPEA prepared in accordance with this EO
EO 13158, Marine Protected Areas	Requires federal agencies whose actions affect the natural or cultural resources that are protected by an MPA to identify actions that protect and conserve MPAs.	Final PEA prepared in accordance with this EO	08/2019	Final SPEA prepared in accordance with this EO

1.4 Project Area

The Project Area is defined as the area within which all direct and indirect effects of AFSC and IPHC fisheries research may occur. As shown in Figure 1-1, AFSC conducts research in three areas in waters of the U.S. off of Alaska: GOARA; BSAIRA; and CSBSRA. In addition, Figure 1-2 shows IPHC research areas. Only a subset of IPHC stations shown in the figure are surveyed each year. The decision regarding which to sample in subsequent years is made in the fall of each year.

Figure 1-2. IPHC Research Areas



Source: IPHC 2023

1.5 Public Review and Comment

Federal agencies must involve agencies, applicants, and the public in the NEPA process (40 CFR §§ 1506.6, 1501.6(a)). To facilitate public comment, a Notice of Availability for the original Draft PEA and the associated LOA application were published in the Federal Register on August 10, 2016 (81 FR 52830) and October 18, 2016 (81 FR 71709), respectively. The Draft PEA evaluated four alternatives:

> (1) No-Action/Status Quo Alternative—Conduct Federal Fisheries and Ecosystem Research with Scope and Protocols Similar to Past Efforts

(2) Preferred Alternative—Conduct Federal Fisheries and Ecosystem Research (New Suite of Research) with Mitigation for MMPA and ESA Compliance

(3) Modified Research Alternative— Conduct Federal Fisheries and Ecosystem Research (New Suite of Research) with Additional Mitigation

(4) No Research Alternative—No Fieldwork for Federal Fisheries and Ecosystem Research Conducted or Funded by AFSC

In September 2016, AFSC received a comment letter from Ahtna Incorporated in support of Alternative 2 and a joint comment letter from the Humane Society of the U.S. (HSUS) and Whale and Dolphin Conservation (WDC). In October 2016, AFSC received joint comments from the HSUS/WDC on the LOA application. The October letter incorporated the same comments previously submitted during the public review period for the Draft PEA. The comments and AFSC's responses on the Draft PEA and initial LOA application are summarized in detail in Section 1.5 of the 2019 PEA (AFSC 2020a).

Subsequently, AFSC prepared and submitted a revised LOA application to include fisheries research conducted by IPHC. AFSC's revised LOA application was published on September 14, 2017 (82 FR 43223) but did not receive comments.

The proposed MMPA rule was published in the Federal Register on August 1, 2018 (83 FR 37638). During the public review period, NMFS received comments from the Marine Mammal Commission (Commission), the Ecological Sciences Communication Initiative and the public. All comments received in response to the publication of the Draft PEA, the initial AFSC LOA application and the proposed rulemaking were considered and used to inform the analysis in the Final PEA.

Public comments on this draft SPEA will be accepted and considered when preparing the Final SPEA. NMFS will make its decision concerning the Preferred Alternative for AFSC research and prepare the Final SPEA and decision document, which will conclude this NEPA process.

2 DESCRIPTION OF ALTERNATIVES

The 2019 Preferred Alternative (NMFS 2019c) established the framework for AFSC fisheries research since 2019 and is the basis for the Status Quo Alternative analyzed in this SPEA. Alternatives evaluated in this SPEA include the Status Quo/No Action Alternative (i.e., permitted research through October 2024) as Alternative 1 and the Preferred Alternative (Alternative 2), which represents deletions of certain studies, modifications to current research, or the addition of new research activities that are planned for the future (i.e., 2024 – 2029). Table 2-1 provides detailed information on existing and proposed surveys and changes to gear types moving forward, while Table 2-2 summarizes the Preferred Alternative as level of effort by gear type. Additional detailed descriptions of the 2019 Preferred Alternative (now analyzed as the Status Quo Alternative) are incorporated by reference from the 2019 PEA. Typical vessels and gear types used during AFSC surveys are also described in detail in the 2019 PEA and are included here as Appendix A (Description of Gear and Vessels). Appendix B provides information on the spatial and temporal distribution of the research effort. Section 2.3 describes and compares mitigation measures proposed under each alternative.

2.1 Status Quo Alternative

The Status Quo Alternative for this SPEA includes only fisheries research that is currently being conducted. Under this alternative, new permits issued in 2024 would replace the existing permits and mirror what was permitted as the Preferred Alternative as described in the 2019 PEA (NMFS 2019c). Research activities, equipment, gear, and sample sizes would not change from what was analyzed as the Preferred Alternative in 2019 for research conducted 2024 – 2029. Table 2-1 outlines details of the Status Quo Alternative (shown in plain text) (with the exception of discontinued studies shown below in Section 2.2).

2.2 Preferred Alternative (Future Research Beginning 2024)

The Preferred Alternative includes: (1) studies described in the Status Quo Alternative without the discontinued studies summarized in the bullets below; (2) additional studies, gear types and level of effort that were not previously analyzed in the 2019 PEA (NMFS 2019c). These additions or modifications to research are indicated in Table 2-1 by bold or italicized text as well as highlighted cells as defined in the table "Color key" above Table 2-1.

Table 2-2 presents research under the Preferred Alternative according to the main gear type used by specific research area. For example, the first rows of the table show how many studies will use hook and line gear such as longline or rod and reel, and in which research areas (i.e., BSAIRA or GOARA, etc.). In other words, Table 2-2 presents the Preferred Alternative as a "tally" of studies by gear type and area.

Discontinued Studies

- Acoustic Trawl Rockfish Study in the GOARA (59 Poly Nor'Eastern trawls, echosounders, and camera systems);
- Acoustic Assessment of Rockfish in Untrawlable Areas of the GOARA (6 Poly Nor'Eastern trawls and echosounders);

- Alaska Department of Fish and Game (ADF&G) Large-mesh trawl survey of GOA and Eastern AI (380 eastern otter trawls);
- ADF&G Small-mesh shrimp and forage fish survey in the GOARA (150 shrimp trawls);
- Arctic Coastal Ecosystem Surveys in the CSBSRA (24 plumb staff beam trawls plus beach seining and midwater trawls);
- Arctic Ecosystem Integrated Survey in the BSAI and CSBSRA (surface trawls, midwater trawls, bongo net tows, and echosounders);
- Atka Mackerel Tag Movement and Abundance in the Aleutian Islands (~90 tows per year using a Bering Sea combo bottom trawl);
- Barotrauma and Tagging of Deep Water Rockfish (seven longline sets);
- Gulf of Alaska Assessment (surface trawls and bongo nets);
- Gulf of Alaska Coral/Sponge Model Validation (camera systems);
- Cold Water Coral Recruitment (SCUBA/snorkeling);
- Crab Studies in Kodiak Island Area (20 beam trawl tows, pots, beach seines and SCUBA) ;
- Deep Water Groundfish Surveys (20 sets of bottom longline gear);
- Habitat, Blue King Crabs, and the Benthic Community: Comparisons within Space and Time (200 plumb staff beam trawls plus 200 rock dredge stations);
- Octopus Gear Trial and Maturity Study (pot gear);
- *Primnoa* Distribution, Recovery and Genetic Connectivity in the Gulf of Alaska (towed cameras and echosounders);
- Reproductive Ecology of Red Tree Coral (SCUBA);
- Response of Fish to Drop Camera Systems (cameras and echosounders);
- Rockfish Habitat Studies/Reproduction of Groundfish (8 commercial bottom trawl tows, bongo nets and cameras);
- Rockfish Reproduction Charters (8 commercial bottom trawl tows);
- Seasonal Distribution and Habitat Use of Managed Fish Species in Upper Cook Inlet, AK (3 small bottom trawl tows plus beach seines);
- St. John Baptist Bay Sablefish Ecology (Bongo nets and ring nets)
- Sun to Sea Camp (beach seines and ring nets);
- The Distribution and Habitat Association of Juvenile *Chionoecetes* Crabs (bottom sled with camera);
- Using Trawl Cameras instead of Bottom Trawls to Estimate Fish Abundance in the Gulf of Alaska and Aleutian Islands (40 Poly Nor'Eastern bottom trawls); and

- Yukon Delta Nearshore Surveys (50 push trawls, 50 midwater Kodiak trawls, pelagic nets and ring nets).

Studies with Reduced Effort 2024-2029

- Gulf of Alaska Shelf and Slope Groundfish Bottom Trawl Survey– trawls using the Poly Nor'Eastern would be reduced from 820 stations to 550 stations;
- Gulf of Alaska Ichthyoplankton Survey Spring – Bottom trawls with net sounders would no longer be conducted and bongo net tows would be reduced to 150 from 250;
- Eastern Bering Sea Groundfish Bottom Trawl Survey – DAS would be reduced to 75 from 130 but number of bottom trawls using the eastern otter trawl would remain the same;
- Fishing Technology Studies to Reduce Bycatch and Habitat Effects of Fishing – DAS would be reduced from 14 to 7 but total bottom trawls using various commercial gear would remain the same; and
- Eastern Bering Sea Ichthyoplankton Survey Spring – 150 Bongo net tows only reduced from – 50 bottom trawls, 50 mid-water trawls, 50 Bongo tows for larval pollock, 30 multiple-opening/closing net tows and 150 Neuston net tows.

Studies with Increased Effort 2024-2029

- Southeast Alaska Coastal Monitoring – Days at sea (DAS) increased to 12-28 from 1-7, no changes to gear or number of tows;
- Aleutian Islands Bottom Trawl Survey – Poly Nor'Eastern bottom trawls increased to 550 from 420; and
- GOA/ Eastern Bering Sea (EBS)/Aleutian Islands Longline Surveys – 90 stations/year (yr) (increased from 75), 160 sets rotated between GOA and BSAI.

Existing Studies with New Gear Planned for 2024-2029

- Northern Bering Sea Ecosystem Surface Trawl Survey – 50 beam trawl tows added; and
- Arctic Ecosystem Distributed Biological Observatory – 50 beam trawl tows added.

New Studies Planned for 2024-2029

- Alaska Red King Crab (RKC) Growth and Survival – 10 beam trawl tows conducted from a small boat;
- Kodiak Age-0/1 Pacific Cod Nursery Habitat – 64 beam trawl tows conducted from a small boat, 64 beach seine hauls, 40 baited camera sets and 75 seines;
- Gulf of Alaska Large-Scale Age-0/1 Pacific Cod Nursery Habitat – 100 beach seine hauls, 500 baited camera sets;
- Gulf of Alaska Coral Settlement Plate Recovery – 3 settlement plats deployed and retrieved with an uncrewed system (UxS);

- Alaska UxS Acoustic Survey GOARA, BSAIRA, and CSBSRA – UxS in conjunction with EK80 echosounders measure abundance and distribution of fish and plankton;
- Alaska Moored Echosounders GOARA, BSAIRA, and CSBSRA – Autonomous echosounders are mounted on seafloor to monitor fish and plankton abundance and behavior;
- Gulf of Alaska Exxon Valdez Oil Spill (EVOS) Benthic Survey – 60 SCUBA transects per year;
- Alaska Aquaculture Research – Scuba and hand nets and pens used to conduct research on *Clupea pallassii* (Pacific herring) and *Crassostrea giga* (Pacific oyster);
- Northern Bering Sea Effects of Trawling Study – 100 Poly Nor'Eastern tows and 200 grab samples to study bottom-trawling effects in the Northern Bering Sea;
- Northern Bering Sea Bottom Trawl Survey – 144 Poly Nor'Eastern tows;
- Northern Bering Sea Integrated Ecosystem Research Survey – 75 surface trawls using a Nordic 264, 75 beam trawls, 35 midwater trawls using an anchovy trawl or equivalent, and 75 Bongo net tows;
- Pacific Cod Tagging Bering Sea – 80 deployments of pot gear
- Alaska Collaborative Crab Tagging Survey – 10-800 pots deployed per survey;
- Bristol Bay Red King Crab Settlement Survey - 48 transects surveyed by SCUBA divers, deployment of 48 larval collection sacks and cameras; and
- IPHC Catch Protection Survey – 20 sets of snap longline gear in the GOARA.

New Studies Planned for 2024-2029 with Gear not Previously Used by AFSC or IPHC

- *Gulf of Alaska (Science-Industry Rockfish Research Collaboration in Alaska) SIRCCA Trawl Survey* – 50 bottom trawls using nephrops gear;
- Alaska Slinky Pot Research GOARA, BSAIRA, and CSBSRA – 1 set of 50-120 slinky pots per day for 14 days, 700-1,680 pots total. At present this study is only planned for 2024 with one set at each of three offshore locations between Yakutat and Cordova, Alaska (personal Communication AFSC November 2023). There are no specific plans to expand the study to additional days and other locations as of November 2023.
- IPHC has plans to conduct Catch Protection research that will look at using a catch protection shuttle system which slides down the longline while the gear is underwater to remove fish to avoid depredation. This research will not incur extra effort or be conducted in new area.

Table 2-1. Detailed Description of Research under the Status Quo Alternative (existing research) and Preferred Alternative (Future Research)

Color Key

Denotes research area GOARA, BSAIRA or CSBSRA	*Reduced effort 2024-2029*	***Increased effort 2024-2029***	***New research 2024-2029***	***New gear 2024-2029***

Study Name	Description	General Area of Operation	Days at Sea (DAS)	Season/ Frequency	Vessels Used	Gear Type	Gear Details	No. Tows/Samples
GOARA								
Studies Using Trawl Gear								
Fishing Technology Studies to Reduce Bycatch and Habitat Effects of Fishing	Develop and test modifications to fishing gear and methods to reduce incidental effects on habitat and non-target fish. Stages include: observation and analysis of fish behavior and gear performance with conventional gear, and design modifications and iterative observations to confirm design functions, and performance testing (bycatch reduction or reduced effect on habitat). Focus on observations with cameras and imaging sonar, while later stages use comparisons of catches under commercial fishing conditions.	GOA	7	All seasons Annual	Fishing vessels	Bottom trawl with net sounders	Net type: Various commercial bottom trawls Net size: Operating net width 18-24 m, height 4-8 m. Mesh size 8 in (forward sections) to 5.5-4 in (aft sections). Footropes large bobbins or disks (18-24 in diameter) with 18-48 in spacing between Tow speed: 3-3.5 knots (kts). Tow duration: Experimental tows – 0.75-6.5 hrs. Depth: 66-154 m Marport headrope and wing sounders, 40 kilohertz (kHz)	20–40/season
						Mid-water trawl	Net type: Various Commercial mid-water trawls Net size: Operating net width 75-136 m, height 10-20 m, with size highly dependent on vessel power. Very large meshes (128-64 m) forward tapering gradually to 4 in in aft sections Tow speed: 3-3.5 kts Tow duration: Experimental tows – 0.75-3 hrs Depth: 66-154 m	See above.
Western Gulf of Alaska Juvenile Fish Survey Fall	Critical to understanding how environmental variability and change affects abundance, distribution, and recruitment of commercially and ecologically important juvenile fishes. Assess abundance and condition of age-0 walleye pollock prior to the onset of the first winter. Ecosystem observations and physical and biological data collection.	GOA	35	Fall Biennial	NOAA Ship	Mid-water trawl	Net type: Anchovy trawl or equivalent Net size: 12 m x 12 m, 3 millimeter (mm) cod end liner Tow speed: 2-3 kts Tow duration: depth dependent, up to 1 hr Depth: oblique to bottom (<200 m)	50-75
						Beam trawl	Net type: beam trawl Net size: 1m x 1m, 3- mm mesh, 4 mm cod end liner Tow speed: 1-2 kts Tow duration: 10 minutes (min) Depth: 50-200 m	50-75
						Bongo net	Net type: Bongo tandem Net size: 0.6 m each ring (mesh 505 µm; 333 µm) Tow speed: 1 kts Tow duration: 15-45 min Depth: 1-200 m	200

Study Name	Description	General Area of Operation	Days at Sea (DAS)	Season/ Frequency	Vessels Used	Gear Type	Gear Details	No. Tows/Samples
EBS/GOA EcoFOCI Mooring Fall/spring	In collaboration with NOAA Research's Pacific Marine Environmental Laboratory. Recover and deploy surface and subsurface moorings along 70 m isobath annually in spring and fall. Collect oceanographic data on currents, temperature, salinity, and dissolved oxygen. Conduct net tows around moorings at the time of deployments to assess the zoo- and ichthyoplankton community. Conduct subset of Bongo net tows around "Unimak Box" to assess plankton community composition.	GOA	31	Fall, Spring Biennial	NOAA Ship Large Chartered Fishing Vessel	Bottom trawl with net sounders	Net type: Poly Nor'Eastern, Tow speed: 3-5 kts Tow duration: 20 min Depth: 150-700 m Marport headrope and wing sounders, 40 kHz	150
						Bongo net	Same as above	150
Alaska RKC Growth and Survival	***Examine survival and growth of red king crab juveniles; examine the effects of density on survival and growth; determine the effects of red king crab on the ecosystem and the effect of predators.***	***GOA***	***7***		***Small boat Skiff***	***Beam trawl***	***Net type: Polypropylene Beam trawl Net size: 2 m opening Tow speed:1.5 kts Tow duration: 3-5 min Depth:15m***	***10 (conducted previous to 2019)***
Gulf of Alaska Shelf and Slope Groundfish Bottom Trawl	Monitor trends in abundance and distribution of groundfish populations. Based on a stratified-random design and area-swept method to estimate abundance. Identify, weigh and count all living organisms, and take biological samples from key groundfish species or other species of interest. Catch data used to estimate relative abundance and determine overfishing level and acceptable biological catch, which informs the specification of total allowable catch (TAC).	GOA	75	Summer Biennial	Large Chartered Fishing Vessel	Bottom trawl	Net type: Poly Nor'Eastern high rise trawl Tow speed: 3 kts Tow duration: 15 min (1.4 kilometers [km] tow length) Depth: out to 1,000 m depth	*550 (reduced from 820 stations and 3 boats)*
Gulf of Alaska Biennial Walleye Pollock Acoustic Trawl Survey Summer	Estimate mid-water abundance and distribution of walleye pollock in GOA shelf. Collect acoustic data series of parallel transects with echosounder. Five split-beam transducers (18, 38, 70, 120, and 200 kHz) are mounted on vessel. Conduct trawl when sufficient echosign is encountered, to identify ensonified targets. Net sounders position trawl in water column and monitor catch. Collect physical oceanographic measurements throughout cruise.	GOA	60	Summer Biennial	NOAA Ship	Bottom trawl	Net type: Poly Nor'Eastern Tow speed: 3 kts Tow duration:10-20 min Depth: 50-600 m Marport headrope and wing sounders, 40 kHz	20
						Mid-water trawl with net sounders	Net type: Aleutian wing trawl Tow speed: 3 kts Tow duration: 10 min-1 hr Depth: 50-600 m	100
						Small mid-water trawl	Net type: Methot or similar Tow speed: 3 kts Tow duration: up to 1 hr Depth: 50-600 m	10
Gulf of Alaska/Shelikof Walleye Pollock Acoustic Trawl Survey Winter	Same as above except during winter.	GOA Shelikof Straight	31	Winter Annual	Same as above	Bottom trawl	Poly Nor'Eastern Same as above during summer survey.	10
						Mid-water trawl with net sounders	Aleutian wing trawl Same as above during summer survey.	20

Study Name	Description	General Area of Operation	Days at Sea (DAS)	Season/ Frequency	Vessels Used	Gear Type	Gear Details	No. Tows/Samples
Gulf of Alaska/Shumagin/ Sanak Walleye Pollock Acoustic Trawl Survey Winter	Same as above in Shelikof	GOA Shumagin Sanak	7-31	Winter Annual	Same as above	Mid-water trawl with net sounders	Aleutian wing trawl Same as above during summer survey.	20
Southeast Alaska Coastal Monitoring	Monitor intra- and inter-annual biophysical features in coastal marine ecosystem in relation to the distribution, abundance, feeding, bioenergetics, and migratory behavior patterns of wild and hatchery juvenile salmon and associated epipelagic ichthyofauna. Identify processes or factors that influence growth and survival of salmon in different marine habitats along seaward migration corridors and GOA.	GOA	***12 – 28 (increased from 1 – 7)***	Summer Annual	Large Chartered Fishing Vessels	Surface trawl	Net type: Nordic 264 surface rope trawl Net size: 20 m x 20 m Tow speed: 3 kts Tow duration: 20 min Depth: 1-20 m	48
						Bongo net	Same as above for "Western Gulf of Alaska Juvenile Fish Survey Fall"	64
Kodiak Age-0/1 Pacific Cod Nursery Habitat	***Evaluate seasonal habitat use and movements by juvenile Pacific cod in GOA. Demersal beach seine surveys sample juvenile fish after settlement in nursery habitats and provide the only reliable measures of age-0 and age-1 abundance of commercially important gadids. Seine surveys typically collect post-settled age-0 gadids in 2-4 m of water during late summer/early fall at densities several orders of magnitude higher than those reported offshore. As such, seine surveys offer a means of understanding 1st year of life survival.***	***GOA***	***50***		***Small boat Skiff***	***Beam trawl (also conduct beach seine for this survey as listed under "Other Gear" below)***	***Net type: beam trawl Net size: 1m x 1m, 3- mm mesh, 4 mm cod end liner Tow speed: 1-2 kts Tow duration: 10 min Depth: 50-200 m***	***64***
Gulf of Alaska (Science-Industry Rockfish Research Collaboration in Alaska) SIRCCA Trawl Survey	***Cooperative rockfish survey with fishing industry to supplement GOA AFSC bottom trawl survey sampling, focused on calibrating fishing power of vessels and increasing data collection in untrawlable habitats***	***GOA***	***100***		***Large, chartered fishing vessel***	***Nephrops trawl (new gear)***	***Fishing industry bottom trawl. A nephrops trawl is towed on the seabed, with the mouth held open by a pair of otter boards (trawl doors). It's designed and rigged to be towed over rough seabeds to target nephrops.***	***50***
Studies Using Other Gears								
Gulf of Alaska Ichthyoplankton Survey Spring	Assess abundance, distribution, size structure, and survival of larvae of key economic and ecological species (walleye pollock, Pacific cod, arrowtooth flounder, sablefish, rockfish), and investigate effects of climate variability on mechanisms leading to recruitment including transport pathways from spawning to potential nursery locations.	GOA	31	Spring Biennial	NOAA Ship, Large chartered fishing vessel	Bongo net *(removed 50 bottom trawls with net sounders)*	Net type: Plankton net Net size: 20 cm and 60 cm Tow speed: 1.5 – 2.5 kts Tow duration: 10 – 30 min Depth: 0 – 300 m	*150 (reduced from: 250 tows)*
GOA/EBS/Aleutian Islands Longline Survey	Monitor and assess the status of sablefish and other groundfish in Alaska. Whale depredation is a common occurrence during the survey by both killer whales (Bering Sea, Aleutian Islands, Western GOA, Central GOA) and sperm whales (Central GOA, Eastern GOA). Opportunistic whale depredation studies occur during survey to help quantify the amount of depredation.	GOA	80	Summer Annual	Large, chartered fishing vessel	Longline	Mainline length: 16 km Set Depth: bottom Gangion length: 1.5 m Gangion spacing: 2 m Hook size and type: 13/0 circle # of hooks and bait: 7,200 hooks baited with squid Soak time: 3 hrs	***90 stations/yr (increased from 75) 160 sets rotated between GOA and BSAI***

Study Name	Description	General Area of Operation	Days at Sea (DAS)	Season/ Frequency	Vessels Used	Gear Type	Gear Details	No. Tows/Samples
Little Port Walter Research Station and Experimental Hatchery	Survey methods include a weir at Sashin Creek, fish aggregation device in the inner bay, fish culture and hatchery facilities, boat surveys and sampling, and freshwater sampling.	GOA shoreside	365	Year round Annual	Shoreside	Various	4.5-inch (in.) mesh gillnet with pingers, Beach seine, 1 Cast net, Hoop Net, Fyke net, Net pen, Dip net, Multiple open/close net, Diving (SCUBA/Snorkeling), weir across Sashin Creek.	50 gillnet 50 beach seine 50 cast 20 hoop 20 fyke 1 net pen >100 dip net
Ted Stevens Marine Research Institute (TSMRI) Alaska Sea Week	Contribute to longterm monitoring of sea stars in Alaska by the Gulf Watch Alaska (GWA) nearshore program. Annual sea star surveys by K-6th grade students contribute valuable information about sea star populations in southeast Alaska. Count, measure, and record health of sea stars within 2 x 20 m transects on beaches around Juneau. Repeated surveys accumulate longterm data to assess responses to changing environmental factors and information for teaching.	GOA shoreside	10	Spring Summer Annual	Shoreside	Shoreline swaths with transect tape	Transect tape	10
Alaska EFH Mapping (FISHPAC)	Collects acoustic and other environmental data in trawl survey areas to develop numerical habitat models for groundfish and shellfish. Bathymetric data are also collected for nautical chart updates.	GOA	20	Summer Intermittent	NOAA Ship Large Chartered Fishing Vessel	Echosounders and Sonar Bottom Sampler Towed Camera Penetrometer	Scientific single beam (38 kHz) and multibeam echosounders (50, 100 kHz); side-scan sonar (180,455 kHz),	Echosounder 5,500 Linear km Bottom sampler 50 stations Towed camera 20 stations Penetrometer 92 stations
Auke Bay Lab Dive Checkouts/Facilities Dives	Perform proficiency dives to keep diver's certification active, and to inspect and maintain the site's saltwater intakes.	GOA	1	Year round Annual	Small boat Shoreside	Diving	SCUBA Snorkel	12
Diver Training, Maintenance, and Collection Operations	Diver checkouts/training, recovery/ replacement of sea water system intake screens, retrieval of temperature loggers, collection of live aquarium specimens for outreach displays at the TSMRI, Kodiak Lab, and other similar operations.	GOA	7	Year round Annual	Small boat Shoreside	Diving	SCUBA Snorkel	N/A
Auke Creek Weir and Research Hatchery	The Auke Creek weir sits above the high tide line in Auke Bay, Juneau, AK. The weir captures outmigrating salmonids in the late winter and spring and then captures returning adult salmonids in the late spring through fall. Hatchery operations include the retention of a limited number of adult salmon, the collection of gametes, incubation of eggs, and short-term rearing of fry for stocking into Auke Lake.	Inland Southeast Alaska	260	Year round Daily (Feb – Oct)	Shoreside	Fish trap attached to weir	Fish trap attached to weir structure across mouth of Auke Creek	N/A
Gulf of Alaska Juvenile Sablefish Tagging	Tag and release juvenile sablefish with 1,000 numerical spaghetti tags and 80 surgically implanted electronic archival tags. Electronic archival tags programmed to continuously record temperature and depth and both numerical and electronic tags will be recovered as sablefish recruit to the commercial fishery at ages 4 and 5.	GOA	4	Summer Annual	Large Chartered Fishing Vessel	Rod and Reel	4 rod and reel herring type jig fishing 3-4 2/0 hooks per jigging rig, with 3-4 oz bank sinkers. Squid is the bait.	16
Gulf of Alaska Large-Scale Age-0/1 Pacific Cod Nursery Habitat	***Same as above near Kodiak.***	***GOA***	***30***	***Summer Annual***	***Small boat Shoreside***	***Beach seine*** ***Baited Cameras***	***See above***	***100 seine hauls*** ***500 baited camera sets***

Study Name	Description	General Area of Operation	Days at Sea (DAS)	Season/ Frequency	Vessels Used	Gear Type	Gear Details	No. Tows/Samples
Gulf of Alaska Coral Settlement Plate Recovery	***Alaska Initiative Deep Sea coral funded project to study reproduction and coral recruitment in SE Alaska.***	***GOA***	***2***	***Spring Summer Annual***	***Large, chartered fishing vessel***	***UxS Camera system Settlement Plates***	***Settlement plates deployed and retrieved with UxS such as an Autonomous Underwater Vehicle (AUV)***	***3***
Alaska UxS Acoustic Survey	***UxS measure abundance and distribution of fish and plankton. Uncrewed surface vehicles (USVs) such as a DriX to keep pace with a fisheries survey vessel (FSV, NOAA Ship Oscar Dyson) without delaying ship's operation and allow concurrent acoustic and trawl measurements. Ship and USV to survey alternate transects, staying within ~3 hrs of each other. USV acoustic observations summarized onboard USV and transmitted to FSV. Ship to conduct trawls, crossing to trawl on USV transects as needed. Tandem USV/FSV survey substantially reduces FSV time, without degrading data quality. Wind-powered UxS such as a Saildrone used independently from a ship.***	***GOA (see also BSAI and Chukchi Sea)***	***70***	***Summer (maybe Spring) Annual***	***NOAA ship***	***Simrad EK80 split-beam echosounders UxS***	***EK80 split-beam echosounders (38, 70, 120, 200 kHz transducers) equivalent to those used on NOAA ships***	***50% of line transects of MACE Acoustic trawl activities***
Alaska Moored Echosounders	***Autonomous echosounders mounted on seafloor to monitor fish and plankton abundance and behavior. Used to complement abundance surveys to monitor marine life throughout an annual cycle, outside of period when ship-based surveys are available. Moorings deployed for 1 yr in locations TBD (likely to include vicinity of U.S./Russia border, northern Bering Sea, or GOA). Up to 12 moorings during permit period.***	***GOA (see also BSAI and Chukchi Sea)***	***365***	***Year round Annual***	***Mooring***	***Simrad EK80 split-beam or broadband wide-band autonomous transceiver (WBAT) echosounders operating at 18, 38, 70, 120, 200 kHz***	***Low-power Simrad WBAT echosounders. Stationary, self-contained, upward-looking echosounder operating at 70 kHz (possibly 38, 200 kHz if deployed in shallow water <75 m). Similar to instruments on NOAA ship Oscar Dyson will be moored on seafloor and cone-shaped beam will look upwards. Operate ~ 5% of time (i.e. ~3 min/hr)***	***Continuous (6 min/hr)***
Alaska Slinky Pot Research	***Exploration of slinky pot fishing characteristics. Goals would include determining selectivity, catch composition, catch efficiency, and interaction with seafloor habitats of slinky pots.***	***GOA (see also BSAI and Chukchi Sea)***	***14***	***Summer Annual***	***Large, chartered fishing vessel***	***Longlined collapsible "slinky" pot (NEW GEAR)***	***Collapsible, lightweight mesh pots filled with bait, attached to a long line, and set at the bottom.***	***1 set of 50-120 pots per day, 700-1680 pots total***
Gulf of Alaska EVOS Benthic Survey	***Transect and quadrat counts of benthic species and take sediment cores and sieve them for later processing. Surveys performed in spring and winter under kelp farms and nearby control sites.***	***GOA***	***20***	***Year round Annual***	***Chartered small boat***	***Camera system Bottom/Sediment Sampler***	***SCUBA transects***	***60 transects/yr***
Alaska Aquaculture Research	***Aquaculture related surveys/research on Clupea pallassii (Pacific herring) and Crassostrea giga (Pacific oyster).***	***GOA***	***N/A***	***Year round Monthly***	***Shoreside***	***SCUBA Snorkeling Phytoplankton net (included with hand nets) Net pens***	***10 x 10 ft or 20 x 20 ft pens with ~ 1 in mesh size.***	***Unknown***
BSAIRA								
Studies Using Trawl Gear								
Eastern Bering Sea Groundfish Bottom Trawl	Collect data on: 1) distribution, abundance, and biological condition of commercially important groundfish and crab species; 2) Catch per unit effort (CPUE), size and age composition data for U.S. commercial fisheries; and 3) Support studies on biology, behavior, and dynamics of key ecosystem components.	Bering Sea	*75 (reduced from 130)*	Biennial	Large Chartered Fishing Vessel	Bottom trawl with net sounders	Net type: 83-112 Eastern otter trawl Net size: 83 ft headrope, 112 ft footrope Tow speed: 3 kts Tow duration: 30 min Depth: 20 to 200 m Marport headrope and wing sounders, 40 kHz	376
						Bottom trawl fished as mid-water trawl	Same as above Eastern Otter Trawl fished as midwater trawl	25 samples per vessel

Study Name	Description	General Area of Operation	Days at Sea (DAS)	Season/ Frequency	Vessels Used	Gear Type	Gear Details	No. Tows/Samples
Fishing Technology Studies to Reduce Bycatch and Habitat Effects of Fishing	See above for GOA	BSAI	*7 (reduced from 14)*	Year round Annual	Fishing vessel	Bottom trawl	Net type: Various commercial bottom trawls Net size: Operating net width 18-24 m, height 4-8 m. Mesh size 8 in (forward sections) to 5.5 to 4 in (aft sections). Footropes large bobbins or disks (18-24 in diameter) with substantial (18-48 in) spacing in between 18 m Tow speed: 3-3.5 kts Tow duration: Experimental tows – 0.75-6.5 hrs Depth: 66-154 m Marport headrope and wing sounders, 40 kHz	40-90/yr
						Mid-water trawl	Net type: Various Commercial mid-water trawls Net size: Operating net width 75-136 m, height 10-20 m, with size highly dependent on vessel power. Large mesh (64-128 m) forward tapering gradually to 4 in in aft sections Tow speed: 3-3.5 kts Tow duration: Experimental tows – 0.75-3 hrs Depth: 66-154 m	40-90/yr
Eastern Bering Sea Slope Bottom Trawl Survey Summer	Locate and successfully trawl stratified random locations on a variety of slope habitats; describe composition, spatial and depth distribution, and relative abundance of groundfish and invertebrate resources; collect biological data from a variety of commercially and ecologically important species; and collect environmental parameters.	Bering Sea	65	Summer Biennial (when funded)	Large, chartered fishing vessel	Bottom trawl with net sounders	Net type: Poly Nor'Eastern Net size: 90 ft headrope, 100 ft footrope Tow speed: 2.5 kts Tow duration: 30 min Depth: 200-1200 m Marport headrope and wing sounders, 40 kHz	200
Aleutian Islands Bottom Trawl Survey	Monitor trends in abundance and distribution of groundfish populations. Multi-species survey based on a stratified-random design and the area-swept method of estimating abundance. Scientific crew identify, weigh and count all living organisms, and collect biological samples from key groundfish species or other species of interest.	Aleutian Islands	75	Summer Biennial	Large, chartered fishing vessels	Bottom trawl with net sounders	Net type: Poly Nor'Eastern bottom trawl with roller gear Net size: 24 m head and footrope Tow speed: 3 kts Tow duration: 15 min Depth: out to 500 m Marport headrope and wing sounders, 40 kHz	***550 (Increased from 420)***
Northern Bering Sea Ecosystem Surface Trawl Survey	Examine early marine ecology of important groundfish, western Alaska salmon, forage fish, and oceanographic indices affecting early marine and overwinter survival of groundfish.	Bering Sea	25	Fall Annual	Large Chartered Fishing Vessel	***Beam trawl (new gear for this survey)***	***Net type: Beam trawl*** ***Net size: 7 mm; mesh 4 mm; mouth opening 2.1 m*** ***Tow speed: 1 kts*** ***Tow duration: 5 min*** ***Depth: 18-65 m***	***50***
						Surface trawl	Net type: Cantrawl Net size: 55 m width, 25 m depth Tow speed: 3.5 to 5 kts Tow duration: 30 min Depth: surface to 25 m depth	110
						Bongo net	Net type: Bongo zooplankton Net size: 505 microns (µm) and 143 µm mesh Tow speed: 1 m/sec Tow duration: depends on depth Depth: surface to 1 m off bottom	200

Study Name	Description	General Area of Operation	Days at Sea (DAS)	Season/ Frequency	Vessels Used	Gear Type	Gear Details	No. Tows/Samples
Eastern Bering Sea Juvenile Fish Survey Fall	Same as above in GOA (Western Gulf of Alaska Juvenile Fish Survey Fall).	Bering Sea	30	Fall Biennial	NOAA ship Large, chartered fishing vessel	Mid-water trawl	Same as above in GOA. Anchovy trawl or equivalent	60
						Beam trawl	Net type: Beam trawl Net size: 7 mm mesh, 4 mm cod end liner Tow speed: 1 – 2 kts Tow duration: 10 min Depth: 50-200 m	60
						Bongo net	Net type: Plankton Net size: 20 cm and 60 cm Tow speed: 1.5 – 2.5 kts Tow duration: 10 – 30 min Depth: 0-300 m	150
Eastern Bering Sea Walleye Pollock Acoustic Trawl Survey Summer	Same survey as in GOA (Gulf of Alaska Biennial Walleye Pollock Acoustic-Summer).	Eastern Bering Sea	62	Summer Biennial	NOAA ship	Bottom trawl with net sounders	Same as above in GOA, Poly Nor'Eastern trawl	130
						Mid-water trawl with net sounders	Same as above in GOA, Aleutian wing trawl	See above
Bering Sea/Bogoslof Walleye Pollock Acoustic Trawl Survey Winter	Same survey as above in GOA and Eastern Bering Sea.	Bering Sea Bogoslof Island Region	31	Winter Biennial	NOAA ship	Bottom trawl with net sounders	Same as above in GOA and Eastern Bering Sea using Poly Nor'Eastern trawl.	130
						Mid-water trawl with net sounders	Same as above in GOA and Eastern Bering Sea. Aleutian wing trawl	See above
Northern Bering Sea Effects of Trawling Study	***Experimental study of bottom-trawling effects on essential fish habitat in the Northern Bering Sea.***	***BSAI***	***30***	***Summer Annual***	***Large, chartered fishing vessel***	***Bottom trawl***	***Net type: Poly Nor'Eastern Tow speed: 3-5 kts Tow duration: 20 min Depth: 150-700 m Marport headrope and wing sounders, 40 kHz***	***100 tows & 200 grab samples***
Northern Bering Sea Bottom Trawl Survey	***See Eastern Bering Sea Groundfish Bottom Trawl.***	***Northern Bering Sea (new area)***	***26***	***Summer Annual***	***Large, chartered fishing vessel Small skiff***	***Bottom trawl***	***See above for Poly Nor Eastern***	***144***
Northern Bering Sea Integrated Ecosystem Research Survey	***Surveying distribution and abundance of pelagic fish species and biological and physical oceanographic indices to evaluate the effect of climate change on the health of pelagic fish in this region. The status of juvenile salmon populations are evaluated as a secondary objective.***	***Northern Bering Sea***	***50***	***Summer Fall Biennial***	***Large, chartered fishing vessel***	***Surface trawl***	***Net type: Nordic 264 surface rope trawl Net size: 20 m x 20 m Tow speed: 3 kts Tow duration: 20 min Depth: 1-20 m***	***75***

Study Name	Description	General Area of Operation	Days at Sea (DAS)	Season/ Frequency	Vessels Used	Gear Type	Gear Details	No. Tows/Samples
						Beam trawl	***Net type: beam trawl*** ***Net size: 1m x 1m, 3- mm mesh, 4 mm cod end liner*** ***Tow speed: 1-2 kts*** ***Tow duration: 10 min*** ***Depth: 50-200 m***	***75***
						Mid-water trawl	***Net type: Anchovy trawl or equivalent*** ***Net size: 12 m x 12 m, 3 mm cod end liner*** ***Tow speed: 2-3 kts*** ***Tow duration: depth dependent, up to 1 hr*** ***Depth: oblique to bottom (<200 m)***	***35***
						Bongo net	***Net type: Plankton net*** ***Net size: 20 cm and 60 cm*** ***Tow speed: 1.5 – 2.5 kts*** ***Tow duration: 10 – 30 min*** ***Depth: 0 – 300 m***	***75***
Studies Using Other Gears								
Eastern Bering Sea Ichthyoplankton Survey Spring	Assess distribution and condition of age-1 walleye pollock immediately after first winter; evaluate recruitment potential of emergent age-1s, a full year prior to assessment during acoustic or bottom trawl surveys. Determine abundance, distribution, size structure, and survival of other key economic and ecological species in region and investigate effects of climate variability on transport pathways from spawning to potential nursery locations for juveniles.	BSAI	31	Spring Biennial	NOAA ship Large, chartered fishing vessel	Bongo net	Net type: Plankton net Net size: 20 cm and 60 cm Tow speed: 1.5 – 2.5 kts Tow duration: 10 – 30 min Depth: 0 – 300 m	*150 (reduced from:* *- 50 bottom trawls* *- 50 mid-water* *- 50 Bongo For Larval pollock,* *- 150 Bongo* *- 30 multiple-opening/closing net* *- 150 Neuston net)*
EBS/GOA EcoFOCI Mooring Fall/Spring	Same as above in GOA.	BSAI	31	Fall Spring Biennial	NOAA ship Large, chartered fishing vessel	Bottom trawl with net sounders	Net type: Poly Nor'Eastern, Tow speed: 3-5 kts Tow duration: 20 min Depth: 150-700 m Marport headrope and wing sounders, 40 kHz	150
						Bongo net	Net type: Plankton Net size: 20 cm and 60 cm Tow speed: 1.5 – 2.5 kts Tow duration: 10 – 30 min Depth: 0 – 300 m	150

Study Name	Description	General Area of Operation	Days at Sea (DAS)	Season/ Frequency	Vessels Used	Gear Type	Gear Details	No. Tows/Samples
						Neuston net	Net type: Plankton Net size: .25 m2 Tow speed: 1 – 3 kts Tow duration: 10 min Depth: surface	150
Alaska EFH Mapping (FISHPAC)	Same as above in GOA.	Northern Bering Sea Eastern Bering Sea	20	Summer Intermittent	NOAA ship Large, chartered fishing vessel	Echosounders Bottom Sampler Towed Camera Penetrometer	Same as above in GOA	Echosounder Linear km: EBS 5,700, NBS TBD Bottom sampler 50 stations Towed camera 20 stations Penetrometer 92 stations
GOA/EBS/Aleutian Islands Longline Survey	Same as above in GOA.	Eastern Bering Sea and Aleutian Islands	80	Summer Annual	Large, chartered fishing vessel	Longline	Same as above in GOA	90 stations/yr (increased from 75) 160 sets rotated between GOA and BSAI
Pacific Cod Tagging Bering Sea	***Work aboard chartered commercial fishing vessels using pot gear and/or bottom trawl gear to capture live Pacific cod. Attach satellite tags to fish and release. In the northern Bering Sea, work with Alaska Native community members and longline fishers to harvest Pacific cod.***	***BSAI***	***14***	***Year round Annual***	***Large, chartered fishing vessel Small skiff***	***Pot gear***	***Pots of various sizes constructed of rebar and webbing Bait: fish or squid Soak time: up to 3 days***	***80***
Alaska Collaborative Crab Tagging Survey	***Crab tagging research using many platforms depending on year or season. Can occur during: EBS bottom trawl survey; active commercial fisheries; ADF&G cost recovery fishery; or chartered commercial vessel. Uses trawl net (EBS survey[1]) or pots (specific charter for tagging) depending on vessel.***	***BSAI***	***5-40***	***Year round Biennial***	***Large, chartered fishing vessel***	***Pot gear***	***Pots of various sizes constructed of rebar and webbing Bait: fish or squid Soak time: up to 3 days***	***10-800 pots/ survey***
Alaska UxS Acoustic Survey	***Same survey as in GOA.***	***BSAI***	***70***	***Summer (maybe spring) Annual***	***NOAA ship***	***Simrad EK80 split-beam echosounders with 38, 70, 120, 200 kHz transducers UxS***	***EK80 split-beam echosounders equivalent to those used on NOAA ships***	***50% of line transects of MACE Acoustic trawl activities***

[1] Trawls already accounted for during EBS trawl survey and therefore, not duplicated here.

Study Name	Description	General Area of Operation	Days at Sea (DAS)	Season/ Frequency	Vessels Used	Gear Type	Gear Details	No. Tows/Samples
Alaska Moored Echosounders	***Same survey as in GOA.***	***BSAI***	***365***	***Year round Annual***	***Mooring***	***Simrad EK80 split-beam or broadband WBAT echosounders operating at 18, 38, 70, 120, 200 kHz***	***Low-power battery powered Simrad WBAT echosounders. This is a stationary, self-contained, upward-looking echosounder operating at 70 kHz (and possibly 38, 200 kHz if deployed in shallow water <75 m). The instruments, similar to those on NOAA ship Oscar Dyson, will be moored on the seafloor and the cone-shaped beam will look upwards. They will operate about 5% of the time (i.e., on for ~3 min per hour)***	***Continuous (6 min/hr)***
Alaska Slinky Pot Research	***Same survey as in GOA.***	***BSAI***	***14***	***Summer Annual***	***Large, chartered fishing vessel***	***Longlined collapsible "slinky" pot (NEW GEAR)***	***Collapsible, lightweight mesh pots filled with bait, attached to a long line, and set at the bottom.***	***1 set of 50-120 pots per day, 700-1680 pots total***
Bristol Bay Red King Crab Settlement Survey	***Placing and retrieving larval collectors at a number of sites in Bristol Bay (spring deployment; fall retrieval). During one cruise, deploy a benthic sled camera to quantify habitat at each site (likely from a chartered crabber fishing vessel).***	***Bering Sea***	***25***		***Chartered small boat***	***Camera system Anchored gillnet larvae collectors Diving***	***SCUBA transects. Larval collectors consisting of gillnets with small mesh sacks filled with bait that are deployed on the bottom using an anchor and buoy marker.***	***48 stations/yr***
CSBSRA								
Studies Using Trawl Gear								
Chukchi Sea Bottom Trawl Survey	Collect baseline data to monitor distribution, abundance, and general ecology of marine animals living on or near the seafloor to determine effects of climate change and potential impacts from further industrialization.	Chukchi Sea	30	Summer One-off	Large, chartered fishing vessel	Bottom trawl with net sounders	Net type: 83-112 Eastern otter trawl Net size: 83 ft headrope, 112 ft footrope Tow speed: 3 kts Tow duration: 15 min Depth: 10 – 100 m Marport headrope and wing sounders, 40 kHz	143
						Bottom trawl	Net type: 3 m Plumb Staff Beam Trawl Net size: 3 m wide Tow speed: 1.5 kts Tow duration: 3 min Depth: 10 – 100 m	40
Arctic Ecosystem Distributed Biological Observatory	Evaluate ecosystem status and change in the northern Bering and Chukchi Seas.	Chukchi Sea Beaufort Sea	28	Fall Annual	NOAA ship	***Beam trawl (new gear for this survey)***	***Net type: Beam trawl*** ***Net size: 7 mm mesh, 4 mm cod end liner*** ***Tow speed: 1 – 2 kts*** ***Tow duration: 2-5 min*** ***Depth: 50-200 m***	***50***

Study Name	Description	General Area of Operation	Days at Sea (DAS)	Season/ Frequency	Vessels Used	Gear Type	Gear Details	No. Tows/Samples
						Bongo net	Net type: Plankton Net size: 20 cm and 60 cm diameter Tow speed: 1.5 – 2.5 kts Tow duration: 10 – 30 min Depth: 0 – 300 m	50
Studies Using Other Gears								
Alaska UxS Acoustic Survey	***Same survey as in GOA and BSAI.***	***Chukchi Sea***	***70***	***Summer (maybe spring) Annual***	***NOAA ship***	***Simrad EK80 split-beam echosounders with 38, 70, 120, 200 kHz transducers*** ***UxS***	***EK80 split-beam echosounders equivalent to those used on NOAA ships***	***50% of line transects of MACE Acoustic trawl activities***
Alaska Moored Echosounders	***Same survey as in GOA and BSAI.***	***Chukchi Sea***	***365***	***Year round Annual***	***Mooring***	***Simrad EK80 split-beam or broadband WBAT echosounders operating at 18, 38, 70, 120, 200 kHz***	***Low-power battery powered Simrad wide-band autonomous transceiver echosounders. This is a stationary, self-contained, upward-looking echosounder operating at 70 kHz (and possibly 38, 200 kHz if deployed in shallow water <75 m). The instruments, similar to those on NOAA ship Oscar Dyson, will be moored on the seafloor and the cone-shaped beam will look upwards. They will operate about 5% of the time (i.e., on for ~3 min per hour)***	***Continuous (6 min/hr)***
Alaska Slinky Pot Research	***Same survey as in GOA and BSAI.***	***Chukchi Sea***	***14***	***Summer Annual***	***Large, chartered fishing vessel***	***Longlined collapsible "slinky" pot (NEW GEAR)***	***Collapsible, lightweight mesh pots filled with bait, attached to a long line, and set at the bottom.***	***1 set of 50-120 pots per day, 700-1680 pots total***
IPHC Research								
IPHC Fisheries Independent Setline Survey (FISS)	Provide data for the Pacific halibut stock assessment. Catch per unit effort (CPUE) in numbers and weight, size, age, and sex composition of Pacific halibut catch used to monitor changes in abundance, growth, and mortality in the population. Determine Pacific halibut range, local depletion, and fleet distribution effects on halibut. In addition, record catch of other organisms captured incidentally to the gear targeting Pacific halibut to provide insight into bait competition, rate of bait attacks, and composition of catch for the directed commercial Pacific halibut fishery. Depredation by marine mammals on fishing gear are recorded to monitor occurrences and assess whether marine mammal depredation affects that set's data to the extent that it cannot be used in the Pacific halibut stock assessment. IPHC implements protected species avoidance, mitigation, and reporting rules adopted by AFSC.	U.S. West Coast north of 36 degrees 40 minutes North, GOA, Aleutian Island Archipelago, and Bering Sea. Stations laid out on a 10-nm by 10-nm grid within the 20-275-fathom (fm) depth range most years (may extend to 400 fm or shallow – 10 fm some years)	110	Summer	Chartered vessel	Longline	1,800-foot-long (300 fm) skates, with 100 hooks per skate. Three to ten skates may be fished at a station. Circle hooks (16/0 Mustad or equivalent) along groundline at 18-foot intervals (100 per skate). 72-thread count gangions, hard lay material between 24 – 48 inches after tying. Swivels may not be used. Hooks baited with 0.25-pound chum salmon. No setting before 5AM to ensure daylight. Soak time: 5 hrs	1,500 sets

Study Name	Description	General Area of Operation	Days at Sea (DAS)	Season/ Frequency	Vessels Used	Gear Type	Gear Details	No. Tows/Samples
IPHC Catch Protection Survey	*Investigate logistics of setting, fishing, and hauling two pilot catch protection devices: a) an underwater shuttle, and b) branchline gear with a sliding shroud system. Investigate performance of gear on catch rates and fish size compared to traditional gear. Help refine potential devices used in Pacific halibut fishery to protect catch on gear from removal or damage by whales and to potentially interrupt the reward cycle leading to depredation. Pilot fishing will not be conducted in the presence of whales and no fish from this study will be retained after sampling.*	*GOA*	*10*	*Spring Summer*	*Chartered vessel*	*Longline*	*Snap gear longline*	*20 sets*

Table 2-2. AFSC/IPHC Research by Gear Type and Estimated and Level of Effort Under the Preferred Alternative

Gear Type	General Gear Description	Gulf of Alaska Research Area Research Area (GOARA)			Bering Sea/Aleutian Islands Research Area (BSAIRA)			Chukchi Sea/Beaufort Sea Research Area (CSBSRA)			IPHC Research		
		Estimated Number of Studies	Estimated Annual Maximum Days at Sea (DAS)	Estimated Annual Level of Effort (tows/ samples)	Estimated Number of Studies	Estimated Annual Maximum DAS	Estimated Annual Level of Effort (tows/ samples)	Estimated Number of Studies	Estimated Annual Maximum DAS	Estimated Annual Level of Effort	Estimated Number of Studies	Estimated Annual Maximum DAS	Estimated Annual Level of Effort
Hook and Line Gear													
Longline	Mainline length: 16 km Set Depth: bottom Gangion length: 1.5 m Gangion spacing: 2 m Hook size and type: 13/0 circle Hooks and bait: 7,200 hooks baited with squid Soak time: 3 hrs	1	80	90 stations/yr Up to 160 sets (rotated between GOA and BSAI)	1	80	90 stations/yr Up to 160 sets (rotated between GOA and BSAI)	-	-	-	-	-	-
Longline (FISS)	1,800-foot-long (300 fm) skates, with 100 hooks per skate. Three to ten skates may be fished at a station. Circle hooks (16/0 Mustad or equivalent) along groundline at 18-foot intervals (100 per skate). 72-thread count gangions, hard lay material between 24 – 48 inches after tying. Swivels may not be used. Hooks baited with 0.25-pound chum salmon. No setting before 5AM to ensure daylight. Soak time: 5 hrs	1	110 total for GOARA, BSAIRA and West Coast	Up to 1500 sets total for GOARA, BSAIRA and West Coast stations	1	110	Up to 1500 sets total for GOARA, BSAIRA and West Coast stations	-	-	-	1	110 total for GOARA, BSAIRA and West Coast	Up to 1500 sets total for GOARA, BSAIRA and West Coast stations
Snap Gear Longline (IPHC only)	Hooks are attached to the long line by snaps.	1	10	Up to 20	-	-	-	-	-	-	-	-	-
Rod and Reel	4 rod and reel herring type jig fishing 3-4 2/0 hooks per jigging rig, with 3-4 oz bank sinkers. Squid is the bait.	1	4	Up to 16	-	-	-	-	-	-	-	-	-
Bottom Trawl Gear													
Beam Trawl	Net type: beam trawl Net size: up to 2 m, 3-7 mm mesh, 4 mm cod end liner Tow speed: 1-2 kts. Tow duration: 3-10 min. Depth: 18-200 m.	3	92	Up to 150	3	105	Up to 185	1	28	Up to 50	-	-	-
Plumb Staff Beam Trawl	Net size: up to 3 m wide. Tow speed: 1.5-3 kts. Depth: 5-100 m. Tow duration: 3-30 minutes.	-	-	-	-	-	-	1	30	Up to 40	-	-	-
Poly Nor'Eastern Trawl	Net size: footrope up to 27 m, headrope up to 30 m. Tow speed: 2.5-5 kts. Depth: 50-1200 m. Duration 10-30 minutes. Marport headrope and wing sounders, 40 kHz	5	272	Up to 1300	6	245	Up to 855 tows Plus 200 grab samples	-	-	-	-	-	-
Eastern Otter Trawl	Net size: 83 ft headrope, 112 ft footrope. Tow speed: 3 kts. Tow duration: 15-30 minutes. Depth: 10-200 m. Marport headrope and wing sounders, 40 kHz.	-	-	-	1	75	Up to 376	1	30	Up to 143	-	-	-

Gear Type	General Gear Description	Gulf of Alaska Research Area Research Area (GOARA)			Bering Sea/Aleutian Islands Research Area (BSAIRA)			Chukchi Sea/Beaufort Sea Research Area (CSBSRA)			IPHC Research		
		Estimated Number of Studies	Estimated Annual Maximum Days at Sea (DAS)	Estimated Annual Level of Effort (tows/ samples)	Estimated Number of Studies	Estimated Annual Maximum DAS	Estimated Annual Level of Effort (tows/ samples)	Estimated Number of Studies	Estimated Annual Maximum DAS	Estimated Annual Level of Effort	Estimated Number of Studies	Estimated Annual Maximum DAS	Estimated Annual Level of Effort
Commercial Bottom Trawl	Net size: Operating net width 18-24 m, height 4-8 m. Mesh size 8 in (forward sections) to 5.5-4 in (aft sections). Footropes large bobbins or disks (18-24 in diameter) with 18-48 in spacing between Tow speed: 3-3.5 kts Tow duration: Experimental tows – 0.75-6.5 hrs. Depth: 66-154 m Marport headrope and wing sounders, 40 kHz	1	7	Up to 40	1	7	Up to 90	-	-	-	-	-	-
Nephrops Trawl	Bottom trawl towed on the seabed, with the mouth held open by a pair of otter boards (trawl doors). Designed and rigged to be towed over rough seabeds to target nephrops.	1	100	Up to 50	-	-	-	-	-	-	-	-	-
Midwater, Surface, and Shallow Water Trawl Gear													
Commercial Midwater Trawl	Net size: Operating net width 75-136 m, height 10-20 m, with size highly dependent on vessel power. Very large meshes (128-64 m) forward tapering gradually to 4 in in aft sections Tow speed: 3-3.5 kts Tow duration: Experimental tows – 0.75-3 hrs Depth: 66-154 m	1	7	Up to 40	1	7	Up to 90	-	-	-	-	-	-
Aleutian Wing Trawl	Net size: headrope/foot rope = 82 m. Vertical opening 27m, codend liners 1.25 centimeters (cm). Tow speed: 3 kts. Depth: 50-600 m. Tow duration: 10 minutes to 1 hr. With 40 hertz H(z door sensors and Simrad FS70.	3	122	Up to 140	2	93	Up to 260	-	-	-	-	-	-
Anchovy Trawl	Net size: 12 m x 12 m, 3 mm cod end liner. Tow speed: 2-3 kts. Tow duration: depth dependent, up to 1 hr. Depth: oblique to bottom (<200m)	1	35	Up to 75	2	80	Up to 95	-	-	-	-	-	-
Methot or Similar Small Midwater Trawl	Tow speed: 3 kts Tow duration: up to 1 hr Depth: 50-600 m	1	60	Up to 10	-	-	-	-	-	-	-	-	-
Eastern Otter Trawl	Bottom trawl fished as midwater trawl.	-	-	-	1	75	Up to 25 per vessel	-	-	-	-	-	-
Nordic 264 Trawl	Net size: 20 m x 20 m. Tow speed: 3 kts. Depth: surface to 20 m. Duration: 20 minutes.	1	28	Up to 48	1	50	Up to 75	-	-	-	-	-	-
Cantrawl	Net size: 55 m width, 25 m depth. Tow speed: 3 to 5 kts. Depth: surface to 25 m Tow duration: 30 minutes	-	-	-	1	25	Up to 110	-	-	-	-	-	-
Other Gear Types													
Beach Seine	Deployed in shallow water from shore by crews in small boats. Net size: 5-61 m long. Mesh size: 0.3-7 cm. Set duration: 10-30 minutes.	3	365	Up to 300	-	-	-	-	-	-	-	-	-

Gear Type	General Gear Description	Gulf of Alaska Research Area Research Area (GOARA)			Bering Sea/Aleutian Islands Research Area (BSAIRA)			Chukchi Sea/Beaufort Sea Research Area (CSBSRA)			IPHC Research		
		Estimated Number of Studies	Estimated Annual Maximum Days at Sea (DAS)	Estimated Annual Level of Effort (tows/ samples)	Estimated Number of Studies	Estimated Annual Maximum DAS	Estimated Annual Level of Effort (tows/ samples)	Estimated Number of Studies	Estimated Annual Maximum DAS	Estimated Annual Level of Effort	Estimated Number of Studies	Estimated Annual Maximum DAS	Estimated Annual Level of Effort
Fyke Net	Fyke net size: 12 m long. Mesh size: 1.3 cm. Set duration: 4 hrs. Freshwater only.	1	365	Up to 20 sets	-	-	-	-	-	-	-	-	-
Cast, Hoop, Dip, and Multiple Open/Close Nets	Surface cast net size: 3.7 m diameter. Mesh size: 10 to 20 mm. Dip, and hoop nets are small hand nets used to collect crustaceans larvae and small fish.	2	365	>170 casts	1	25	Up to 48 stations	-	-	-	-	-	-
Gillnet	4.5-in. mesh size with pingers	1	365	Up to 50	-	-	-	-	-	-	-	-	-
Bongo Net – Tandem	Net size: 60 cm each ring (mesh 505 µm; 333 µm) Tow speed: 1 kts. Tow duration: 15-45 min Depth: 1-200 m	3	94	Up to 415	-	-	-	-	-	-	-	-	-
Bongo Net – Zooplankton	Net size: 505 µm and 143 µm mesh Tow speed: 1 m/sec. Tow duration: depends on depth Depth: surface to 1 m off bottom	-	-	-	1	25	Up to 200	-	-	-	-	-	-
Bongo Net -Plankton	Net size: 20 cm and 60 cm Tow speed: 1.5 – 2.5 kts. Tow duration: 10 – 30 min Depth: 0 – 300 m	1	31	Up to 150	4	142	Up to 525	1	28	Up to 50	-	-	-
Neuston Net	Net size: 0.25 m^2. Tow speed: 1 – 3 kts. Tow duration: 10 min. Depth: surface				1	31	Up to 150	-	-	-	-	-	-
Pot Gear including “Slinky” Pots	Pots of various sizes constructed of rebar and webbing or plywood and plastic. Bait: fish or squid. Soak time: 3 days to 3 months. Slinky pots are collapsible, lightweight mesh pots filled with bait, attached to a long line, and set at the bottom.	1	14	Up to 1,680 pots total	3	68	Up to 2,560 pots total	1	14	Up to 1,680 pots total	-	-	-
Net Pens and Fish traps	Pens at Little port Walter Research Station and Experimental Hatchery and Alaska Aquaculture Research (10 x 10 ft or 20 x 20 ft pens with ~ 1 in. mesh size). Fish trap at Auke Creek	3	365	74 pens 1 trap	-	-	-	-	-	-	-	-	-
Settlement Plates	Deep Sea coral funded project to study reproduction and coral recruitment in SE Alaska.	1	2	3 plates	-	-	-	-	-	-	-	-	-
Bottom Sampler and Penetrometer	Benthic samplers are used to collect sediment and associated benthic invertebrate samples. Depths <200 m. Penetrometers are dropped from stationary or underway vessel to seafloor with < 3 m penetration.	2	40	110 bottom samples 92 penetrometer stations	1	20	50 bottom samples 92 penetrometer stations	-	-	-	-	-	-
Video or Still Cameras	Cameras attached to nets or trawls or towed by sleds. Includes baited camera traps handheld cameras, and cameras on UxS.	4	122	20 towed 540 baited 6 handheld 3 UxS	2	45	20 towed 48 handheld	-	-	-	-	-	-

Gear Type	General Gear Description	Gulf of Alaska Research Area Research Area (GOARA)			Bering Sea/Aleutian Islands Research Area (BSAIRA)			Chukchi Sea/Beaufort Sea Research Area (CSBSRA)			IPHC Research		
		Estimated Number of Studies	Estimated Annual Maximum Days at Sea (DAS)	Estimated Annual Level of Effort (tows/ samples)	Estimated Number of Studies	Estimated Annual Maximum DAS	Estimated Annual Level of Effort (tows/ samples)	Estimated Number of Studies	Estimated Annual Maximum DAS	Estimated Annual Level of Effort	Estimated Number of Studies	Estimated Annual Maximum DAS	Estimated Annual Level of Effort
Echosounders and Side Scan Sonar	Scientific single beam (38 kHz) and multibeam echosounders (50, 100 kHz); side-scan sonar (180,455 kHz), EK80 split-beam echosounders, and low-power Simrad WBAT stationary, upward looking moored echosounders 38, 70, or 200 kHz	3	365	5500 linear km, 50% of MACE acoustic trawls, and up to 12 moored locations (continuous; 3-6 min. per hr)	3	365	5700 linear km EBS (NBS TBD), 50% of MACE acoustic trawls, and up to 12 moored locations (continuous; 3-6 min. per hr)	2	365	50% of MACE acoustic trawls and up to 12 moored locations (continuous; 3-6 min. per hr)	-	-	-
Uncrewed Systems (UxS)	Includes USVs such DriX; and wind-powered Saildrones, and Autonomous Underwater Vehicles (AUV).	2	72	50% of line transects of MACE Acoustic trawl activities; plus locating 3 coral settlement plates	1	70	50% of line transects of MACE Acoustic trawl activities	1	70	50% of line transects of MACE Acoustic trawl activities	-	-	-
SCUBA and Snorkel	Human divers collect invertebrates and benthic samples and/or video/photograph habitat.	5	>30	>75	1	25	Up to 48 stations	-	-	-	-	-	-
Shoreline Transects	Transect tape along shoreline swaths. 2 x 20 m transects on beaches around Juneau.	1	10	10	-	-	-	-	-	-	-	-	-
Weirs	Weirs across Sashin Creek (Little Port Walter) and Auke Creek (with fish trap)	2	365	N/A	-	-	-	-	-	-	-	-	-

2.3 Mitigation Measures under the Status Quo and Preferred Alternatives

AFSC considers the current suite of mitigation and monitoring measures to be necessary to avoid adverse interactions with protected species and still allow the AFSC and its cooperating partners to fulfill their scientific missions. The mitigation measures currently used during research are also proposed under the Preferred Alternative during the period 2024 – 2029, with specific additions as noted (see Table 2-3). These mitigation measures are subject to change as a result of the notice and comment process to issue a new five-year final rule and letter of authorization (MMPA) and as a result of ESA Section 7 consultation.

All mitigation measures apply during IPHC research and IPHC researchers must follow all mitigation measures discussed below.

2.3.1 Specific Marine Mammal Monitoring and Mitigation Measures

All research vessels for AFSC and IPHC will conduct marine mammal monitoring. Because of limited berthing space and other constraints, a dedicated protected species observer (PSO) may not be possible on every vessel. Therefore, the designated chief scientist (CS), field party chief, lead sampler, or vessel captain will take on the role of Marine Mammal Visual Monitor (MMVM), or the CS may assign another crewperson to fulfill the dedicated MMVM role at any given time, and to staff assigned these duties. Prior to the cruise, MMVMs will receive training in marine mammal and sea turtle species identification and an MMVM packet that illustrates the AFSC Mitigation and Monitoring protocols including active avoidance, handling procedures, the move-on rule, recording, and reporting. Briefings between MMVM and any vessel crew who may look out for marine mammals will occur prior to the start of all research activity, and again when new personnel join the crew.

Monitoring protocols, protected species incidental take (PSIT) reporting, and operational and handling procedures are implemented whether occurring on AFSC, AFSC-supported, or IPHC cruises. MMVMs will watch for listed marine mammals and protected species, implement mitigation measures, and record significant observations and direct interactions with listed marine mammals or protected species.

A significant interaction is defined as:

- Marine mammals entering into the gear deployment area or waters within 100 yards of the vessel;
- Sightings of less common marine mammals including Cook Inlet DPS beluga whale, North Pacific right whale, blue whale, or sperm whale; As many photos as possible of North Pacific right whale (head shots are most helpful in identification);
- Marine mammals that do not move from a research site or survey station;
- Marine mammals that display unusual behavior or change behavior;
- Large groups of listed marine mammals (greater than 10 humpback whales or more than 2-3 of other species);
- If visible from the vessel, observe Steller Sea Lions at rookeries or haulouts and determine whether any alert, startle, or movement behavior (Table 79) is observed during the time the vessel is operating in the area, including any stampeding caused at Steller Sea Lion rookeries by the research operation.

Direct interactions are where a marine mammal contacts the vessel, is captured by or contacts the research gear or is injured from the gear, or the animal is otherwise injured or killed due to the research operation.

MMVMs will avoid continuous long durations (>4 hours at a time or a total of 12 hours per day) to prevent fatigue. As safety permits, the MMVM will be stationed where the best possible view can be maintained. MMVM will achieve 100% monitoring coverage of gear deployment areas. MMVMs will maximize eyes on the water time by employing an audio recorder or other data recorder.

MMVM will:

- Look and listen for marine mammals at least 15 minutes before approaching or occupying a study site or survey station and immediately report any sightings to the vessel operator so that appropriate avoidance procedures can be invoked;
- Watch for marine mammals while conducting a transect;
- Alert the vessel operator and vessel crew to the presence of any listed species;
- Monitor for listed marine mammals and protected species during transit between stations; this will occur during daytime hours;
- When protected or listed species are present, direct all vessel action necessary to initiate mitigation procedures including, for example, humpback whale approach regulations and the move-on rule (see Section 2.2.2);
- Use the AFSC Protected Species Interaction Form (Appendix B) or another consistent reporting mechanism to document less common marine mammal sightings and all vessel/marine mammal direct interactions. Section 8 of Appendix C provides instructions on how and when to report encounters with protected species.

The MMVM will record:

- As much information as possible about observations and direct interactions including time; weather; viewing conditions; sea state; distance from vessel; depths; and numbers, sizes, and sex of listed species;
- Marine mammals entering into the gear deployment area or waters within 100 yards of the vessel;
- Sightings of less common marine mammals including Cook Inlet Distinct Population Segment (DPS) beluga whale, North Pacific right whale, blue whale, or sperm whales;
- As many photos as possible of any observed North Pacific right whales; photos will be taken from an appropriate distance of > 500 yards.
- Marine mammals that do not move from a research site or survey station and any marine mammals that display unusual behavior or change behavior;
- Sightings of large groups of ESA-listed marine mammals such as a group of 10 or more humpback whales or groups of 3 or more other whales, ice seals, or Steller sea lions;
- Observations of Steller Sea lions at rookeries or haulouts and document any alert, startle, or movements as the research vessel operates in the area; critical habitat for Steller sea lions has

been identified around major Steller sea lion haulout areas and rookeries[2]. Section 2.2.4 describes specific mitigation measures for major haulouts and rookeries; and

- Direct interactions where a marine mammal contacts the vessel, is captured by or contacts the research gear or is injured from the gear, or the animal is otherwise injured or killed due to the research operation.

The MMVM will immediately report to their Division Directorate:

- Any and all direct interactions between a marine mammal and the vessel or gear. Direct interactions include vessel strikes, gear strikes, capture, injury, and mortality. The Division Directorate will then notify the AFSC Environmental Compliance Officer, Alaska Region Protected Resources Specialists, and the Alaska Marine Mammal Stranding Network.
- Significant observations of the following: any North Pacific right whale, Cook Inlet Beluga whale, or any stampeding caused at Steller sea lion rookeries by the research operation.

MMVMs will be provided the following equipment:

- Satellite phone with contact information or email system to communicate direct interactions including injuries and mortalities to survey managers;
- Daily tide and current tables for the action area;
- Stopwatch or timekeeping device;
- High magnification binoculars;
- Rangefinder;
- GPS and compass;
- PSIT or equivalent electronic forms;
- Electronic or hard copy of the final LOA;
- Electronic or hard copy of the final BiOp with Terms and Conditions; and
- Clipboard and pencils or computer, as available.

Additional mitigation measures that will be followed to lower the risk of vessel strikes of all listed species include:

- Based on recommendations from the MMVM, the vessel captain will actively avoid listed marine mammals using best professional judgement and will take direct action to avoid ship strikes such as slowing down, altering course, stopping, or even reversing course;
- Tow speed during surveys and transit speed between survey stations will be kept slow to minimize the risk of vessel strike; specific speeds are listed in (NMFS 2019a). AFSC and AFSC-supported research vessel speeds during trawling or deploying sampling will be less than 5 kts. IPHC vessel speeds will be less than 4 kts when research vessels are actively setting gear, and

[2] https://media.fisheries.noaa.gov/dam-migration/steller-sea-lion-critical-habitat-alaska.pdf; Accessed October 21, 2022

less than 2 kts when hauling gear. When marine mammals or other protected species are present, tow durations will be kept short, when possible, to minimize interactions;

- When transiting between sampling stations in designated critical habitat for Steller sea lions, North Pacific right whales, or Cook Inlet beluga whales and when conducting acoustic surveys in these critical habitat areas, vessels will slow to an effective speed of 10 kts any time ESA-listed marine mammals are observed within an estimated distance of 0.5 nm;
- When transiting through passes in the Aleutian Islands and through the Bering Strait, the MMVM and vessel captain will be extra vigilant in maintaining a watch and will assign additional watch standers if possible due to heavy use of these passes by marine mammals, including North Pacific right whale;
- Vessels may conduct research operations at night, transit between stations, jog or run patterns to maintain position and sea friendliness, drift, or anchor as long as the MMVM and vessel Captain are extra vigilant in maintaining a watch, assigning additional watch standers, listening for blows, and/or delay operations in areas of likely marine mammal occurrence; and
- When deploying gear at night, forward areas of the ship can remain dark for navigation but visibility amidships and aft must be at least 46 m (50 yards) around the vessel. During night-time or limited visibility gear deployments, the research area around the ship will be searched for marine mammals before gear deployment.

2.3.2 Specific Humpback Whale, Pacific Right Whale, and Steller Sea Lion Measures

Vessels engaged in research activities will follow the Alaska Humpback Whale Approach Regulations at all times (see 50 CFR §§ 216.18, 223.214, and 224.103(b)). These regulations require that vessels:

- Do not approach within 100 yards of a humpback whale, or cause another vessel or object to approach within 100 yards of a humpback whale;
- Do not intercept or enter the path of oncoming humpback whales causing them to surface within 92 m of the vessel;
- Do not disrupt the normal behavior or ongoing activity of a whale; and
- Operate at a slow, safe speed (see 33 CFR § 83.06) when near a humpback whale or whales.

Pursuant to the BiOp, research vessels will also follow the right whale approach regulations at 50 CFR § 224.103(c) both within and outside of North Pacific right whale critical habitat. These measures are also stated in the BiOp (NMFS 2019a):

- No one will approach (including by interception) within 500 yards of a right whale by vessel, aircraft, or any other means;
- If within 500 yards of a right whale when underway, a vessel will steer away from the right whale and immediately leave the area at a slow safe speed.

No-transit zones around Steller Sea lion rookeries and haulouts will be followed (50 CFR § 224.103(d)), with the exceptions discussed below. AFSC and AKR PRD staff will review any sites selected within 3 nm of rookeries and haulouts. If the review shows that disturbance at the rookeries or haulouts is unlikely

from research activities at the selected survey station, then the station may be included, subject to the move-on rule and other mitigation measures described in Sections 2.2.1, 2.2.2, and 2.2.3. If this review shows that disturbance is likely, research activities at that station will be avoided between April 20 and June 30, as was required in the 2019 BiOp (NMFS 2019a), and during other time periods at rookeries and year-round at haulouts, vessels should not transit within 2 nm of specified Steller Sea Lion rookeries and haulouts. All other regulations associated with Steller sea lion critical habitat will be followed (58 FR 53138, 58 FR 45269, 59 FR 30715). An additional mitigation measure for working around Steller Sea lion rookeries and haulouts provided in the 2019 BiOp (NMFS 2019a) will also be followed:

- If visible from the vessel, observe Steller Sea Lions at rookeries or haulouts and determine whether any alert, startle, or movement behavior is observed during the time the vessel is operating in the area, including any stampeding caused at Steller Sea Lion rookeries by the research operation.

2.3.3 Specific Mitigation Measures for Pacific Walrus

Any surveys that will occur in the Northern Bering Sea north of Nome, the Chukchi and/or Beaufort Seas, must work with USFWS on a Walrus and/or Polar Bear Interaction Plan during the planning of the survey.

Walruses in the water can be disturbed by underwater sounds produced by a vessel's engines and propellers. Cautiously move away from the animals if you observe any of the following behaviors:

- Rapid changes in direction or swimming speed
- Erratic swimming patterns
- Grouping up and “head bobbing” to investigate the source of the disturbance
- Escape tactics such as prolonged diving, underwater exhalation, underwater course changes, or rapid swimming at the surface
- Females attempting to shield a calf with her body or by her movements

Marine motor vessels should maintain a separation buffer from walruses hauled out on land or ice to avoid disturbance. Mariners should assume that known walrus haulouts will be occupied.

- Vessels less than 50 feet in length should remain **at least 0.5 nautical miles** away from a walrus haulout.
- Vessels 50 feet or more but less than 100 feet in length should remain **at least 1 nautical mile** away from a walrus haulout.
- Vessels 100 feet or more in length should remain **at least 3 nautical miles** away from a walrus haulout.
- All vessels should refrain from anchoring or conducting tendering or fishing operations **within 3 nautical miles** of a walrus haulout.

2.3.4 Specific Mitigation Measures for Seabirds and Sea Otters

For fisheries research using *trawl vessels and gear* the 2018 BiOp (USFWS 2018a) states:

- A designated PSO will be assigned for each survey cruise. The PSO will be the CS or a designee. PSOs are trained in protected species identification and all AFSC Mitigation and Monitoring protocols including active avoidance, recording, and reporting.

- The PSO's scope of responsibilities includes monitoring for threatened and endangered species. When the PSO is not on the bridge, the vessel operator will take up those essential functions to identify and avoid protected species and report any interaction to the PSO.
- The PSO will watch for protected species (including short-tailed albatross) and take proactive steps to avoid deploying the gear in any situation where there is a high likelihood for an interaction with protected species. In particular, the PSO will alert the vessel operator and vessel crew to the presence of short-tailed albatross. Under those circumstances, the PSO will direct all vessel action necessary to initiate mitigation procedures.
- The PSO will use the AFSC Protected Species Interaction Form or its equivalent to record all sightings of and significant interactions with short-tailed albatrosses.
- Third wires will be limited to use on mid-water trawls conducted during summer and winter acoustic surveys that target groundfish such as walleye pollock.
- Chumming (i.e., releasing additional bait to attract target species to the gear), or addition of offal to the water column, is not allowed during research trawl deployment.

For fisheries research using *longline vessels and gear*, the 2018 BiOp states:

- A designated PSO as described for trawl vessels will also be assigned for each longline vessel survey cruise. The PSO's scope of responsibilities, duties, and reporting requirements are also as described above for trawl vessels.
- Tori lines (paired streamers) must be deployed before longline gear is set. The paired streamer line mitigation measures follow the same deployment and performance standards required for commercial longline vessels, as recommended by Melvin *et al.* (2001, as cited in USFWS 2018b), and are derived from collaborative research conducted between Washington Sea Grant, NMFS, and the freezer longline and sablefish longline components of the commercial industry. A crewman must ensure that the streamer lines meet performance standards and are working properly, and the PSO is present during the set to ensure protocols are being followed.
- Longline gear must be set at a slow speed to ensure that the line sinks quickly, reducing the potential for entanglements. Seven-pound (lb.) lead balls or equivalent must be used to increase the sink rate and ensure the groundline reaches the seafloor.
- AFSC longline protocols specifically prohibit chumming before or during the longline setting operations (i.e., releasing additional bait to attract target species to the gear), but if research is being conducted on contracted commercial catcher/processors, spent bait and offal must be discarded away from the longline gear as it is being retrieved, thereby attracting marine mammals and birds away from the longline. Due to the volume of fish caught with each set and the length of time it takes to retrieve the longline (up to 8 hours), the retention of spent bait and offal onboard until the gear is completely retrieved is not possible.

These mitigation measures for all NMFS and UWFWs protected species also apply during IPHC research; written mitigation protocols must be followed by IPHC researchers and must be incorporated into contract language.

AFSC's *2020 Operational Mitigation Measures and Handing Procedures for Fisheries Research* (AFSC 2020a) outlines procedures to be conducted on board a NOAA vessel, or a vessel chartered by NOAA, IPHC, or an affiliate. The procedures described in the manual were developed based on protocols used during previous research surveys, best practices developed for commercial fisheries, or measures specified in MMPA and ESA regulatory documents.

From the 2020 manual, *general mitigation* measures and handling procures that apply to marine mammals and seabirds include:

- A Sea Bird Avoidance Plan must be prepared for all surveys that use longlines.
- Annual mitigation training is required for CSs and vessel operators.
- Each vessel must have a mitigation kit that includes range-finding binoculars, the AFSC encounter form, permits, the 2020 Mitigation Manual (AFSC 2020a), a spreadsheet format monitoring log, species identification guides and keys, the compliance quick review sheet, the entanglement flyer, and the AFSC Protected Species Handling form.
- A 2 nm area must be monitored for 15 minutes before every station by a trained and dedicated monitor. All research activities from gear deployment to gear retrieval will be monitored, along with transit between stations. Monitors will be stationed in a safe area with best possible viewing.
- To avid observer fatigue, continuous monitoring must not be for more than 4 hours.
- Each morning the deck will be checked for stranded birds.

The 2020 manual also includes the following *handling procedures* for captured seabirds:

- Personal safety must be maintained when handling a captured sea bird by wearing gloves and protecting your eyes.
- Ensure that the salvage form is correctly filled out.
- Identify the bird to species if possible.
- Photograph the bird(s).
- Describe the bird's condition.
- Check for leg bands or tags.

The BiOp completed for a recent consultation on NOAA-funded Distributed Biological Observatory time series cruises (USFWS 2021a) summarizes *specific mitigation applicable to ESA-listed birds* from the 2020 manual:

- NOAA requires extra vigilance in maintaining watch and will assign additional watch standers due to the greater risk of encountering ESA-listed birds in areas heavily used including molting areas, areas of critical habitat, and along passes around the Aleutian Islands and through the Bering Strait.
- Monitors must receive additional training on all mitigation measures including how to identify ESA-list birds, and what to do with unknown species.

- If research gear is deployed after dark or during limited visibility, the area around the ship must be searched for congregations of ESA-listed birds before gear is deployed.

NOAA will require vessels do the following to prevent bird strikes:

- Slow down, alter course, stop, or reverse course to avoid striking ESA-listed birds.
- Tow speeds during AFSC surveys and while deploying sampling gear will be less than 5 knots (kts), during IPHC surveys will be less than 4 kts when research vessels are actively setting gear, and less than 2 kts when hauling gear.
- Tow durations will be kept short, when possible, to minimize interactions with ESA-listed birds.
- For night-time research operations, the CS and vessel operator will be extra vigilant in maintaining a watch, assign additional watch standers, and look out for congregations or flocks of eiders. If necessary, the CS and vessel operator will use best judgement as to whether the research vessel should delay operations or *move on* to avoid large rafts of seabirds or locations where there is considerable fishing vessels as well as seabirds. This could occur during seasons of higher seabird occurrence, August through April, or in locations where there is significant overlap between seabirds and fishing vessels. This *move-on* approach for eiders is similar to the *move-on* mitigation measure used by AFSC research vessels to avoid large whales and/or aggregations of marine mammals (NMFS 2019c).
- When deploying gear after daylight, mariners should attempt to keep deck lighting to a minimum, and shield lights to direct illumination inboard and downward to the extent possible while still maintaining compliance with navigation rules. If red lighting is used, those lights should be limited to interior spaces, and that windows be shaded to the extent practicable when indoor spaces must be lit at night.

Specifically for *sea otters* the manual states that:

- If a sea otter carcass that has been dead less than 24 hours is found, USFWS (1-800-362-5148) or the Alaska Sea Life Center (1-888-744-7325) must be contacted.
- The carcass is less than 24 hours old if there are no maggots or flies observed, no foul odors or dark fluids, eyes are present and not wrinkled or shrunken, the animal was observed alive within the last 12 hours, the body is not scavenged, and the fur does not pull free in clumps.

Table 2-3. Proposed Mitigation Measures

	Alternative 1 No Action, Status Quo Alternative	Alternative 2 Preferred Alternative
General Measures Applicable to All Surveys (Alt. 1 and 2 similar)	● Coordination and Communication: In advance of each survey, coordination with the NOAA Office of Marine and Aviation Operations or other relevant parties to ensure clear understanding of the mitigation measures and the manner of their implementation. Conduct briefings at the outset of each survey and as necessary with the ship's crew. Chief scientist (CS) to coordinate with Officers on Deck (OOD) or equivalent to ensure procedures are understood. ● Vessel speed: if vessel crew or dedicated observers sight protected species that may intersect the vessel, they will immediately communicate with the bridge for appropriate course alteration or speed reduction as possible. When transiting between sampling stations, AFSC, IPHC, or contracted research vessels will cruise at 6-14 kts but average about ten kts. ● Vessels engaged in research will follow the NMFS Code of Conduct for Marine Mammal Viewing (https://www.fisheries.noaa.gov/alaska/marine-life-viewing-guidelines/alaska-marine-mammal-viewing-guidelines-and-regulations) and will: o Remain at least 100 yards from marine mammals; o Time spent observing individual(s) animals will be limited to 30 minutes; o Whales will not be encircled or trapped between boats or boats and shore. o If approached by a whale, will put the engine in neutral as sea conditions allow and allow the whale to pass. ● Tow speed during surveys and transit speed between survey stations will be kept slow to minimize the risk of vessel strike; specific speeds are listed in (NMFS 2019a). AFSC and AFSC-supported research vessel speeds during trawling or deploying sampling will be less than 5 kts. IPHC vessel speeds will be less than 4 kts when research vessels are actively setting gear, and less than 2 kts when hauling gear. When marine mammals or other protected species are present, tow durations will be kept short, when possible, to minimize interactions. ● Protected species watches shall be conducted by watch-standers (those navigating the vessel and/or other crew) at all times when the vessel is being operated. ● MMVM will avoid continuous long durations (>4 hours at a time or a total of 12 hours per day) to prevent fatigue. As safety permits, the monitors will be stationed where the best possible view can be maintained and will achieve 100% monitoring coverage of gear deployment areas. MMVMs will maximize eyes on the water time by employing an audio recorder or other data recorder. ● When deploying any type of sampling gear at sea monitoring for any unusual circumstances will be done and professional judgement will be used to avoid any risks to marine mammals, turtles, and birds during use of all research equipment. This requirement will be conveyed to IPHC. ● AFSC will designate a compliance coordinator who shall be responsible for ensuring compliance with all requirements. ● Protected Species Training: Conduct a formalized protected species training program for all crew members that are part of AFSC and IPHC affiliated research and cooperative research. Training will include topics such as monitoring and sighting protocols, species identification, decision-making factors for avoiding take, instructive examples of where the use of best professional judgement was determined to be successful or not, protocols for handling and documenting protected species interactions, and reporting requirements (see Appendix C for Protected Species Handling Procedures). ● Review written protocols for avoiding adverse interactions with protected species and make them fully consistent with training materials and guidance. In addition, review informational placards and reporting procedures and update as necessary. ● Implement the handling or disentanglement protocols when necessary. ● Incorporate specific language into vessel and cooperating partner contracts that stipulates all training requirements, operating procedures and reporting requirements. ● Do not approach within 1 km of locations where marine mammals are aggregated, including pinniped rookeries and haulouts unless research cleared by AKRO.	

	Alternative 1 No Action, Status Quo Alternative	Alternative 2 Preferred Alternative
Surveys Using Trawl Gear (Alt. 1 and 2 similar)	● For all trawl surveys (surface, midwater and bottom), the OOD, CS (or other member) and crew standing watch on the bridge will scan for protected species using binoculars during all daytime operations. The goal is 360-degree monitoring coverage around the vessel. ● For all trawl surveys, the period of protected species monitoring will begin before the vessel arrives on station and for 15 min before net deployment and will extend continuously until the net has been retrieved typically for over 30 min on all trawl types. Monitoring will also be conducted during any pre-set activities including trackline reconnaissance, conductivity, temperature, and depth (CTD) casts, and plankton or bongo net hauls. ● Scan the surrounding waters with the naked eye and rangefinding binoculars. During nighttime operations, visual observation will be conducted using the naked eye and available vessel lighting. ● The CS must confirm with the captain or the bridge that no marine mammals or other protected species have been seen within 500 m of the ship or appear to be approaching the ship during a 10-minute period prior to the deployment of any trawl gear. ● For surface trawls using the Nordic 264 trawl, two pairs of acoustic signaling devices known as “pingers” are installed near the net opening, one on either side. Acoustic pingers, when submerged, emit an underwater pulse of sound, or “ping”. The intent of these devices is to discourage protected species from entering the net. Nordic 264 trawl nets will be fitted with Marine Mammal Excluder Devices. ● Whenever surface trawl nets are used in southeast Alaska, AFSC will install and use acoustic deterrent devices, with two pairs of the devices installed near the net opening. AFSC must ensure that the devices are operating properly before deploying the net. ● If protected species are sighted within 500 m of the vessel and are considered at risk of interaction before setting the gear, the OOD may decide to implement the “move-on” rule and transit to a different section of the sampling area. If killer whales are sighted at any distance in the Puget Sound Research Area, the “move-on” rule is applied. In lieu of moving on, the vessel can remain on site for 10 minutes to see if the animals move. If animals do move on, the MMVM will watch for another 10 minutes and if there are no other sightings the gear can be deployed. Trawl gear will not be deployed if protected species are sighted near the ship unless there is no risk of interaction as determined by the OOD or CS. ● After moving on, monitoring protocols continue as reconnaissance of the new location is conducted and any other scientific gear is deployed (CTDs, bongos, etc.), a period of at least 10 minutes since moving to the new location. If protected species are still visible from the vessel and appear at risk, the OOD may decide to move again or skip the station. The OOD and CS may discuss strategies for avoid takes of these species. ● If trawling has been suspended because of protected species presence, trawl operations only resume when the animals have no longer been sighted, are outside minimum approach distance, or are no longer at risk. ● Continue visual monitoring while gear is deployed. If protected species are sighted before gear retrieval, the CS, watch leader, or OOD will determine the best action to minimize interactions with animals. ● Care will be taken when emptying the trawl, including opening the cod end as close as possible to the deck of the checker (or sorting table) in order to avoid damage to protected species that may be caught in the gear but are not visible upon retrieval. ● Conduct standard tow durations of no more than 30 minutes excluding deployment and retrieval at target depths for less than 3 nm. ● Clean gear prior to deployment. Empty gear as quickly as possible to ensure no protected species or birds are entangled.	

	Alternative 1 No Action, Status Quo Alternative	Alternative 2 Preferred Alternative
Gillnet Gear (Alt. 1 and 2 similar)	● Gillnet operations will be conducted as soon as is practicable upon arrival at the sampling station. ● MMVM watch will be conducted prior to beginning of net deployment as described above for trawl gear. ● The "move-on" rule will be implemented as described above for trawl gear. ● AFSC shall maintain visual monitoring effort will be continued during the entire period of time that gillnet gear is in the water (i.e., throughout gear deployment, fishing, and retrieval). If marine mammals are sighted before the gear is fully removed and appear to be at risk of interaction gear will be pulled immediately. AFSC may use best professional judgment in making this decision. ● If gillnet operations have been suspended because of the presence of marine mammals, they will resume when practicable only when the animals are believed to have departed the minimum approach distance of 100 y ards. AFSC may use best professional judgment in making this determination. ● Acoustic deterrent devices will be installed and used on all gillnets. AFSC will ensure that the devices are operating properly before deploying the net.	
Beach Seine Gear	● Visually survey the area for protected species prior to set. ● Do not make the set if hauled out pinnipeds are within 200 m. ● Lift and remove the gear from the water if protected species are observed to be interacting with it.	● Bird entrapment by beach seines will be avoided because they will be visible from the small boats deploying such nets. If birds could be potentially entrapped, the seines will not be deployed. ● Other mitigation measure to protect shorebirds: o NMFS researchers will not travel beyond wet sand beach and up on to dry sand beach. o Pulling the seine only requires that the ends wind up on the edge of the water. o Lunch will be eaten on the boat, not on the beach. ● Seines will be kept in the wet to protect the non-target fish that will be released. ● All other mitigation measures same as Status Quo Alternative.
Setline and Longline Surveys, and Hook and Line or Rod and Reel Surveys	● Conduct visual monitoring at least 30 minutes prior to the setting the gear or for the duration of transit between set locations if shorter than 30 minutes. Monitoring shall be conducted as described above for trawl surveys ● Implement the "move on" rule as described for trawl surveys if any protected species are present within 500 m of the vessel and appear to be at risk of interactions. ● Deploy gear as soon as possible upon arrival on station (depending on marine mammal presence). MMVM maintains visual monitoring throughout deployment and gear retrieval. ● If setting operations have been halted due to the presence of the protected species, setting can resume only if no protected species have been observed for at least 30 minutes. ● If protected species are detected within 500 m of the area and are at risk of entanglement, haul-back of the gear may be postponed until the officer on watch determines that it is safe to proceed. ● Chumming is prohibited. Bait must be removed from hooks during longline retrieval and retained on the vessel until all gear is	● To protect short-tailed albatross and other birds, AFSC will test the use of night-time only operations. Night setting is an accepted best practice to prevent seabird bycatch in longline fisheries globally (Løkkeborg 2011). Melvin *et al.* (2019) also reported dramatic positive effects of night setting for albatrosses and shearwaters, whose bycatch per unit effort were >85% lower at night. For surveys that cannot employ nighttime only operations, other mitigation options include line weighting, alternative float and weight configurations, slower setting speed, offal retention. ● For all longline surveys paired streamers to deter birds must be used. Melvin *et al.* (2019) reported a 78% decrease in seabird bycatch after the adoption of streamer lines as mitigation to avoid interactions between commercial fisheries and short-tailed albatross. Streamer lines are used by AFSC to avoid interactions with seabirds, including short-tailed albatross. ● All other mitigation measures same as Status Quo Alternative.

	Alternative 1 No Action, Status Quo Alternative	Alternative 2 Preferred Alternative
	removed from the area. No discards of offal or spent bait will occur while longline gear is in the water. ● Monitoring and baiting procedures for hook and line and rod and reel gear are the same as those for longline gear.	
Pot and Trap Gear	● No specific requirements.	● Use of weighted lines is required for crab traps. ● If beach traps are used, fit them with aluminum bars to prevent protected species from entering the holding/collection area. ● All other mitigation measures same as Status Quo Alternative.
Plankton Nets, Fyke Nets, Cast Nets, Small-mesh Towed Nets, Oceanographic and Water Sampling Devices, Divers, and Video Cameras	● These gear types are not considered to pose risk to protected species because of their small size, slow deployment speeds, and structure. Therefore, no specific mitigation measures are required. However, the officer on watch and crew will monitor for any unusual circumstances that may arise at a sampling site and use professional judgment and discretion to avoid any potential risks to protected species during deployment.	● Bird entrapment by small, towed nets will be avoided because birds will be visible from the small boats deploying such nets. If birds could be potentially entrapped, the nets will not be deployed. ● All other mitigation measures same as Status Quo Alternative.
Uncrewed Systems (UxS) - Including Uncrewed Aerial Systems (UAS – Drones) and USV (Saildrones)	● Use of UAS must comply with applicable Federal Aviation Administration (FAA) regulations. ● UAS only to be flown by an experienced operator. ● UAS altitudes may range up to 400 ft above ground level depending on the method of use (i.e., flying transects or targeting specific species) or species involved. UAS will not be flown directly over pinniped haulouts or birds. ● UAS flights will be line of sight in accordance with FAA regulations and in accordance with applicable sections of NOAA's UAS Policy 220-1-5 (NOAA 2019). ● Use of USV such as Saildrones or remotely operated vehicles (ROVs) pose minimal risk to protected species, but researchers must follow standard avoidance measures before deployment. ● For work in intertidal areas UAS will not be launched near bird besting areas or over groups of birds or pinnipeds. ● If a marbled murrelet is observed in the area, UAS operations will cease until the bird(s) have left the area. ● Key seabird nesting and breeding locations will be avoided. ● As per regulation (50 C.F.R. § 27.34), UAS cannot take off or land on Refuge lands.	
Sea Turtle Measures	● AFSC will take appropriate measures to handle and release sea turtles without injury, consistent with procedures in 50 CFR 223.206(d)(1). ● If applicable, crew will measure, photograph, and apply flipper and passive integrated transponder tags to any live sea turtle, and salvage any carcass or parts or collect any other scientifically relevant data from dead sea turtles, per authorization in 50 CFR 222.310 (endangered) and 223.206 (threatened) regarding the handling of ESA-listed sea turtles by designated NMFS agents (see Appendix C for Protected Species Handling Procedures).	
Salmonid Measures	● With the exception of directed research that is permitted under Section 10 of the ESA to take salmonids, AFSC may elect to retain any whole or part (e.g., fin clip) of dead sub-adult salmon that are incidentally captured.	

	Alternative 1 No Action, Status Quo Alternative	Alternative 2 Preferred Alternative
	● Live adult salmon will be handled as priority and will be processed quickly (weighed and measured) and returned to the water as soon as practicable.	
Handling Procedures for Incidentally Captured Individuals (see Appendix C)	● Handling Procedures (see Appendix C): Implement AFSC established protocols to reduce interaction with protected species following a step-wise order; 1) ensure health and safety of crew; 2) depending on how and where an animal is hooked or entangled, take action to prevent further injury to the animal; 3) take action to increase the animal's chance of survival; and 4) record detailed information on the interaction, actions taken and observations of the animal throughout the incident. ● Captured live or injured protected species are released from research gear and returned to the water as soon as possible with no gear or as little gear remaining on the animal as possible. Animals are released without removing them from the water if possible. Data collection is conducted in such a manner as not to delay release of the animal(s) and should include species identification, sex identification if genital region is visible, estimated length, disposition at release (e.g., live, dead, hooked, entangled, amount of gear remaining on the animal, etc.) and photographs. The CS or crew should collect as much data as possible from hooked or entangled animals, considering the disposition of the animal; if it is in imminent danger of drowning, it should be released as quickly as possible. Biological samples could only be collected in accordance with Section 109(h)(1) of the MMPA for live/dead protected species (non-listed) or under a directed scientific research and enhancement permit. ● If a large whale is alive and entangled in fishing gear, the vessel should immediately call the U.S. Coast Guard at Very High Frequency Channel 16 and/or the appropriate Marine Mammal Health and Stranding Response Network. Entangled whales may be reported to the NOAA Fisheries entanglement reporting hotline (1-877-767-9425). ● The CS will submit data on all captured animals to marine mammal experts at the appropriate NMFS Science Center who will use specific criteria to determine whether the injury is considered serious (i.e., more likely than not to result in mortality). If insufficient data has been collected for any reason, the marine mammal experts may not be able to determine the severity of the injury. However, the marine mammal experts may use other types of information to assign the injury to either the serious or non-serious categories. ● Regarding sea otters, AFSC's 2020 Operational Mitigation Measures and Handing Procedures for Fisheries Research (AFSC 2020a) states that If a sea otter carcass that has been dead less than 24 hours is found, USFWS (1-800-362-5148) or the Alaska Sea Life Center (1-888-744-7325) must be contacted. The carcass is less than 24 hours old if there are no maggots or flies observed, no foul odors or dark fluids, eyes are present and not wrinkled or shrunken, the animal was observed alive within the last 12 hours, the body is not scavenged, and the fur does not pull free in clumps.	

3 AFFECTED ENVIRONMENT

Section 3 of the 2019 PEA (NMFS 2019c) provides a comprehensive summary of physical, biological and socioeconomic resources that characterize the affected environment within the Project Area. As a supplement to the 2019 PEA, this section reviews all resources but only provides detailed updates for resources that have changed in status or condition, or that may be affected by the new proposed research activities described under the Preferred Alternative.

3.1 Physical Environment

The 2019 PEA describes the physical environment and large marine ecosystems that comprise the AFSC and IPHC research areas. This information has not changed and is herein incorporated by reference. The PEA also lists and describes all special resource areas such as designated EFH, Habitat Areas of Particular Concern (HAPCs), closed areas, and MPAs and National Marine Sanctuaries (NMS) in the AFSC research areas. There are no NMS in Alaska.

Table 3-1. Physical Environment Status Summary

Special Resource Area	Reference	Description/Change since 2019 PEA
EFH and HAPC	86 FR 51833 86 FR 60568 87 FR 66125 NPFMC and NMFS (2023)	The Salmon Fisheries FMP (Amendments 14 and 15), the BSAI King and Tanner Crab FMP (Amendment 51), and the Scallop Fishery FMP (Amendment 17) were amended in 2021. The BSAI Groundfish FMP (Amendment 124) and the GOA Groundfish FMP (Amendment 112) were amended in 2022. These amendments did not change or affect EFH or HAPC designations in Alaskan waters.
Closed Areas	https://www.adfg.alaska.gov/index.cfm?adfg=cfnews.main https://www.akleg.gov/basis/get_documents.asp?docid=15357 https://alaskabeacon.com/2023/05/03/to-protect-orcas-federal-judge-orders-closure-of-iconic-southeast-alaska-troll-fishery/ https://www.adfg.alaska.gov/index.cfm?adfg=commercialbyareasoutheast.main All Accessed June 6, 2023	The 2019 PEA (Table 3.3-1) identified 51 areas within AFSC research areas in GOARA and BSAIRA with seasonal or year-round closures to all fishing gear or trawling or pot gear only. The CSBSRA is closed to commercial fishing. Emergency or seasonal closures to protect crab habitat, salmon habitat, or other stocks and habitat are also enacted each year. In addition, due to declining crab populations, numerous commercial and personal use king and tanner crab fisheries were closed in 2023.
MPAs	https://marineprotectedareas.noaa.gov/dataanalysis/mpainventory/mpaviewer/ https://www.nationalparks.org/explore/parks/bering-land-bridge-national-preserve https://www.nps.gov/cakr/index.htm All Accessed June 6, 2023	Table 3.1-4 of the 2019 PEA describes 16 MPAs in AFSC research areas. MPAs include wildlife refuges, research reserves, habitat conservation areas, and historic parks, national parks and preserves (Glacier Bay and Katmai) and a marine reserve (Sitka Pinnacles). Two additional MPAs were not included in the 2019 PEA: Cape Krusenstern National Monument and the Bering Land Bridge Preserve (both designated in 1978).
NMS	87 FR 6850	While there are currently no designated NMS in Alaskan waters, a nomination for the St. George Unangan Heritage NMS was accepted to the national inventory in January 2017. In 2022, a final determination confirmed the Unangan Heritage NMS will remain in the inventory beyond a January 27, 2022 expiration date. In addition, the Alaĝum Kanuux̂ site in the Bering Sea was nominated as a NMS in 2021 and added to the inventory of successful nominations on June 8, 2022.

3.2 Biological Environment

3.2.1 Fish

The following subsections describe the following categories of fish species that maybe encountered in AFSC research areas: ESA-listed fish; target fish under the FMPs; ecosystem component species, including prohibited species, under the FMPs; and other fish species. Although three elasmobranchs (Pacific sleeper shark, salmon shark and spiny dogfish) are found in Alaska waters, they are either not migratory (Pacific sleeper shark) or not managed as highly migratory species (HMS) (salmon shark and spiny dogfish) (PFMC 2023).

3.2.1.1 ESA-Listed Fish

As shown in Table 3-2, ESA-listed fish potentially found in the GOARA or BSAIRA include green sturgeon, Pacific salmon, and steelhead trout. Detailed descriptions of these species can be found in Section 3.2.1.1 of the 2019 PEA (NMFS 2019c). Designated critical habitat that may be affected by AFSC and IPHC activities is discussed in Section 3.2.1.1.1 of this SPEA.

No stocks of Pacific salmonids that originate from freshwater habitat in Alaska are listed under the ESA. However, ESA-listed Pacific salmon Evolutionary Significant Units (ESUs) and DPSs of steelhead trout that originate in freshwater habitat in Washington, Oregon, Idaho, and California migrate into marine waters off Alaska and have been found in coded wire tag retrieval data in Prince William Sound (Brase and Sarafin 2004). In Alaska waters, ESA-listed salmonid ESUs mix with hundreds to thousands of other non-listed ESUs originating from the Pacific coast, Alaska, and Asia (NMFS 2019c). The Pacific salmon ESUs and steelhead trout DPSs potentially encountered by AFSC and IPHC research efforts are shown in Table 3-2.

Other ESA-listed Pacific salmon and steelhead populations originating in the Sacramento River or California Central Valley may be encountered in Oregon and Washington waters where IPHC research uses longlines and setlines. In addition, threatened eulachon from the Southern DPS, and the Puget Sound/Georgia Basin DPSs of bocaccio (endangered) and Puget Sound/Georgia Basin DPS yelloweye rockfish (threatened) may also be encountered in coastal waters of the Pacific Northwest. However, while IPHC research activities using setlines occurs in Washington and Oregon coastal waters where fish from these DPSs may be encountered, IPHC research has not taken fish from any of these populations over the period 2016-2022 (personal communication, AFSC August 2023). IPHC activities do take yelloweye rockfish in Alaskan waters but they are not from an ESA-listed DPS. Therefore, only those ESA-listed fish ESUs or DPSs that may range into Alaskan waters and be encountered by AFSC and IPHC research efforts in Alaskan waters are included in this SPEA. Any critical habitat potentially affected by IPHC setline and longline activities in U.S. west coast waters is described in Section 3.2.1.1.1.

On October 4, 2019, NMFS initiated the 5-year review process for 17 Pacific salmon ESUs and 11 Steelhead DPSs (84 FR 53117). As of June 2023, some but not all of these status reviews were available for species potentially encountered by AFSC research activities. Table 3-2 summarizes the status of the potentially affected ESUs, indicates which 5-year reviews have been completed, and shows the most currently available information for all ESA-listed fish ESUs or DPSs that may be encountered by AFSC and IPHC research activities.

Table 3-2. ESA-Listed Fish Species/Populations Potentially Within the Project Area

ESA-Listed Fish Species	DPS, ESU or Stock	Current ESA Status	Current Estimated Abundance	References	Description/Change from 2019 PEA
Green Sturgeon *(Acipenser medirostris)*	Southern DPS	T	2,106 adults 11,055 subadults	**NMFS (2018a)** **Mora *et al.* (2018)** 71 FR 17757 74 FR 52300 **NMFS (2019a)** **NMFS (2021a)** 85 FR 12905	No change in ESA-listed status or critical habitat. Critical habitat designated in 2009 off U.S. west coast and in certain coastal bays and estuaries of Oregon and Washington and thus may be encountered by IPHC research activities (see Section 3.2.1.1.1). Species rare in Alaskan waters; presence is limited to a few anecdotal reports of sightings and captures, occurring mostly in southeastern Alaska (at the mouths of the Stikine and Taku rivers) (NMFS 2019a). Marine distribution considerably larger than freshwater habitat and extends from Mexico into Alaska. The 5-year review was initiated in 2020 and completed in 2021; no change warranted.
Chinook Salmon (*Oncorhynchus tshawytscha*)	Lower Columbia River ESU	T	68,061	**NMFS (2016a)** **Wilson *et al.* (2020)** NMFS (2013) **NMFS (2019a)** **NMFS (2022d)** 70 FR 37160 70 FR 52630	5-year review process for 17 Pacific salmon ESUs initiated on October 4, 2019 (84 FR 53117). Some reviews are complete as noted here. Designated critical habitat for Chinook species that may be encountered by IPHC research in Washington, Oregon or California is discussed in Section 3.2.1.1.1. No change in status for this DPS. The 2022 5-year review confirmed the Lower Columbia River ESU of Chinook salmon should remain listed as threatened.
	Puget Sound ESU	T	32,481 adults	**NMFS (2016d)** **NMFS (2007b)** **NMFS (2019a)** 70 FR 37160 70 FR 52630	No change in status. Most recent 5-year review completed in 2016. Latest 5-year review not available as of August 2023. As of 2019, average adult escapement was estimated to be 32,481.

ESA-Listed Fish Species	DPS, ESU or Stock	Current ESA Status	Current Estimated Abundance	References	Description/Change from 2019 PEA
Chinook Salmon (con't)	Snake River Fall Run ESU	T	11,254 adults	**NMFS (2016e)** **NMFS (2017a)** **NMFS (2019a)** **NMFS (2022b)** 70 FR 37160 58 FR 68543	No change in status. The most recent 5-year review for the Snake River Fall Run ESU was completed in 2022. No change in status was warranted and the ESU remains threatened.
	Snake River Spring/Summer Run ESU	T	17,043 adults	**NMFS (2016e)** **NMFS (2017b)** **NMFS (2019a)** **NMFS (2022g)** 70 FR 37160 58 FR 68543	No change in status. The most recent status review was completed in 2022. No change in status was warranted and this ESU remains threatened. However, NMFS is concerned about current trends in abundance and productivity and recommends specific actions at the population and ESU levels over the next 5 years. A new status review prior to the standard 5-year period has been recommended.
	Upper Columbia River Spring Run ESU	E	9,057 adults	**NMFS (2016f)** **NMFS (2016h)** UCSRB (2007) **NMFS (2019a)** **NMFS (2022h)** 70 FR 37160 70 FR 52630	No change in status. The 2022 status review for the Upper Columbia River spring run ESU found that no change in status was warranted and the ESU remains endangered.
	Upper Willamette River ESU	T	45,896	**NMFS (2016g)** ODFW and NMFS (2011) **NMFS (2019a)** 70 FR 37160 70 FR 52630	No change in status. The 5-year review was published in 2016. As of August 2023, the most recent 5-year review for this ESU is not available.

ESA-Listed Fish Species	DPS, ESU or Stock	Current ESA Status	Current Estimated Abundance	References	Description/Change from 2019 PEA
Chum Salmon (*Oncorhynchus keta*)	Columbia River ESU	T	10,644 (average total adult escapement 2002-2014)	**NMFS (2016a)** NMFS (2013) **NMFS (2019a)** **NMFS (2022d)** 70 FR 37160 70 FR 52630	No change in status. The 5-year review for Columbia River chum salmon was completed in 2022 and concluded that this ESU of chum salmon should remain listed as threatened.
	Hood Canal Summer Run ESU	T	27,452 adult spawners	**NMFS (2016d)** **Brewer *et al.* (2005)** **NMFS (2019a)** 70 FR 37160 70 FR 52630	No change in status. The 5-year review was published in 2016. As of August 2023, the most recent 5-year review for this ESU is not available.
Coho Salmon (*Oncorhynchus kisutch*)	Lower Columbia River ESU	T	~56,000 total adult spawners (3-year average).	**NMFS (2016a)** NMFS (2013) **NMFS (2019a)** **NMFS (2022d)** 70 FR 37160 81 FR 9252	No change in status. The 2022 5-year review concluded that this ESU of coho salmon should remain listed as threatened.
Sockeye Salmon (*Oncorhynchus nerka*)	Ozette Lake ESU	T	2,321 adult spawners	**NMFS (2016c)** **NMFS (2009b)** **NMFS (2019a)** **NMFS (2022f)** 70 FR 37160 70 FR 52630	No change in status. Based on results of the 2022 5-year review, NMFS determined the Ozette Lake ESU should remain classified as threatened.

ESA-Listed Fish Species	DPS, ESU or Stock	Current ESA Status	Current Estimated Abundance	References	Description/Change from 2019 PEA
Sockeye Salmon (con't)	Snake River ESU	E	1,373 adults	**NMFS (2016e)** NMFS (2015) **NMFS (2019a)** **NMFS (2022c)** 70 FR 37160 58 FR 68543	No change in status. The most recent status review (2022) for the Snake River ESU found that no change in either delineation or status as endangered was warranted.
Steelhead Trout (*Oncorhynchus mykiss*)	Lower Columbia River DPS	T	Current population estimates are not available.	**NMFS (2016a)** NMFS (2013) **NMFS (2019a)** **NMFS (2022d)** 71 FR 834 70 FR 52630	October 4, 2019, NMFS initiated the 5-year review process for 11 Steelhead DPSs (84 FR 53117). Comment period on review extended to May 26, 2020 (85 FR 16619). As of June 2023, several steelhead 5-year reviews are available as noted below. Critical habitat does not extend into AFSC/IPHC action area (NMFS 2019a). Therefore, the actions being considered would not affect steelhead trout critical habitat and it is not discussed further. The 2022 5-year review concluded that this DPS of steelhead should remain listed as threatened.
	Middle Columbia River DPS	T	Current population estimates are not available.	**NMFS (2016b)** **NMFS (2009a)** **NMFS (2019a)** **NMFS (2022e)** 71 FR 834 70 FR 52630	No change in status. The 2022 5-year status review concluded no change in status for this DPS; it remains threatened. In addition, there was no change in delineation of the DPS.
Steelhead (con't)	Puget Sound DPS	T	Current population	**NMFS (2016d)** **NMFS (2019a)** 72 FR 26722	No change in status. The most recent The 5-year review for this DPS was completed in 2016. As of August 2023, a more recent review is not available.

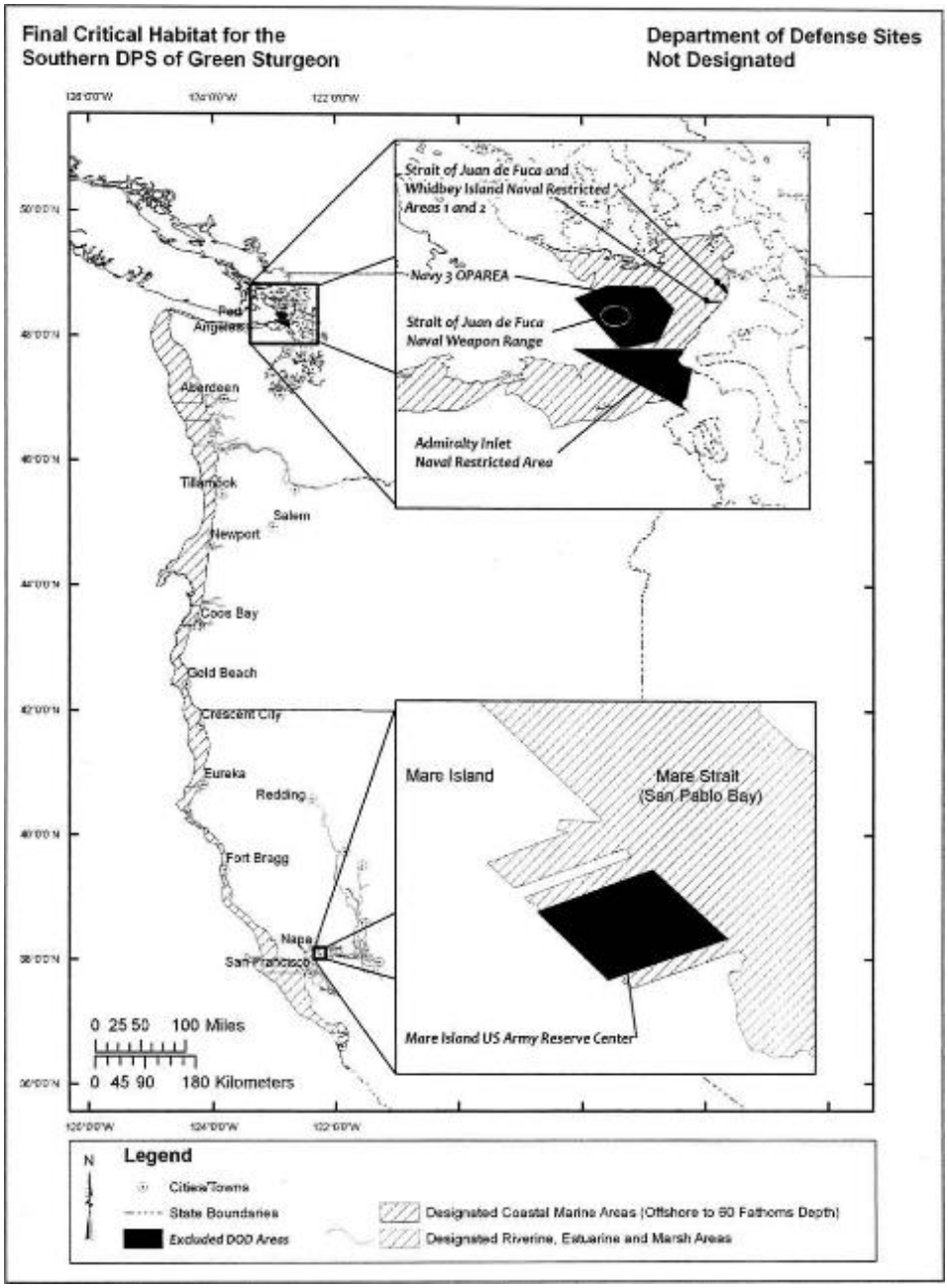
ESA-Listed Fish Species	DPS, ESU or Stock	Current ESA Status	Current Estimated Abundance	References	Description/Change from 2019 PEA
			estimates are not available	81 FR 9252	
	Snake River Basin DPS	T	71,000 adults yearly average 1990-1994	**NMFS (2016e)** **NMFS (2017b)** **NMFS (2019a)** **(NMFS 2022a)** 71 FR 834 70 FR 52630	No change in status. The 2022 5-year status review did not recommend any change in status; it remains threatened. Also no change in delineation of DPS was warranted.
	Upper Columbia River DPS	T	2,340	**NMFS (2016f)** UCSRB (2007) **NMFS (2019a)** **NMFS (2022h)** 71 FR 834 70 FR 52630	The most recent status review completed in 2022 found that no change in status was warranted and the ESU remains threatened.
	Upper Willamette River DPS	T	Current population estimates are not available	**NMFS (2016g)** ODFW and NMFS (2011) **NMFS (2019a)** 71 FR 834 70 FR 52630	No change in status. The most recent The 5-year review for this DPS was completed in 2016. As of August 2023, a more recent review is not available.

[1]ESA-listing status includes Endangered (E), Threatened (T) or Candidate Species (50 CFR 17.11).

3.2.1.1.1 Designated Critical Habitat for ESA-listed Fish

Green Sturgeon: NMFS designated critical habitat for the southern DPS of green sturgeon in 2009 (74 FR 52300). This final rule designated approximately 515 km of riverine habitat, 2,323 square kilometers (km^2) of estuarine habitat, and 29,581 km^2 of coastal marine habitat in California, Oregon, and Washington. The rule also designated approximately 784 km of habitat in the Sacramento-San Joaquin Delta, and 350 km^2 adjacent to the Sacramento River (Figure 3-1).

Figure 3-1. Green Sturgeon Southern DPS Critical Habitat



Source: 74 FR 52299

Chinook Salmon Critical Habitat[3]: In 1993, NMFS designated critical habitat for Snake River Chinook salmon runs (58 FR 68543). In 1999, critical habitat was revised for the Snake River Spring/Summer Run (64 FR 57399). At that time NMFS designated all river reaches presently or historically accessible to listed spring/summer Chinook salmon (except river reaches above impassable natural falls, Dworshak and Hells Canyon Dams, and Napais Creek). The designations also included offshore marine areas with water quality conditions and forage such as invertebrates and fishes that support growth and maturation of Chinook salmon.

In September 2005 (effective January 2, 2006), NMFS designated critical habitat for four Chinook salmon ESUs: Lower Columbia River; Puget Sound; Upper Columbia River Spring Run; and the Upper Willamette River (70 FR 52630, 52684). This critical habitat in Puget Sound and the Columbia River Estuary is defined as the photic zone or the extreme high water line out to a depth of 30 m.

Chum Salmon Critical Habitat: In September 2005 (effective January 2, 2006), NMFS designated critical habitat for the Columbia River and Hood Canal Summer Run chum salmon ESUs (70 FR 52630, 52684). The designation included estuarine and nearshore marine areas, and offshore marine areas that support forage for growth and maturation of salmon.

Coho Salmon Critical Habitat: A final rule designating critical habitat for the Lower Columbia River ESU of coho salmon was published on February 24, 2016 (81 FR 9252). In this rule NMFS designated about 3,701 stream miles within the lower Columbia River as critical habitat for coho salmon. The areas designated contained physical and biological features essential to the conservation of the species.

Sockeye Salmon Critical Habitat: In 1993, NMFS designated critical habitat for the Snake River sockeye salmon ESU (58 FR 68543) and included the outlet of the Columbia River. Critical habitat for the Ozette Lake ESU was designated in 2005 (70 FR 37159).

Steelhead Trout Critical Habitat: In September 2005 (effective January 2, 2006), NMFS designated critical habitat for the following steelhead trout ESUs: Lower Columbia River; Upper Columbia River; Middle Columbia River; Snake River Basin; and Upper Willamette River (70 FR 52629). Critical habitat for the Puget Sound DPS was designated on February 24, 2016 (81 FR 9252).

[3] Maps of all designated critical habitat for Pacific salmonid and steelhead populations can be found at: https://www.fisheries.noaa.gov/resource/map/critical-habitat-maps-and-gis-data-west-coast-region, Accessed August 25, 2023

3.2.1.2 Target or Managed Species

Following the approach described in the 2019 PEA, target fish include species: managed for commercial fisheries; belonging to a species category defined in regional FMP; or for which AFSC conducts stock assessment surveys. Only target or managed species with average annual total catch greater than one metric ton (1 mt) are listed. All target or managed species as defined in this assessment are found in either the GOARA or the BSAIRA. There are currently no authorized commercial fisheries in the central Arctic Ocean[4] (i.e., CSBSRA). However, the Fish Resources of the Arctic Management Areas FMP considers several Arctic species as described in Table 3-3.

Table 3-3 lists the target species evaluated in this SPEA and their current stock status[5] using the following definitions:

- Overfishing – annual rate of catch is too high;
- Overfished – population size is too small; or
- Rebuilt - previously overfished stock that has increased in abundance to the target population size that supports its maximum sustainable yield.

While some management and reporting considerations have changed since the 2019 PEA, the stock status has not changed for the majority of target or managed species shown in Table 3-3 and considered in this SPEA.

[4] https://oceans-and-fisheries.ec.europa.eu/news/arctic-agreement-prevent-unregulated-fishing-enters-force-2021-06-25_en, Accessed June 12, 2023

[5] https://www.fisheries.noaa.gov/national/population-assessments/fishery-stock-status-updates Accessed June 8, 2023

Table 3-3. Target Species Status Summary

Target or Managed Fish[1]	Research Area	Stock Status as Reported in 2019 PEA	Current Status[2]	Description/Change from 2019 PEA
Alaska plaice *Pleuronectes quadrituberculatus*	GOARA BSAIRA	No overfishing, not overfished	No overfishing, not overfished	No change
Alaska skate *Bathyraja parmifera*	BSAIRA	No overfishing, not overfished	No overfishing, not overfished	No change
Aleutian skate *Bathyraja aleutica*	GOARA BSAIRA	No overfishing, overfished status unknown No overfishing, not overfished	No overfishing, overfished status unknown No overfishing, not overfished	No change
Arctic cod *Boreogadus saida*	BSAIRA CSBSRA	Not overfished	No overfishing, overfished status unknown	Overfished status is now unknown. There is no commercial fishing for Arctic cod in federal, state, or international waters, but they are managed in federal waters under the Fish Resources of the Arctic Management Area FMP.
Arrowtooth flounder *Atheresthes stomias*	GOARA BSAIRA	No overfishing, not overfished	No overfishing, not overfished	No change
Atka mackerel *Pleurogrammus monopterygius*	GOARA BSAIRA	No overfishing, overfished status unknown No overfishing, not overfished	No overfishing, overfished status unknown No overfishing, not overfished	No change
Blackspotted rockfish *melanostictus*	GOARA BSAIRA	No overfishing, not overfished	No overfishing, not overfished	No change. This species is now considered as part of the blackspotted and rougheye rockfish complex.
Bering skate *Bathyraja interrupta*	GOARA BSAIRA	No overfishing, overfished status unknown No overfishing, not overfished	No overfishing, overfished status unknown No overfishing, not overfished	No change
Big skate *Raja binoculata*	GOARA	No overfishing, overfished status unknown	No overfishing, overfished status unknown	No change
Bigmouth sculpin *Hemitripterus bolini*	BSAIRA	No overfishing, overfished status unknown	Not reported	Cottidae are considered to be an ecosystem component species in the BSAIRA. Their status is not reported in the fishery stock status updates.
Butter sole *Isopsetta isolepis*	GOARA	No overfishing, not overfished	No overfishing, not overfished	No change

Target or Managed Fish[1]	Research Area	Stock Status as Reported in 2019 PEA	Current Status[2]	Description/Change from 2019 PEA
Capelin *Mallotus villosus*	BSAIRA	Overfishing unknown	Not reported	Capelin are considered to be a forage fish species in the BSAIRA. Their status is not reported in the fishery stock status updates but a forage species report that includes Pacific capelin is prepared every other year for the GOA and BSAI.
Commander skate *Bathyraja lindbergi*	BSAIRA	No overfishing, not overfished	No overfishing, not overfished	No change
Darkfin sculpin *Malacocottus zonurus*	BSAIRA	No overfishing, overfished status unknown	Not reported	Cottidae are considered to be an ecosystem component species in the BSAIRA. Their status is not reported in the fishery stock status updates.
Dover sole *Microstomus pacificus*	GOARA	No overfishing, not overfished	No overfishing, not overfished	No change
Dusky rockfish *Sebastes variabilis*	GOARA	No overfishing, not overfished	No overfishing, not overfished	No change
English sole *Parophrys vetulus*	GOARA	No overfishing, not overfished	No overfishing, not overfished	No change
Eulachon[3] *Thaleichthys pacificus*	GOARA BSAIRA	Status unknown	Not reported	No change. Eulachon are considered to be a forage fish species in the GOARA and BSAIRA. Their status is not reported in the fishery stock status updates but a forage species report that includes eulachon is prepared every other year for the GOA and BSAI.
Flathead sole *Hippoglossoides elassodon*	GOARA BSAIRA	No overfishing, not overfished	No overfishing, not overfished	No change
Giant grenadier *Albatrossia pectoralis*	GOARA BSAIRA	Status unknown	Not reported	No change. Giant grenadier are considered to be an ecosystem component species in the GOARA and BSAIRA. Their status is not reported in the fishery stock status updates.
Great sculpin *Myoxocephalus polyacanthocephalus*	GOARA BSAIRA	No overfishing, overfished status unknown	Not reported.	Cottidae are considered to be an ecosystem component species in the BSAIRA and GOARA. Their status is not reported in the fishery stock status updates.
Greenland turbot *Reinhardtius hippoglossoides*	BSAI	No overfishing, not overfished	No overfishing, not overfished[4]	No change
Harlequin rockfish *Sebastes variegatus*	GOARA	No overfishing, overfished status unknown	No overfishing, overfished status unknown	No change

Target or Managed Fish[1]	Research Area	Stock Status as Reported in 2019 PEA	Current Status[2]	Description/Change from 2019 PEA
Kamchatka flounder *Atheresthes evermanni*	BSAIRA	No overfishing, not overfished	No overfishing, not overfished	No change
Leopard skate *Bathyraja panthera*	BSAIRA	No overfishing, not overfished	No overfishing, not overfished	No change
Longnose skate *Raja rhina*	GOARA	Status unknown	No overfishing, overfished status unknown	Overfishing status is now reported
Longspine thornyhead *Sebastolobus altivelis*	GOARA	No overfishing, overfished status unknown	No overfishing, overfished status unknown	No change
Mud skate *Bathyraja taranetzi*	BSAIRA	No overfishing, not overfished	No overfishing, not overfished	No change
Northern rockfish *Sebastes polyspinus*	GOARA BSAIRA	No overfishing, not overfished	No overfishing, not overfished	No change
Northern rock sole *Lepidopsetta bilineatus*	GOARA BSAIRA	No overfishing, not overfished	No overfishing, not overfished	No change
Pacific cod *Gadus macrocephalus*	GOARA BSAIRA	No overfishing, not overfished	No overfishing, not overfished	No change. Note that the "not overfished" status refers only for the GOA and Bering Sea. Overfished status is unknown for the Aleutian Islands.
Pacific grenadier *Coryphaenoides acrolepis*	GOARA BSAIRA	Unknown	Not reported	No change. Pacific grenadier is considered to be an ecosystem component species in the GOARA and BSAIRA. Their status is not reported in the fishery stock status updates
Pacific hake *Merluccius productus*	GOARA	Not overfished	No overfishing, not overfished	No change. Pacific hake is managed by the Pacific Fishery Management Council (PFMC)
Pacific halibut *Hippoglossus stenolepis*	GOARA BSAIRA	Not reported	Overfishing unknown, not overfished	Pacific halibut is considered to be a prohibited species in the GOARA and BSAIRA. Spawning biomass increased gradually to 2016, and then decreased to an estimated ~86,600 t at the beginning of 2022, with an approximate 95% credible interval ranging from ~58,700-125,400 (Stewart and Hicks 2022)
Pacific herring *Clupea pallasii*	GOARA BSAIRA	Not reported	Not overfished	No change. Pacific herring are considered to be a prohibited species in the GOARA and BSAIRA. A report on herring is prepared every other year for both the GOA and BSAI.

Target or Managed Fish[1]	Research Area	Stock Status as Reported in 2019 PEA	Current Status[2]	Description/Change from 2019 PEA
Pacific ocean perch *Sebastes alutus*	GOARA BSAIRA	No overfishing, not overfished	No overfishing, not overfished. Rebuilt as of 2017.	No change
Pacific sleeper shark *Somniosus pacificus*	GOARA	No overfishing, overfished status unknown	No overfishing, overfished status unknown	No change. Managed as part of the Shark Complex. Not migratory[5]
Plain sculpin *Myoxocephalus jaok*	GOARA BSAIRA	No overfishing, overfished status unknown	Not reported	Cottidae are considered to be an ecosystem component species in the BSAIRA and GOARA. Their status is not reported in the fishery stock status updates.
Popeye grenadier *Coryphaenoides cinereus*	BSAIRA GOARA	Status unknown	Not reported	Popeye grenadier are considered to be an ecosystem component species in the BSAIRA and GOARA. Their status is not reported in the fishery stock status updates
Redbanded rockfish *Sebastes proriger*	GOARA	No overfishing, overfished status unknown	No overfishing, overfished status unknown	No change
Rex sole *Glyptocephalus zachirus*	GOARA BSAIRA	No overfishing, not overfished No overfishing, overfished status unknown	No overfishing, not overfished No overfishing, overfished status unknown	No change
Rougheye rockfish *Sebastes aleutianus*	GOAR BSAIRA	No overfishing, not overfished	No overfishing, not overfished	No change. This species is now considered as part of the blackspotted and rougheye rockfish complex
Sablefish *Anoplopoma fimbria*	GOARA BSAIRA	No overfishing, not overfished	No overfishing, not overfished	No change
Saffron cod *Eleginus gracilis*	BSAIRA CSBSRA	Not overfished.	No overfishing, overfished status unknown	Overfished status is now unknown. There is no commercial fishing for saffron cod in federal, state, or international waters, but they are managed in federal waters under the Fish Resources of the Arctic management Area FMP
Salmon shark *Lamna ditropis*	GOARA BSAIRA	Not reported in 2019 PEA	No overfishing, overfished status unknown	Managed as part of the Shark Complex. Migratory, but not managed as an HMS (PFMC 2023)
Sharpchin rockfish *Sebastes zacentrus*	GOARA	No overfishing, overfished status unknown	No overfishing, overfished status unknown	No change

Target or Managed Fish[1]	Research Area	Stock Status as Reported in 2019 PEA	Current Status[2]	Description/Change from 2019 PEA
Silvergray rockfish *Sebastes brevispinis*	GOARA	No overfishing, overfished status unknown	No overfishing, overfished status unknown	No change
Shortraker rockfish *Sebastes borealis*	GOARA BSAIRA	No overfishing, overfished status unknown	No overfishing, overfished status unknown	No change
Shortspine thornyhead *Sebastolobus alascanus*	GOARA BSAIRA	No overfishing, overfished status unknown	No overfishing, overfished status unknown	No change
Southern rock sole *Lepidopsetta bilineata*	GOARA BSAIRA	No overfishing; not overfished	No overfishing, not overfished	No change
Spiny dogfish *Squalus acanthias*	GOARA	No overfishing, overfished status unknown	No overfishing, overfished status unknown	No change. Managed as part of the Shark Complex. Migratory, but not managed as an HMS (PFMC 2023)
Starry flounder *Platichthys stellatus*	GOARA BSAIRA	No overfishing; not overfished No overfishing Overfished status unknown	No overfishing, not overfished No overfishing, overfished status unknown	No change
Walleye pollock *Gadus chalcogrammus*	GOARA BSAIRA	No overfishing, not overfished Status unknown	No overfishing, not overfished No overfishing, not overfished	No change Overfished status in Bogoslof area is unknown
Whiteblotched skate *Bathyraja maculata*	BSAIRA	No overfishing; not overfished	No overfishing Not overfished	No change
Yelloweye rockfish *Sebastes ruberrimus*	GOARA	No overfishing, overfished status unknown	No overfishing, overfished status unknown	No change
Yellowfin sole *Limanda aspera*	GOARA BSAIRA	No overfishing, not overfished No overfishing, not overfished	No overfishing, not overfished No overfishing Not overfished	No change

[1] Only target species with average annual total catch greater than one metric ton (1 mt) are listed.
[2] As of March 31, 2023 (NMFS 2023a).
[3] The ESA-listing for eulachon only encompasses the subpopulations of these fish within the states of Washington, Oregon, and California. Any eulachon encountered in Alaskan waters would not be ESA-listed.
[4]Source: https://www.fisheries.noaa.gov/species/greenland-turbot Accessed June 8, 2023.
[5] http://environmentalaska.us/pacific-sleeper-sharks.html#:~:text=MOVEMENTS%20AND%20MIGRATION%3A%20Satellite%20tags%20have%20been%20attached,that%20they%20did%20not%20migrate%20to%20other%20areas. Accessed June 12, 2023.

3.2.1.3 Ecosystem Component Species

The ecosystem component includes prohibited species, forage fish species, grenadier, squids, and sculpins. Many species of fish found in Alaska marine waters are considered to be prohibited for catch and sale in commercial groundfish fisheries managed by NMFS. For halibut, herring, salmon, steelhead, and crabs, this is primarily due to management under an international agreement (for halibut, the IPHC) or because the species is managed under separate FMPs (salmon and crab). Catch of prohibited species must be avoided and catch must be retained to the sea immediately, unless retention is required. Forage fish species are managed to prevent the development of a commercial directed fishery in recognition that forage fish are a critical food source for many species. Grenadiers, squids, and sculpins are managed as incidental catch (directed fishing is prohibited) with limitations on allowable retention amounts or on commercial exchange.

Prohibited Species in the GOARA and BSAIRA include: Pacific halibut; Pacific herring; Pacific salmon, steelhead trout; king crab; and tanner crab. Forage fish species include: Osmeridae family (eulachon, capelin, and other smelts); Myctophidae family (lanternfishes); Bathylagidae family (deep-sea smelts); Ammodytidae family (Pacific sand lance); Trichodontidae family (Pacific sand fish); Pholidae family (gunnels); Stichaeidae family (pricklebacks, warbonnets, eelblennys, cockscombs, and shannys); Gonostomatidae family (bristlemouths, lightfishes, and anglemouths); and Order Euphausiacea (krill). Grenadiers include: Pacific grenadier; Popeye grenadier; and Giant grenadier. Squids include: Chirotuthidae family; Cranchiidae family (glass squid); Gonatidae family (armhook squid); Onychoteuthidae family (hooked squid); and Order Sepioidea (North Pacific bobtail squid). Sculpins include: Cottidae family; Hemitripteridae family; Psychrolutidae family; and Rhamphocottidae family (NMFS 2023a).

Table 3-3 provides updates for status of prohibited species with average annual catch greater than 1 mt since the 2019 PEA (NMFS 2019c) (where available). Section 3.2.1.2 of the 2019 PEA provides details on prohibited species with greater than 1 mt annual average catch.

3.2.1.4 Other Non-Listed Fish Species

Hundreds of fish species have been caught during the course of AFSC research that may or may not be managed or subject to formal stock assessments or belong to one of the categories described in the previous subsections. As described in the 2019 PEA (NMFS 2019c), other fish species that are not considered to be target fish, HMS, or prohibited species can be caught during AFSC research surveys. The Alaska portion of the Chukchi and western Beaufort seas support at least 107 fish species, representing 25 families (Mecklenburg et al. 2002, Logerwell and Rand 2010, Love 2005, Harris 1993, Johnson et al. 2010; all as cited in (NMFS 2019c)). Families and sub-families include: lampreys, sleeper sharks; dogfish sharks, herrings; smelts; whitefish; trout and salmon; lanternfish; cods; sticklebacks; greenlings; sculpins; sailfin sculpins; fathead sculpins; poachers; lumpsuckers; snailfish; eelpouts; pricklebacks; gunnels; wolfish; sand lances; and righteye flounders. For these species and all other non-commercial, non-listed species, the analyses provided in the 2019 PEA remain valid.

3.2.2 Marine Mammals

Tables 3-4 and 3-5 show the ESA-listed marine mammal species and non-listed marine mammal species, respectively, that may be encountered by AFSC research activities in the GOARA, BSAIRA, or CSBSRA,

or during IPHC research activities along the U.S. west coast. The tables provide updates on ESA-listed marine mammal abundance and status since the 2019 PEA. Detailed descriptions of species life history are provided in Section 3.2.2 of the 2019 PEA (NMFS 2019c). As per the 2019 final rule (84 FR 46788) and 2019 BiOp (NMFS 2019a), ESA-listed gray whales from the Western North Pacific (WNP) stock are considered to be extralimital in the action area and, thus, would not be adversely impacted by research activities. Therefore, WNP gray whales are not discussed further in this SPEA. Whales from the non-listed Eastern North Pacific (ENP) stock are discussed in Section 3.2.2.2

The 2019 BiOp (NMFS 2019a), does not mention Guadalupe fur seals; the 2019 final MMPA rule discusses this species but does not estimate any takes under the MMPA. The core range of Guadalupe fur seals lies in coastal waters south of San Francisco (McCue *et al*. 2021). Even though these fur seals are occasionally observed in Oregon and Washington waters (Garcia-Aguilar *et al*. 2018), it is unlikely tat any IPHC activities would encounter a Guadalupe fur seal and the species is not discussed further.

3.2.2.1 ESA-Listed Marine Mammals

Table 3-4 compares abundances used in the 2019 MMPA final rule (84 FR 46788) to the most current abundances (where available) in Young *et al.* (2023) or Carretta *et al.* (2023).

Section 3.2.2.1.1 describes changes in humpback whale stock structure and abundance. Critical habitat designated for ESA species that may be encountered in AFSC and IPHC research areas is described in Section 3.2.2.1.2, including changes to critical habitat for humpback whales and southern resident killer whales. Impacts to designated critical habitat are described in Section 4.3.2.2.4 for the Status Quo Alternative and 4.4.2.2.1 for the Preferred Alternative. Table 1-1 describes AFSC consultation efforts with NMFS and USFWS for marine mammals under section 7 of the ESA.

Table 3-4. ESA-Listed Marine Mammals Within the Project Area

ESA Listed Species	DPS or Stock	2019 Final Rule Abundance[1]	Current Abundance[2]	Current ESA and MMPA Status	Other Abundance Information	References	Description/Change from 2019 PEA
Sperm Whale *(Physeter macrocephalus)*	Eastern North Pacific (ENP) Stock California/ Oregon/ Washington (CA/OR/WA) Stock	Unknown 1,997	Unknown 1,997	E, D	The data used in estimating the abundance of sperm whales in the entire North Pacific are more than 8 years old; therefore, a reliable estimate of abundance for the entire North Pacific stock is considered unavailable. Potential Biological Removal (PBR) for the CA/OR/WA stock is 2.5. Abundance has not been revised since 2019.	**Young *et al.* (2023)** **Carretta *et al.* (2023)** **Muto *et al.* (2022)** Moore and Barlow (2014) 35 FR 18319	No change in ESA status or abundance estimates. Critical Habitat not designated. According to the 2019 final rule (84 FR 46788), CA/WA/OR stock only occurs along the U.S. west coast while the North Pacific stock can be found in the GOARA and BSAIRA. Moore and Barlow (2014) reported that sperm whale abundance appeared stable from 1991 to 2008 and additional data from a 2014 survey do not change that conclusion.
Humpback Whale[3] *(Megaptera novaeangliae)*	Mexico DPS (Mexico N. Pacific stock) Western N. Pacific stock Central America/S. Mexico DPS (CA/OR/WA stock) Mainland Mexico DPS (CA/OR/WA stock)	NR 1,107 2,900 NR	918 1,084 1,496 3,477	T, D E, D E, D T, D	Based on the new stock definitions abundance is considered to be 918 whales. However, abundance data for the Mexico DPS are more than 8 years old. It is no longer clear that the population is increasing. Therefore, the minimum population estimate for this stock is unknown and PBR is undetermined**.** Abundance of the W. North Pacific stock is 1,084 (CV=0.088); the data are more than 8 years old. Therefore, the minimum population estimate for this stock is unknown and PBR is undetermined. It is no longer clear that the population is increasing. Based on the new stock definitions, abundance of the Central America DPS is 1,496 (CV=0.171); PBR in U.S. waters is 3.5 whales per year. Based on the new stock definitions, abundance of the Mainland Mexico – CA-OR-WA stock of humpback whales is considered to be 3,477 animals (CV=0.099). PBR for this stock in U.S. waters is 43 whales per year.	**Carretta *et al.* (2023)** **Young *et al.* (2023)** Sato and Wiles (2021) 81 FR 62260 86 FR 21082 **NMFS (2021b)**	No change in ESA listing but changes to MMPA stock definitions were made by NMFS in 2023 **(Carretta *et al.* 2023, Young *et al.* 2023)** (see Section 3.2.2.1.1). ESA-listed humpback whales encountered in AFSC research areas can belong to either the threatened Mexico DPS (Mexico N. Pacific stock) (GOARA and BSAIRA), the endangered Western N. Pacific stock (BSAIRA and CSBSRA), or to the non-endangered Hawaii DPS (GOARA and BSAIRA). IPHC activities off the U.S. west coast may overlap with whales from the endangered Central America DPS. Critical habitat was designated April 21, 2021 and may overlap with AFSC and IPHC research activities. See Section 3.2.2.1.2 for a discussion of newly designated humpback whale critical habitat.
Blue Whale *(Balaenoptera musculus musculus)*	ENP Stock	1,647	1,898	E, D	The most-recent abundance estimate for 2018 is 1,898 (CV=0.085) whales. PBR is 7 whales but since most blue whales are outside U.S. waters from November to March (5 months), PBR for U.S. waters is 7/12 of the total PBR, or 4.1 whales per year.	**Carretta *et al.* (2023)** **Carretta *et al.* (2022)** Barlow (2016) NMFS (1998) 35 FR 18319	No change in ESA status. Critical Habitat not designated. ENP Blue whales feed off of the U.S. west coast in the summer and to a lesser extent in the Gulf of Alaska. According to the 2019 final rule (84 FR 46788) blue whales may be encountered in the GOARA and BSAIRA, and by IPHC research along the U.S. west coast.

ESA Listed Species	DPS or Stock	2019 Final Rule Abundance[1]	Current Abundance[2]	Current ESA and MMPA Status	Other Abundance Information	References	Description/Change from 2019 PEA
Fin Whale *(Balaenoptera physalus velifera)*	CA/OR/WA Stock Northeast Pacific Stock	9,029 Unknown	11,065 3,168	E, D	The best estimate of fin whale CA/OR/WA stock abundance is 11,065 (CV=0.405) whales. PBR is 80. There are no reliable estimates of current and historical abundances for the entire northeast Pacific stock. Estimates of abundance in certain areas within the range of the stock are over a decade old. The best provisional estimate for the Northeast Pacific stock is 3,168 (CV = 0.26) fin whales from the 2013 survey. PBR is calculated to be 51.	**Carretta *et al.* (2023)** **Carretta *et al.* (2022)** **Carretta *et al.* (2021)** **Muto *et al.* (2021)** **Young *et al.* (2023)** **NMFS (2019b)** 35 FR 18319 83 FR 4032	No change in ESA status. Critical Habitat not designated. A 5-year review was initiated in January of 2018 (83 FR 4032) and completed in February of 2019 **(NMFS 2019b)**. The review 5-year review concluded that the fin whale should be down-listed from endangered to threatened and recommended that NMFS commence rulemaking in the future to reclassify. According to the 2019 final rule (84 FR 46788), the CA/WA/OR stock only occurs along the U.S. west coast while the Northeast Pacific stock can be found in the GOARA and BSAIRA.
Sei Whale *(Balaenoptera borealis borealis)*	ENP Stock	519 (CA/OR/WA waters only)	519 (CA/OR/WA waters only) 29,632 (central and ENP waters only)	E, D	The best estimate of abundance for sei whales in the central and ENP is 29,632 whales (CV = 0.242). For California Current waters, abundance is the unweighted geometric mean of the 2008 and 2014 estimates, or 519 (CV=0.40) sei whales. PBR is 0.75.	**Carretta *et al.* (2021)** **Carretta *et al.* (2022)** **Carretta *et al.* (2023)** Barlow (2016) **NMFS (2021c)** 35 FR 18319	No change in ESA status. Critical Habitat not designated. According to the 2019 final rule (84 FR 46788) this stock occurs GOARA and BSAIRA and along the U.S. west coast where IPHC research is conducted. A 5-year review was initiated in January 2018 (83 FR 4032) and completed in August of 2021. The review recommended no change in ESA-listing. No data on trends in sei whale abundance exist for the ENP. Barlow (2016) noted that an increase in sei whale abundance observed in 2014 is partly due to recovery of the population from commercial whaling but may also involve distributional shifts in the population.
Bowhead Whale (*Balaena mysticetus*)	Western Arctic Stock	16,820	14,025	E, D	The best estimate of abundance from the 2019 ice-based survey is 14,025 whales (CV = 0.228). PBR is 116 whales.	**Young *et al.* (2023)** **Muto *et al.* (2021)** 35 FR 18319	Critical habitat not designated. No change in ESA status or critical habitat. A recovery plan has not been developed for this species. Bowhead whales can be found in the BSAIRA and CSBSRA.
Beluga Whale (*Delphinapterus leucas*)	Cook Inlet DPS	327	331	E, D	The 2022 Final Stock Assessment Report (SAR) **(Young *et al.* 2023)** documented an estimated abundance of 279 (CV = 0.061) and a PBR of 0.53 for the Cook Inlet DPS based on a weighted average from annual estimates in 2014, 2016, and 2018. However, Goetz *et al.* (2023) calculated an abundance estimate based on video and counting passes conducted during late June 2021 and early June 2022. The authors recommend that 331 be considered the official best estimate for this population and note that there is 65.1% probability that the population is now increasing at 0.9% per year.	**Muto *et al.* (2021)** **Muto *et al.* (2022)** **NMFS (2016i)** **Young *et al.* (2023)** **Goetz *et al.* (2023)** 73 FR 62919 76 FR 20180	No change in ESA status or critical habitat. A 5-year review was initiated in February 2021 (86 FR 11504) and completed in August of 2022. The review recommended no change in ESA-listing. The most recent recovery plan was prepared in 2016. Cook Inlet beluga whales would only be encountered in Cook Inlet, which is considered to be part of the GOARA. AFSC surveys are conducted in critical habitat for Cook Inlet Beluga whales. See section 3.2.2.1.2 for details on Cook Inlet Beluga critical habitat.
Killer Whale *(Orcinus orca)*	ENP Southern Resident (SRKW) DPS	83	74	E, D	The SRKW stock is a trans-boundary stock ranging as far south as CA to as far north as SE Alaska. The population most recently numbered 74 whales. PBR for SRKW is 0.13.	**Carretta *et al.* (2023)** **Carretta *et al.* (2022)**	No changes in ESA status. Only the SRKW stock of killer whales is listed under the ESA. Critical habitat for SRKW was revised August 2, 2021 (86 FR 41668) and may overlap with IPHC research activities. See Section 3.2.2.1.2. for a discussion of SRKW killer whale critical habitat.
North Pacific Right Whale (*Eubalaena japonica*)	ENP	31	31	E, D	The only recent estimate of abundance comes from mark-recapture analyses of photo-identification and genetic data through 2008. The calculated PBR for this stock is 0.05, which is equivalent to one take every 20 years.	**Young *et al.* (2023)** **Muto *et al.* (2022)** 35 FR 18319 71 FR 38277 73 FR 12024	No change in ESA status or critical habitat. A five-year review was initiated in March of 2022, and is not yet completed (87 FR 17991). North Pacific right whales may be encountered in the GOARA or the BSAIRA. AFSC survey activities in the GOARA and BSAIRA occur in designated critical habitat for North Pacific right whales. On September 26, 2023, NMFS announced its intention to revise critical habitat for the North Pacific right whales (88 FR 65940). See section 3.2.2.1.2 for details on North Pacific right whale critical habitat.

ESA Listed Species	DPS or Stock	2019 Final Rule Abundance[1]	Current Abundance[2]	Current ESA and MMPA Status	Other Abundance Information	References	Description/Change from 2019 PEA
						73 FR 19000	
Ringed Seal (*Phoca hispida*)	Arctic Subspecies	unknown	171,418 U.S. Bering Sea waters only	T, D	A reliable population estimate for the entire subspecies is not available, but survey methods have been applied to substantial portions of the subspecies' range in U.S. waters. Using 2012 data an abundance estimate of 171,418 ringed seals (95% CI: 141,588-201,090) was calculated for the U.S. portion of the Bering Sea. PBR is 4,755 seals for the U.S. portion of the subspecies, but this number is noted to be negatively biased.	**Young *et al.* (2023)** **Muto *et al.* (2022)** 77 FR 76706 **Quakenbush *et al.* (2022)** **Quakenbush *et al.* (2023)**	No change in ESA status. A five-year review was initiated in November of 2020, and is not yet completed (85 FR 76017). Critical habitat designated on April 1, 2022 (87 FR 19232), effective May 2, 2022. AFSC research areas overlap with ringed seal critical habitat. See Section 3.2.2.1.2 for a description of the newly designated critical habitat. According to the final rule (84 FR 46788) ringed seals may be encountered in the BSAIRA and the CSBSRA. In May 2022 and 3023, researchers **Quakenbush *et al.* (2022), Quakenbush *et al.* (2023)** used trained wildlife-detection dogs to survey an 88 km^2 area near Northstar Island in the Beaufort Sea for the presence of ringed seals and ringed seal structures such as breathing holes and lairs. The authors documented 61 ringed seal structures in 2022 and 73 in 2023.
Bearded seal (*Erignathus barbatus*)	Beringia DPS	273,676	301,830 U.S. Bering Sea waters only	T, D	A reliable population estimate for the entire DPS is not available, but survey methods have been applied to substantial portions of the DPSs range in U.S. waters. Using 2012 data an abundance estimate of 301,836 bearded seals (95% CI: 238,195-371,147) was calculated for the U.S. portion of the Bering Sea. PBR is 8,210 seals for the U.S. portion of the DPS, but this number is noted to be negatively biased.	**Young *et al.* (2023)** **Muto *et al.* (2022)** 77 FR 76740 87 FR 19180	No change in ESA status. A five-year review was initiated in January of 2021, and is not yet completed (86 FR 2648). Critical habitat designated on April 1, 2022 (87 FR 19180), effective May 2, 2022. AFSC research areas overlap with bearded seal critical habitat. See Section 3.2.12.1.2 for a description of the newly designated critical habitat. According to the final rule (84 FR 46788) bearded seals may be encountered in the BSAIRA and the CSBSRA.
Steller Sea Lion (*Eumetopias jubatus*)	Western U.S. DPS	54,267	52,932	E, D	Since 2003, the abundance of the Western stock has increased, but there has been considerable regional variation in trend. The most recent comprehensive aerial photographic and land-based surveys of Western Steller sea lions in Alaska were conducted in 2018 and 2019. PBR is 318 for the U.S. portion of the DPS.	**NMFS (2019a)** **NMFS (2008b)** **Young *et al.* (2023)** **Muto *et al.* (2022)** 62 FR 24345 58 FR45269	No change in ESA status or critical habitat. A 5-year review was initiated in February 2017 (82 FR 57955) and completed in February 2020. The review recommended no change in ESA-listing. The most recent recovery plan was completed in 2008. According to the final rule (84 FR 46788), Steller sea lions may be encountered in the GOARA and the BSAIRA. AFSC research areas overlap with Steller sea lion critical habitat. See Section 3.2.2.1.2 for a description of the critical habitat.
Northern Sea Otter[4] *(Enhydra lutris nereis)*	SW Alaska DPS	N/A	51,935	T	The 2023 SAR for the southwest Alaska DPS provided an adjusted estimate of 51,935 and a PBR of 2,296 animals. The previous SAR (2014) noted 54,771 individuals with an N_{min} of 45,064 individuals. A species status assessment completed in 2020 reported populations by management units totaling 51,382 animals in this stock.	**USFWS (2014c)** **USFWS (2017a)** **USFWS (2020b)** **USFWS (2023c)** 70 FR 46366 74 FR 51988	No change in ESA status or critical habitat. The SW stock was listed as threatened under the ESA in 2005 as a DPS. The most recent species status report was completed in 2020. Sea otters from this stock may be encountered by AFSC research in the GOARA and BSAIRA. The USFWS designated 15,000 km^2 of critical habitat for the southwest DPS of sea otters in 2009. AFSC research may overlap with these areas. See section 3.2.1.2.2 for a description of sea otter critical habitat.

ESA Listed Species	DPS or Stock	2019 Final Rule Abundance[1]	Current Abundance[2]	Current ESA and MMPA Status	Other Abundance Information	References	Description/Change from 2019 PEA
Polar Bear[4] (*Ursus maritimus*)	Southern Beaufort Sea (SBS) Stock Chukchi/Bering Sea (CBS) Stock	1,526 Based on data from 2001-2006 Unknown	900 Based on data from 2010 Unknown	T, D	In 2021, the USFWS finalized revised marine mammal stock assessment reports for each of the two polar bear stocks in Alaska: The SBS polar bear stock and the CBS polar bear stock. The SBS population estimate may be biased low because the western extent of the study area fell short of the SBS range. PBR for the SBS stock is 14. The USFWS is currently conducting a habitat use, ecology, and population status study of polar bears in the Chukchi Sea to reduce uncertainty in the status and trends of the CBS stock. PBR for this stock is calculated to be 30 using a 1990 N_{min} of 2,000 animals.	**USFWS (2021e)** **USFWS (2021d)** 73 FR 28212 75 FR 76086 86 FR 54996	No change in ESA status. In 2008 all U.S. polar bears across their range were listed as threatened. In 2010, the USFWS designated an area of 484,734 km^2 as critical habitat for the U.S. populations of polar bears. The area included sea-ice, terrestrial denning, and barrier island habitats in Alaska and adjacent territorial and U.S. waters. However, in 2013 the U.S. District Court for the District of Alaska issued an order vacating and remanding to the USFWS the 2010 designation. The USFWS appealed the ruling and on February 29, 2016, the U.S. Court of Appeals for the Ninth Circuit ruled that the USFWS had acted properly in designating critical habitat for polar bears. See Section 3.2.1.1.2 for a discussion of polar bear critical habitat. On Oct. 5, 2021, the USFWS announced the intention to conduct a 5-year status review (86 FR 54996). As of August 2023, the 5-year review is not yet available. The CBS stock ranges across the CSBSRA and northern BSAIRA and the SBS stock ranges across the CSBSRA. The stock ranges overlap in the northeastern Chukchi Sea.
Pacific Walrus[4] (*Odobenus rosmarus divergens*)	Alaska Stock	129,000 Bering Sea only	257,193	Candidate For Listing	The most recent SAR for walrus was completed in 2023. The previous 2014 SAR noted that the size of the Pacific walrus population has never been known with certainty. However, using data from 2013-2017, researchers generated an abundance estimate of 257,193 (95% CI: 171,138–366,366) for the Pacific walrus population. The USFWS considers this estimate to be the best available information on population size, as no more recent survey data are available. The calculated PBR value for the Pacific walrus stock is 3,210 animals.	76 FR 7634 82 FR 46618 **USFWS (2014b)** **Beatty *et al.* (2022)** **USFWS (2023d)**	No change in ESA status. Critical Habitat not designated. In 2011, the USFWS determined that listing the Pacific walrus as endangered or threatened under the ESA was warranted, but precluded by higher priority listing actions and the agency noted the species as a candidate for listing. In 2017, the USFWS determined that the listing of Pacific walruses as endangered or threatened under the ESA was not warranted. In June of 2021, the U.S. Court of Appeals for the Ninth Circuit ordered the USFWS to reconsider its decision not to list Pacific walruses under the ESA. As of September 2023, a decision on the listing has not been published. This species is found in the Chukchi and Bering Seas so AFSC research in the CSBSRA and BSAIRA may encounter them.

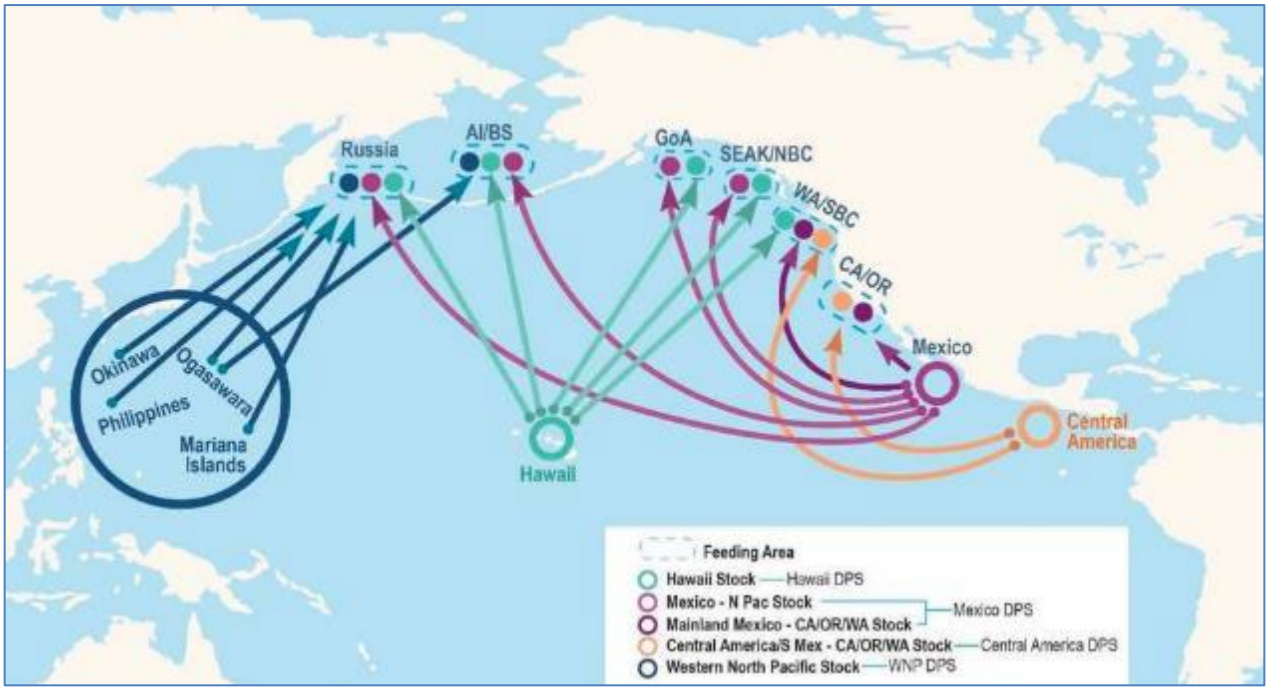
Note: E = endangered, T= threatened; D = depleted under the MMPA NR = Not reported. N/A = not applicable
[1]2019 Abundance taken from 84 FR 46788.
[2]Citations for abundance are shown in References column.
[3]Stock definitions were revised in 2022 (Carretta *et al.* 2023, Young *et al.* 2023) .
[5]Managed by USFWS, so not included in the NMFS MMPA final rule (84 FR 46788). Citations for 2019 abundances are provided in the References column.

3.2.2.1.1 Changes to Humpback Whale Stock Designations

On September 8, 2016, NMFS issued a final rule which revised the global listing status of the humpback whale by dividing the species into 14 DPSs (81 FR 62260). In 2022, NMFS further refined humpback whale stock structure based on feeding area and migratory routes, and recognized 4 DPSs in the North Pacific: the Western north Pacific DPS (endangered); the Mexico DPS (threatened;) the Central America DPS (endangered); and the Hawaii DPS (not-listed under the ESA) (Carretta *et al.* 2023, Young *et al.* 2023). In prior stock assessments, NMFS had designated three stocks of humpback whales in the North Pacific: the California/Oregon/Washington (CA/OR/WA) stock; the Central North Pacific stock; and the Western North Pacific stock. These stocks were not necessarily aligned with the ESA DPSs because some were composed of whales from more than one DPS, which led NMFS to reevaluate stock structure under the MMPA (Carretta *et al.* 2023, Young *et al.* 2023).

Individuals from the Central America DPS, Mexico DPS, and Hawaii DPS feed within potential IPHC research areas. Individuals from the Mexico DPS and Hawaii DPS migrate to the GOARA and BSAIRA (Figure 3-2). On April 21, 2021, NMFS designated critical habitat for 3 ESA-listed DPSs of humpback whales (86 FR 21082): the endangered Western North Pacific DPS; the threatened Mexico DPS; and the endangered Central America DPS. See Section 3.2.2.1.2 for a discussion of humpback whale critical habitat.

Figure 3-2. North Pacific Humpback Whale Stocks



Source: Carretta *et al.* (2023), Young *et al.* (2023).

As shown in Figure 3-1, the primary wintering areas of the Central America/Southern Mexico-CA/OR/WA stock (Central America DPS) include the Pacific coasts of Nicaragua, Honduras, El Salvador, Guatemala, Panama, Costa Rica. Primary summering areas for whales from this stock include the California and Oregon coasts, with a few individuals possible off of northern Washington/southern British Columbia. The primary wintering areas of the Mainland Mexico – CA/OR/WA stock (part of Mexico DPS) include the mainland Mexico states of Nayarit and Jalisco, with some animals seen as far south as Colima and Michoacán. Summer feeding destinations for whales in this stock include waters off of California, Oregon, Washington, Southern British Columbia, Alaska, and the Bering Sea.

3.2.2.1.2 Critical Habitat Designations

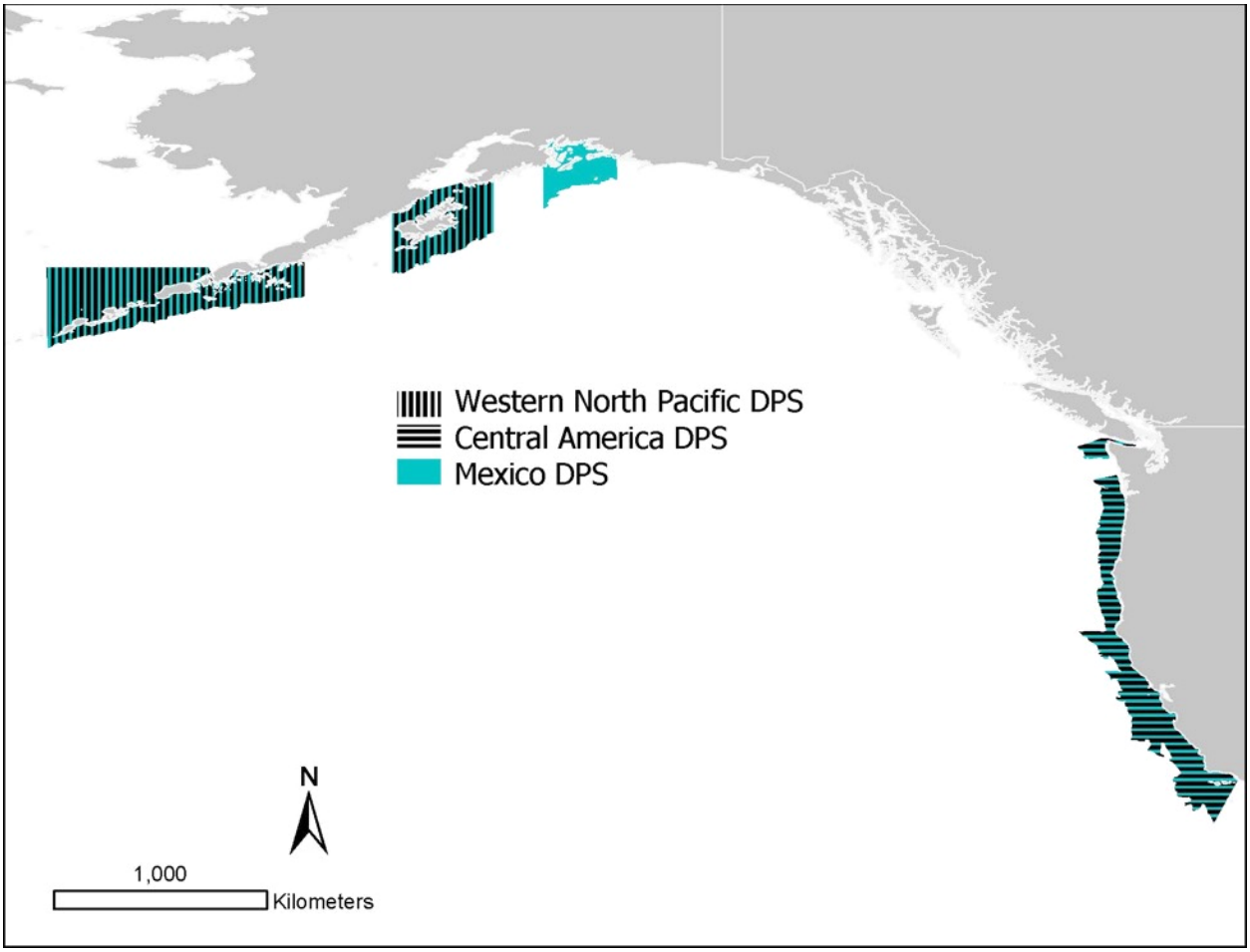
Humpback Whale Critical Habitat

In 2021, NMFS designated critical habitat for three ESA-listed DPSs of humpback whales (86 FR 21082): the endangered Western North Pacific DPS; the threatened Mexico DPS; and the endangered Central America DPS (Figure 3-3). Specific areas designated as critical habitat for the Central America DPS of humpback whales contain approximately 48,521 square nautical miles of marine habitat in the North Pacific Ocean within the portions of the California Current Ecosystem off the coasts of Washington, Oregon, and California. This critical habitat overlaps with IPHC research areas.

Specific areas designated as critical habitat for the Western North Pacific DPS of humpback whales contain approximately 59,411 square nautical miles of marine habitat in the North Pacific Ocean, including areas within the eastern Bering Sea and Gulf of Alaska. Specific areas designated as critical habitat for the Mexico DPS of humpback whales contain approximately 116,098 square nautical miles of marine habitat in the North Pacific Ocean, including areas within portions of the eastern Bering Sea, Gulf of Alaska, and California Current Ecosystem. These designated critical habitat areas are within AFSC and IPHC research areas.

The final rule (86 FR 21082) describes access to adequate prey as the only essential physical or biological feature of humpback whale critical habitat. NMFS considered and evaluated various biological and physical features of humpback whale habitat in addition to access to prey such as migratory corridors and soundscape but determined that the best available scientific information does not currently support recognizing any additional essential features. Sections 4.3.2.2.4 and 4.4.2.2.1 describe the effects of the Status Quo and Preferred Alternative, respectively, on humpback whale critical habitat.

Figure 3-3. Humpback Whale Critical Habitat



Source: https://www.fisheries.noaa.gov/resource/map/humpback-whale-critical-habitat-maps-and-gis-data Accessed June 1, 2022

Southern Resident Killer Whale Critical Habitat

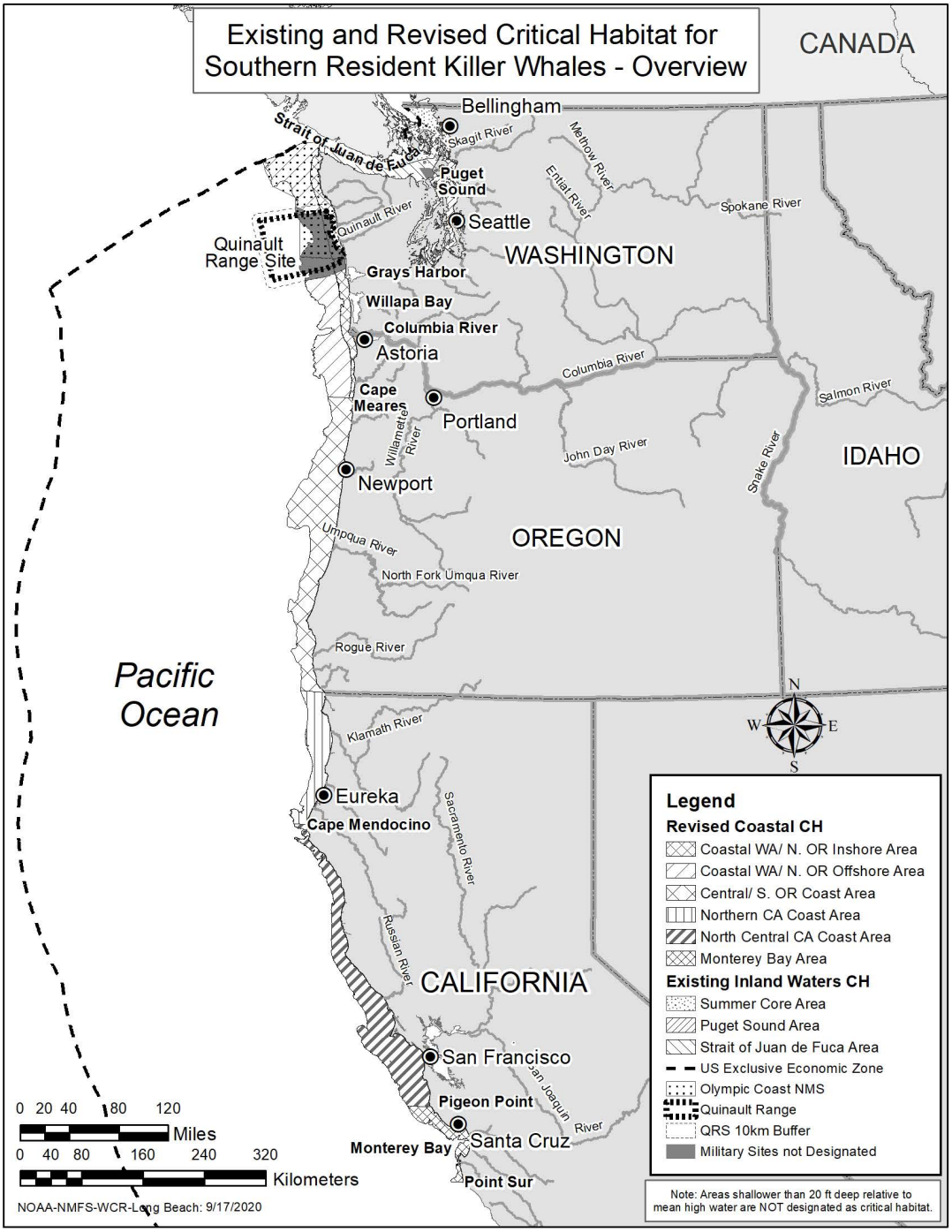
The 2021 revision added six additional coastal areas totaling 41,204 km^2 and excluded the Quinault range site from the designation (86 FR 41668) (Figure 3-4). Some IPHC research is potentially conducted near these areas.

The original 2006 final rule designating critical habitat for southern resident killer whales (71 FR 69054) determined that based on the best available scientific information, the following features were essential to the conservation of the species within inland waters of Washington: (1) Water quality to support growth and development; (2) prey species of sufficient quantity, quality and availability to support individual growth, reproduction and development, as well as overall population growth; and (3) passage conditions to allow for migration, resting, and foraging.

The same three biological and physical features were identified in the revised rule (86 FR 41668). As described in the final revised rule, southern resident killer whales range over a variety of habitats, including inland waters and open ocean coastal areas from the Monterey Bay area in California north to Southeast Alaska. They are highly mobile, and can cover large distances, However, analyses of their movement patterns on the outer coast have revealed preferred depth bands and distances from shore that suggest potential travel corridors, and variations in travel speed or duration of occurrence (86 FR 41668).

Impacts of the alternatives on southern resident killer whales are described in Sections 4.3.2.2.4 and 4.4.2.2.1.

Figure 3-4. Revised Critical Habitat for Southern Resident Killer Whales



Source: https://media.fisheries.noaa.gov/2021-07/map-srkw-ch-overview-fedreg-final7.pdf?null=, Accessed June 1, 2021

Ringed Seal Critical Habitat

On April 1, 2022, NMFS designated critical habitat for the Arctic subspecies of ringed seals (87 FR 19232). The critical habitat designation covers areas of marine habitat in the Bering, Chukchi, and Beaufort seas (Figure 3-5), and overlaps with the AFSC research areas.

Five factors were considered in the development of critical habitat for ringed seals: (1) geographical area; (2) physical or biological habitat features essential to the conservation of the species; (3) specific areas occupied by the species that contain essential physical and biological features; (4) special management considerations or protection; and (5) adequacy of occupied critical habitat to ensure the conservation of the species (87 FR 19232).

Figure 3-5. Ringed Seal Arctic Subspecies Designated Critical Habitat

Source: https://media.fisheries.noaa.gov/2022-03/arctic-ringed-seal-critical-habitat.pdf Accessed May 18, 2022

Essential features for the conservation of the species include:

- Snow covered sea ice suitable for subnivean birth lair formation and maintenance for sheltering pups during whelping and nursing – defined as waters 3 m or more in-depth containing area of shorefast ice or dense stable pack ice that contain snow drifts of sufficient depth to form and maintain birth lairs (typically at least 54 cm deep);
- Sea ice suitable for basking and molting – defined as waters 3 m or more in depth with 15% or higher concentrations of sea ice; and
- Primary prey resources to support ringed seals – defined as small, schooling fish and small crustaceans.

The designated critical habitat depicted in Figure 3-4 was identified by NMFS as the specific area that contains all three of these physical and biological essential features. Since it is unlikely that AFSC would be conducting research in this critical habitat area during the ice-covered season, effects on critical habitat would be focused on primary prey resources for ringed seals; see Sections 4.3.2.2.4 and 4.4.2.2.1 for a discussion of the effects of the alternatives on this PBF.

Bearded Seal Critical Habitat

On April 1, 2022, NMFS designated critical habitat for the Beringia DPS of bearded seals (87 FR 19180). The critical habitat designation covers areas of marine habitat in the Bering, Chukchi, and Beaufort seas (Figure 3-6), and overlaps with the AFSC research areas.

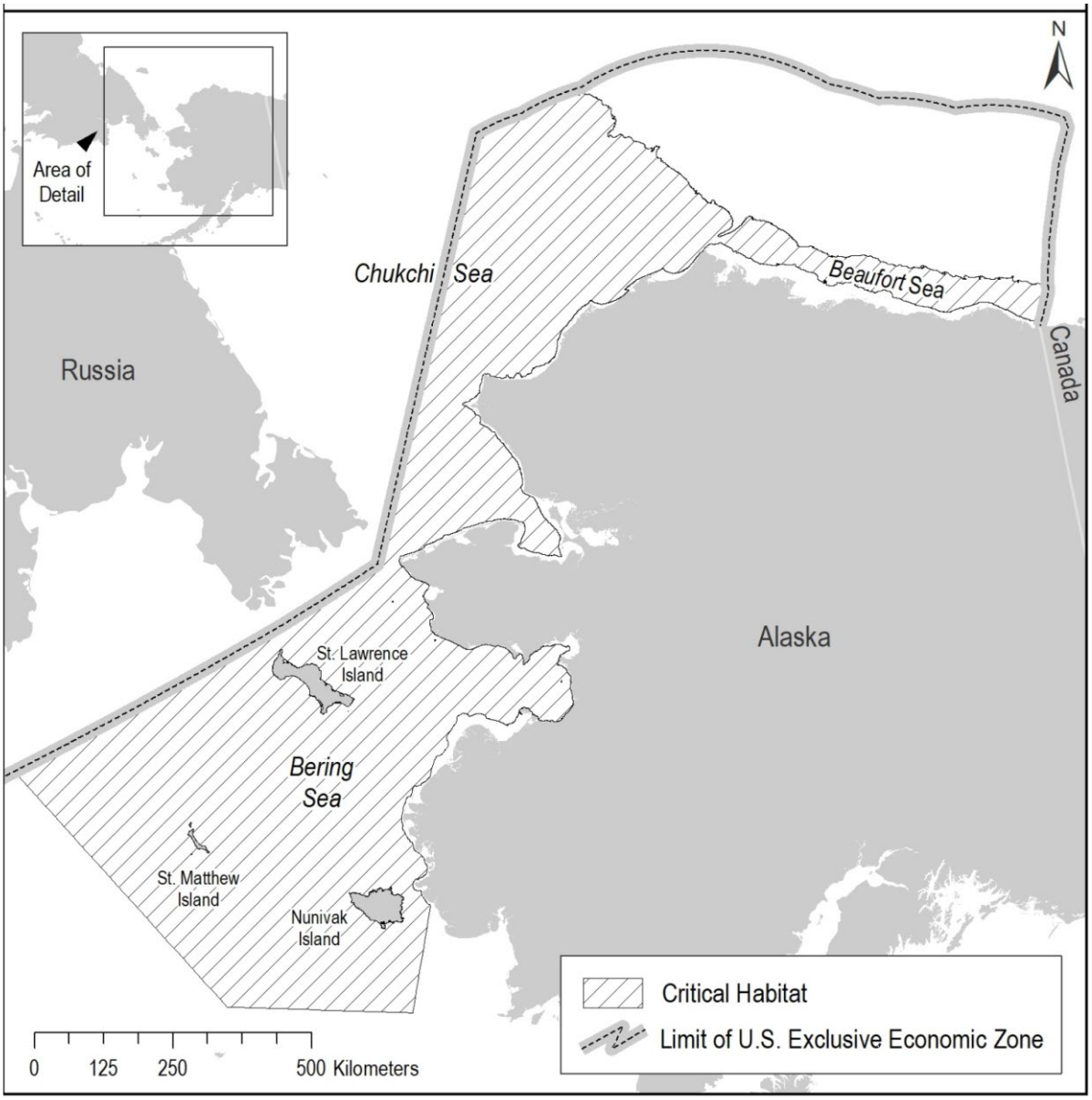
To identify specific areas that may qualify as critical habitat for bearded seals of the Beringia DPS, NMFS considered five factors: (1) geographical area occupied by the species at the time of listing; (2) physical or biological habitat features essential to the conservation of the species; (3) specific areas occupied by the species that contain one or more of the essential physical and biological features; (4) which of the essential features may require special management considerations or protection; and (5) whether a critical habitat designation limited to geographical areas occupied by the species at the time of listing would be inadequate to ensure the conservation of the species (87 FR 19180). Essential features for the conservation of the species include:

- Sea ice habitat suitable for whelping and nursing – defined as waters 200 m or less deep containing pack ice of at least 25% concentration and providing bearded seals access to those waters from the ice;
- Sea ice habitat suitable for molting – defined as waters 200 m deep or less containing pack ice of at least 15% concentration and providing bearded seals access to those waters from the ice; and
- Primary prey resources to support bearded seals – defined as waters 200 m deep or less containing benthic organisms, including epifaunal and infaunal invertebrates, and demersal fish.

These PBFs of bearded seal critical habitat are dynamic with variable locations on both spatial and temporal scales. Bearded seal movements and habitat use are strongly influenced by the seasonality of sea ice; the seals range widely, choosing the most suitable habitat conditions. The identified PBFs can be found in any given year in the designated critical habitat shown in Figure 3-5 (87 FR 19180). However, since it is unlikely that AFSC would be conducting research in this critical habitat area during the ice-

covered season, any effects would be focused on primary prey resources for bearded seals. Sections 4.3.2.2.4 and 4.4.2.2.1 describe the effects of the alternatives on this PBF.

Figure 3-6. Bearded Seal Beringia DPS Critical Habitat



Source: https://media.fisheries.noaa.gov/2022-03/beringia-dps-bearded-seal-critical-habitat.pdf Accessed May 18, 2022

Cook Inlet Beluga Whale Critical Habitat

On April 11, 2011, NMFS designated two areas covering 7,800 km^2 of the Cook Inlet marine environment as critical habitat for beluga whales (76 FR 20180) (Figure 3-7). Area 1 encompasses the area from the mouth of Three Mile Creek north and east to include waters of the Susitna, Little Susitna, and Chickaloon rivers below the mean higher high water (MHW) level. High concentrations of beluga whales are often observed in these areas from spring through fall. Drainages in Area 1 support large eulachon and salmon runs, providing important foraging habitat for Cook Inlet beluga whales during ice-free months; Area 1 is used extensively by these whales between April and November (NMFS 2008a). Critical Habitat Area 1 also encompasses shallow tidal flats or mudflats that provide beluga additional areas for foraging, calving, molting, and escape from predators.

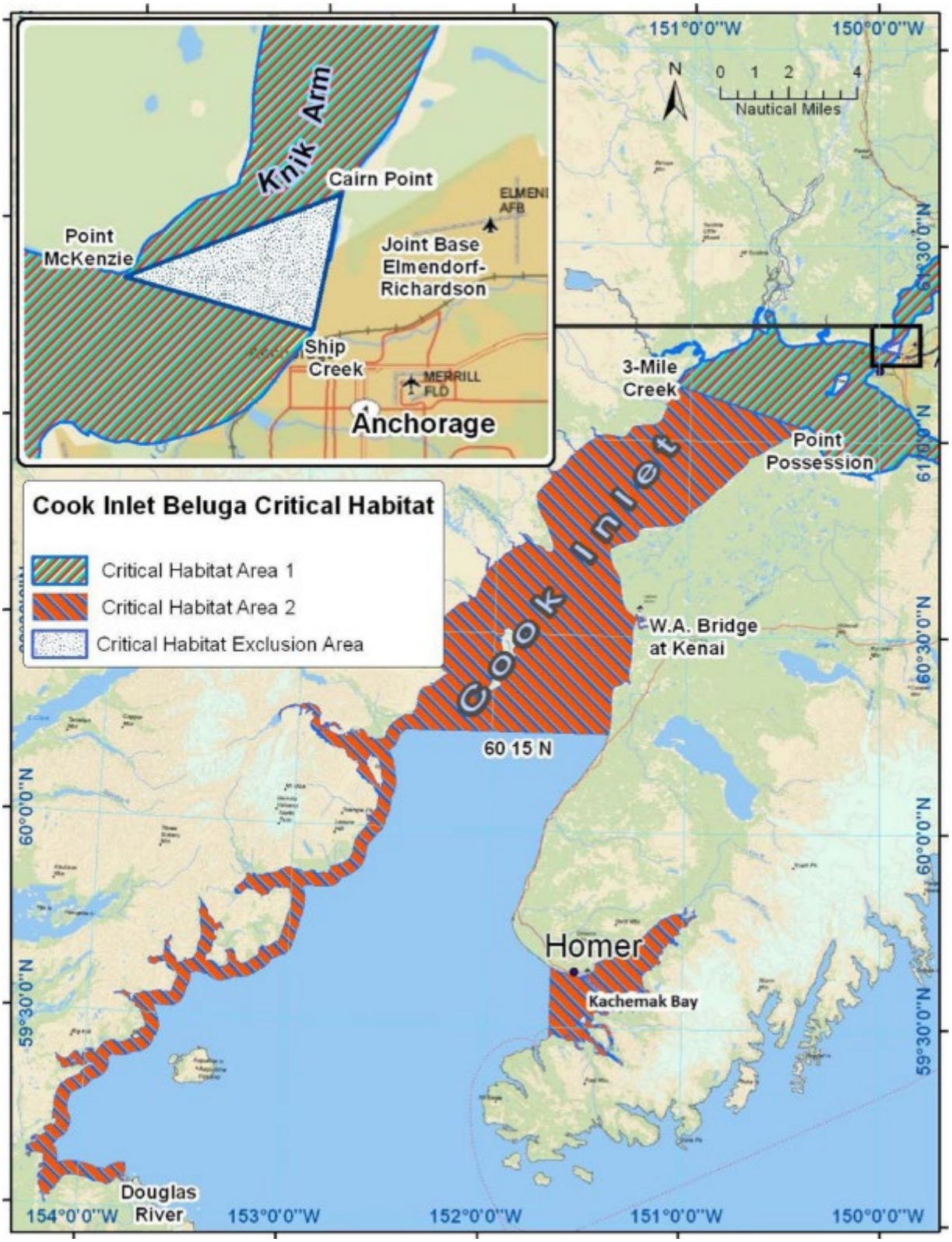
Critical Habitat Area 2 lies south of Area 1 and encompasses all marine waters of Cook Inlet south of a line connecting Point Possession and the mouth of Three Mile Creek, and north of 60.25°N, including waters within 3.7 km of MHW along the western shoreline of Cook Inlet between 60.25°N and the mouth of Douglas River; all waters of Kachemak Bay east of 151°40.00°W; and waters of the Kenai River below the Warren Ames Bridge at Kenai. Area 2 includes nearshore areas along western Cook Inlet and Kachemak Bay and is known as fall and winter foraging and transit habitat for beluga whales, as well as spring and summer habitat for smaller concentrations of beluga whales. AFSC and IPHC research activities in Cook Inlet would be expected to overlap with part of these areas.

Critical habitat for Cook Inlet beluga whales is defined by certain primary biological features (PBFs) (NMFS 2011) including:

- PBF #1: Intertidal and subtidal waters of Cook Inlet with depths less than 30 feet (ft) mean lower low water (9.1 m) and within 5 miles (8 km) of high and medium flow anadromous fish streams;
- PBF #2: Primary prey species consisting of four species of Pacific salmon (Chinook, sockeye, chum, and coho), Pacific eulachon, Pacific cod, walleye pollock, saffron cod, and yellowfin sole;
- PBF #3: Waters free of toxins or other agents of a type and amount harmful to Cook Inlet beluga whales;
- PBF #4: Unrestricted passage within or between the critical habitat areas; and
- PBF #5: Waters with in-water sound below levels resulting in the abandonment of critical habitat areas by Cook Inlet beluga whales.

Sections 4.3.2.2.4 and 4.4.2.2.1 described the effects of the alternatives on Cook Inlet beluga critical habitat.

Figure 3-7. Cook Inlet Beluga Whale Critical Habitat

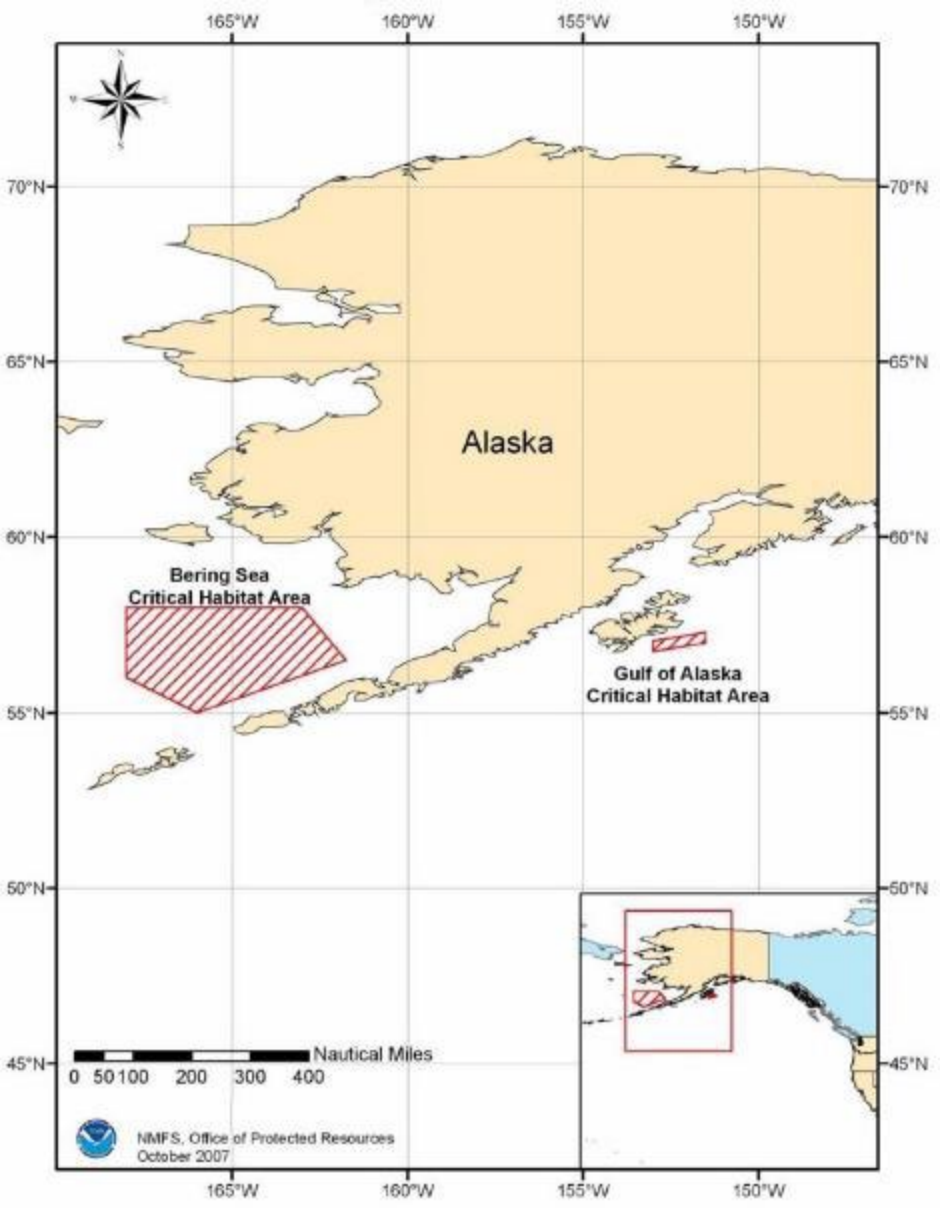


Source: https://media.fisheries.noaa.gov/dam-migration/belugawhale_cookinletch.pdf Accessed June 28, 2023

North Pacific Right Whale Critical Habitat

In 2006, NMFS issued a final rule designating two areas in the North Pacific as northern right whale critical habitat; one area is in the GOA south of Kodiak Island and one is located in the Bering Sea (71 FR 38277) (Figure 3-8). In 2008, NMFS re-designated the same two areas as North Pacific right whale critical habitat under the newly recognized species name, *E. japonica* (73 FR 19000). AFSC and IPHC research overlaps with these areas, though specific mitigation measures are used within right whale critical habitat to avoid interaction with this species (see Section 2). Sections 4.3.2.2.4 and 4.4.2.2.1 describe the effects of the alternatives on this critical habitat.

Figure 3-8. North Pacific Right Whale Critical Habitat



Source: https://media.fisheries.noaa.gov/dam-migration/northpacificrightwhale.pdf Accessed June 28, 2023

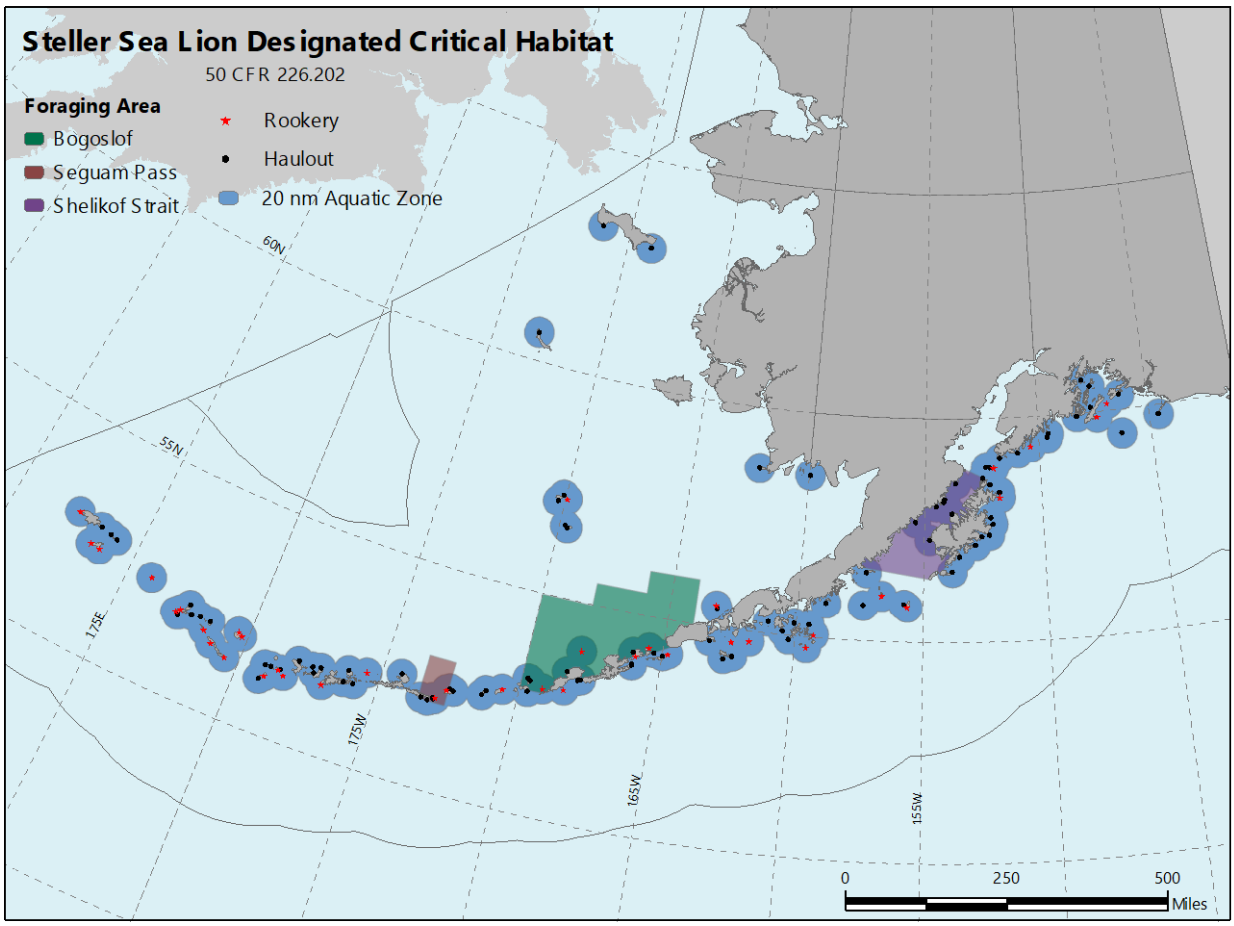
Steller Sea Lion Critical Habitat

Critical habitat for Steller sea lions was designated in 1993 (58 FR 45269). Critical habitat includes the major Steller sea lion rookeries and major haulouts identified in regulation and associated terrestrial, air, and aquatic zones (Figure 3-9):

- Terrestrial zone: Critical habitat includes a terrestrial zone that extends 3,000 feet (0.9 km) landward from the baseline or base point of each major rookery and major haulout in Alaska.
- Air zone: Critical habitat includes an air zone that extends 3,000 feet (0.9 km) above the terrestrial zone of each major rookery and major haulout in Alaska, measured vertically from sea level.
- Aquatic zone: Critical habitat includes an aquatic zone that extends 3,000 feet (0.9 km) seaward in State and Federally managed waters from the baseline or basepoint of each major rookery and major haulout in Alaska that is east of 144degrees W. longitude. Critical habitat includes an aquatic zone that extends 20 nm (37 km) seaward in State and Federally managed waters from the baseline or basepoint of each major rookery and major haulout in Alaska that is west of 144degrees W. longitude.

Critical habitat also includes three special aquatic foraging areas in Alaska: the Shelikof Strait area, the Bogoslof area, and the Seguam Pass area. IPHC and AFCS research activities may occur within or near these areas. Sections 4.3.2.2.4 and 4.4.2.2.1 describe the effects of the alternatives on this critical habitat.

Figure 3-9. Steller Sea Lion Critical Habitat



Source: https://media.fisheries.noaa.gov/dam-migration/steller-sea-lion-critical-habitat-alaska.pdf; Accessed June 29, 2023

Northern Sea Otter Critical Habitat

The USFWS designated 15,000 km^2 of critical habitat for the southwest DPS of northern sea otters in 2009 (74 FR 51988). This critical habitat is broken into 5 units: Western Aleutian; Eastern Aleutian; South Alaska Peninsula; Bristol Bay; and Kodiak, Kamishak, and Alaska Peninsula (Figure 3-10).

Figure 3-10. Southwest Alaska Sea Otter Critical Habitat

Source: USFWS (2017a).

As defined by USFWS (2017a), Primary Constituent Elements (PCEs) are the physical and biological features essential to conservation of the species and may require special management considerations. The PCEs for the designated northern sea otter critical habitat of the sea otter are:

- PCE 1: Shallow, rocky areas where marine predators are less likely to forage, which are waters less than 6.6 ft (2 m) in depth;
- PCE 2: Nearshore waters within 328 ft (100 m) of the mean high tide line;
- PCE 3: Kelp forests that occur in waters less than 66 ft (20 m) in depth; and
- PCE 4: Prey resources within the areas identified by PCEs 1, 2, and 3 that are present in sufficient quantity and quality to support the energetic requirements of the species.

Sections 4.3.2.2.4 and 4.4.2.2.1 describe the effects of the alternatives on this critical habitat.

Polar Bear Critical Habitat

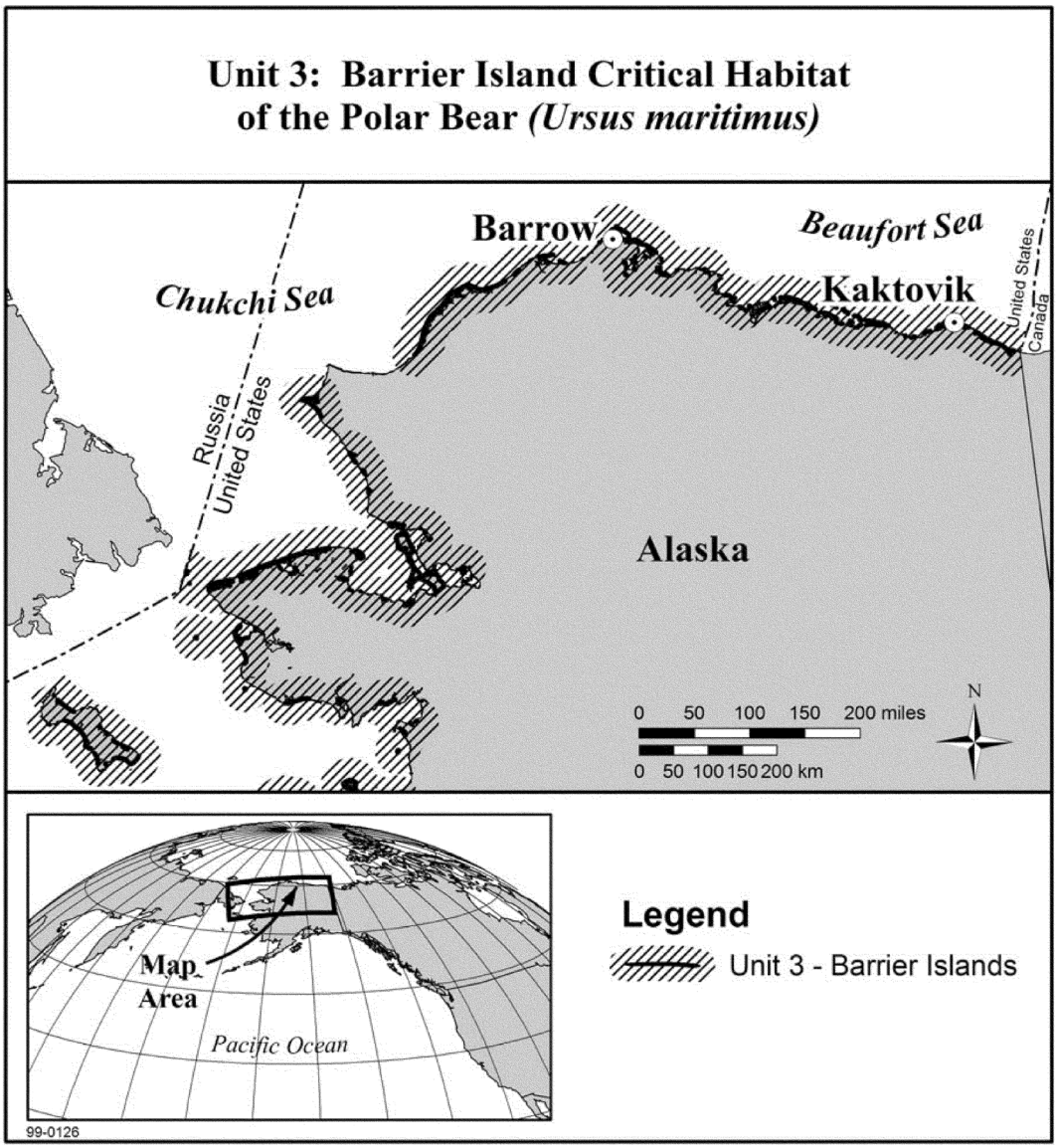
In 2010, the USFWS designated a total of 484,734 km^2 of Alaskan and adjacent territorial and U.S. waters as critical habitat for the polar bear (75 FR 76086) (USFWS 2010). The designation was set aside in 2013 as a result of legal challenges by several groups. In 2016, the set aside was reversed by the courts

and the original designation was reinstated. Three units of critical habitat were designated, corresponding to the following PCEs of critical habitat described in the final rule:

- Sea-ice habitat used for feeding, breeding, denning, and movements, which is sea ice over waters 300 m (984.2 ft) or less in depth that occurs over the continental shelf with adequate prey resources (primarily ringed and bearded seals) to support polar bears. AFSC does not conduct research during periods of ice cover; therefore, this aspect of the critical habitat is not discussed further.
- Terrestrial denning habitat, which includes topographic features, such as coastal bluffs and river banks, with suitable macrohabitat characteristics. AFSC does not conduct research on land so terrestrial critical habitat is not discussed further.
- Barrier island habitat used for denning, refuge from human disturbance, and movements along the coast for access to denning and feeding habitats, comprising all barrier islands and associated mainland spits along the Alaska coast, and the water, ice, and terrestrial habitat within 1.6 km of these islands, designated as a no-disturbance zone (Figure 3-11).

Sections 4.3.2.2.4 and 4.4.2.2.1 described the effects of the alternatives on the barrier island PCE of this critical habitat.

Figure 3-11. Designated Barrier Island Polar Bear Critical Habitat



Source: 75 FR 76086

3.2.2.2 Non-listed Marine Mammals

Table 3-5 provides the most recent abundances of non-listed marine mammals that could be encountered in the AFSC and IPHC research areas. The table compares the most recently available abundances reported in Young *et al.* (2023) or Carretta *et al.* (2023) with those used in the 2019 MMPA final rule (84 FR 46788), as appropriate.

The 2019 final rule (84 FR 46788) included abundances for the following non-ESA-listed marine mammals that occur off the U.S. west coast (not in AK waters) but no takes were requested for these species. These stocks are not shown in Table 3-5, and interactions with IPHC research are not expected. See the 2019 final rule for additional details:

- Pygmy sperm whale - CA/OR/WA stock
- Dwarf sperm whale - CA/OR/WA stock
- Common bottlenose dolphin - California coastal stock (CA/OR/WA offshore stock is included)
- Striped dolphin - CA/OR/WA stock
- Long-beaked common dolphin - CA/OR/WA stock
- Harbor porpoise - Morro Bay, Monterey Bay, San Francisco-Russian River, Northern CA/Southern OR, N. Oregon/WA Coast, and Washington Inland Waters stocks (SE Alaska, GOA, and Bering Sea stocks are included).

Table 3-5. Abundance of Non-Listed Marine Mammals that May be Encountered by AFSC and IPHC Research Activities

Species and Stock or DPS	GOARA	BSAIRA	CSBSRA	U.S. West Coast[1]	2019 Final Rule[2]	Current Estimated Abundance[3]
Harbor Porpoise *(Phocoena phocoena vomerina)*						
SE Alaska Stock[4]	X				unknown	unknown
GOA Stock	X				31,046	31,046
Bering Sea Stock		X	X		40,150	unknown
Dall's Porpoise *(Phocoenoides dalli)*						
Alaska Stock	X	X			83,400	unknown
CA/WA/OR stock				X	25,750	16,498
Pacific White-Sided Dolphin *(Lagenorhynchus obliquidens)*						
CA/OR/WA Stock				X	26,814	34,999
North Pacific Stock	X	X			26,880	26,880
Risso's Dolphin *(Grampus griseus)*						
CA/OR/WA Stock				X	6,336	6,336

Species and Stock or DPS	GOARA	BSAIRA	CSBSRA	U.S. West Coast[1]	2019 Final Rule[2]	Current Estimated Abundance[3]
Common Bottlenose Dolphin *(Tursiops truncatus truncatus)*						
CA/OR/WA Offshore				X	1,924	3,477
Common Dolphin *(Delphinus delphis delphis)*						
CA/OR/WA Stock				X	969,861	1,056,308
Northern Right Whale Dolphin *(Lissodelphis borealis)*						
CA/OR/WA Stock				X	26,556	29,285
Gray Whale *(Eschrichtius robustus)*						
ENP Stock[5]	X	X	X	X	26,960	26,960
Killer Whale *(Orsinus orca)*						
ENP Northern Resident	X			X	261	302
West Coast Transient	X			X	243	349
ENP Offshore	X	X		X	300	300
AT1 Transient[6]	X				7	7
ENP GOA, AI and BS Transient	X	X	X		587	587
ENP Alaska Resident	X	X			2,347	1,920
Short-finned Pilot Whale *(Globicephala macrorhynchus)*						
CA/OR/WA Stock				X	836	836
Baird's Beaked Whale *(Berardius bairdii)*						
CA/OR/WA Stock				X	2,697	1,363
Alaska Stock	X	X			unknown	unknown
Cuvier's Beaked Whale *(Ziphius cavirostris)*				X	3,274	5,454
CA/OR/WA Stock	X	X			unknown	unknown
Alaska Stock						
Other Beaked Whales[7] *Mesoplodon spp.*				X	3,044	3,044
Beluga Whale (*Delphinapterus leucas*)						
Beaufort Sea		X	X		39,258	39,258
Eastern Chukchi Sea		X	X		20,752	13,305
Eastern Bering Sea		X			6,994	12,269
Bristol Bay		X			1,926	2,040

Species and Stock or DPS	GOARA	BSAIRA	CSBSRA	U.S. West Coast[1]	2019 Final Rule[2]	Current Estimated Abundance[3]
Humpback Whale[8] *(Megaptera novaeangliae)* Hawaii DPS	X	X			NR	11,278
Minke Whale *(Balaenoptera acutorostrata)* CA/OR/WA Stock				X	636	915
Alaska Stock	X	X	X		unknown	unknown
California Sea Lion *(Zalophus californianus)* United States	X			X	296,750	257,606
Steller Sea Lion *(Eumetopias jubatus monteriensis)* Eastern U.S. DPS	X			X	41,638	43,201
Northern Fur Seal *(Callorhinus ursinus)*						
Pribilof/Eastern Pacific	X	X		X	237,561	626,618
California Stock	X			X	14,050	14,050
Northern Elephant Seal *(Mirounga angustirostris)* California Breeding	X	X		X	179,000	187,386
Harbor Seal *(Phoca vitulina richardsii)*						
California Stock[9]				X	30,968	30,968
OR/WA Coast Stock[9]				X	24,732	24,732
WA N. Inland Waters[9]				X	11,036	11,036
Southern Puget Sound[9]				X	1,568	1,568
Hood Canal[9]				X	1,088	1,088
Clarence Strait	X				31,634	27,659
Dixon/Cape Decision	X				18,105	23,478
Sitka/Chatham Strait	X				14,855	13,289
Lynn Canal/Stephens Passage	X				9,478	13,388
Glacier Bay/Icy Strait	X				7,210	7,455
Cook Inlet/Shelikof	X				27,386	28,411
Prince William Sound	X				29,889	44,756
South Kodiak	X				19,199	26,448
North Kodiak	X				8,321	8,677
Bristol Bay		X			32,350	44,781
Pribilof Islands		X			232	229
Aleutian Islands		X			6,431	5,588

Species and Stock or DPS	GOARA	BSAIRA	CSBSRA	U.S. West Coast[1]	2019 Final Rule[2]	Current Estimated Abundance[3]
Spotted Seal (*Phoca largha*) Bering Alaska		X	X		461,625	461,625
Ribbon Seal (*Histriophoca fasciata*) Alaska		X	X		184,000	184,697
Northern Sea Otter (*Enhydra lutris nereis*)						
Southcentral Alaska[10]	X				N/A	21,617
Southeast Alaska[11]	X				N/A	22,359
Washington[12]				X	N/A	1,806

[1] May overlap with IPHC research off of Washington, Oregon and N. California.
[2] Distribution and abundance from the 2019 Final Rule (84 FR 46788), as applicable
[3] Source: Carretta *et al.* (2023), Young *et al.* (2023).
[4] In 2022, the Southeast Alaska stock was divided into three separate stocks: the Northern Southeast Alaska Inland Waters stock; the Southern Southeast Alaska Inland Waters stock; and the Yakutat/Southeast Alaska Offshore Waters stock. For simplicity, the total abundance summed for these three SE Alaska stocks is reported here as a comparison to the abundance for the Southeast Alaska stock reported in the 2019 final rule (84 FR 46788). For details on the stock structure and abundances see (Young *et al.* 2023).
[5] ENP gray whales experienced an unusual mortality event (UME) beginning in 2019 (which is ongoing) https://www.fisheries.noaa.gov/national/marine-life-distress/2019-2023-gray-whale-unusual-mortality-event-along-west-coast-and (Accessed June 13, 2023). Necropsies conducted on a subset of stranded whales indicated that many animals showed evidence of nutritional stress.
[6] There has been no recruitment in this population since 1984 (Young *et al.* 2023).
[7] *Mesoplodon spp*. species are managed as a single stock due to difficulty in distinguishing among them.
[8] Changes to stock definitions were made by NMFS in 2023 (Carretta *et al.* 2023, Young *et al.* 2023). See Section 3.2.2.1.1.
[9] These stocks are included because IPHC takes could be from any harbor seal stock (84 FR 46788).
[10] Abundance from: USFWS (2023a)
[11] Abundance from: USFWS (2023b)
[12] Abundance from: USFWS (2018b)
NR = Not Reported

3.2.3 Seabirds

3.2.3.1 ESA-Listed Seabird Species

There are four ESA-listed bird species with the potential to occur in the AFSC and IPHC research areas: the short-tailed albatross; the Steller's eider; the spectacled eider; and the marbled murrelet (CA/OR/WA population only). Only marbled murrelets in California, Oregon and Washington waters are ESA-listed; the Alaska population is not. Details regarding these ESA-listed bird species are shown in Table 3-6. Table 1-1 describes AFSC consultation efforts with USFWS for bird species under section 7 of the ESA to date. Effects of the Status Quo Alternative and the Preferred Alternative on these species are described in Sections 4.3.2.3 and 4.4.2.3, respectively.

3.2.3.1.1 Critical Habitat Designations

Critical habitat has not been designated for short-tailed albatross. Critical habitat for ESA-listed marbled murrelets was designated in 1996 and revised in 2011 for forested breeding habitat in Washington, Oregon, and California (76 FR 61599). This critical habitat is located in upland areas and would be unlikely to be affected by IPHC research activities in Oregon and Washington and is not described further. The following subsections describe critical habitat for the two ESA-listed eider species that may be encountered by AFSC and IPHC research.

Steller's Eider Critical Habitat

In 2001, the USFWS designated 7,330 km^2 of critical habitat for the Alaska-breeding population of Steller's eiders, including breeding habitat on the Yukon-Kuskokwim Delta (Y-K Delta), molting and staging areas in the Kuskokwim Shoals and Seal Islands, and molting, wintering, and staging areas at Nelson Lagoon and Izembek Lagoon (66 FR 8850) (Figure 3-12). AFSC research activities in the BSAIRA and IPHC activities in the Y-K Delta may overlap with some of these critical habitat areas.

USFWS PCE's for Steller's eider critical habitat (for specific units) are: marine waters up to 9 m deep and the underlying substrate; the associated invertebrate fauna in the water column; the underlying marine benthic community; and where present, eelgrass beds and associated flora and fauna. Regardless of the boundaries of the critical habitat units, all waters greater than 9 m deep are not considered to be critical habitat for this species (66 CFR 8850). For Unit 1, the PCE includes the vegetated intertidal zone and all open water inclusions within this zone. See Sections. 4.3.2.3 and 4.4.2.3 for a discussion of the effects of the alternatives on designated critical habitat.

Spectacled Eider Critical Habitat

In 2001, the USFWS designated over 100,000 km^2 as critical habitat for spectacled eiders (66 FR 9146). The critical habitat includes areas on the Y-K Delta, and in Norton Sound, Ledyard Bay, and the Bering Sea between St. Lawrence and St. Matthew islands (Figure 3-13). These areas are important breeding, molting, and wintering areas for the spectacled eider and overlap with AFSC research activities in the BSAIRA and CSBSRA and IPHC research in the BSAIRA (near the Y-K Delta).

USFWS PCE's for spectacled eider include: for Units 1 and 2 (the Y–K Delta units), the vegetated intertidal zone and all open water inclusions within this zone; for the Norton Sound Unit (Unit 3) and the Ledyard Bay Unit (Unit 4), all marine waters greater than 5 m (16.4 ft) in depth and less than or equal to 25 m (82.0 ft) in depth, along with associated marine aquatic flora and fauna in the water column, and the

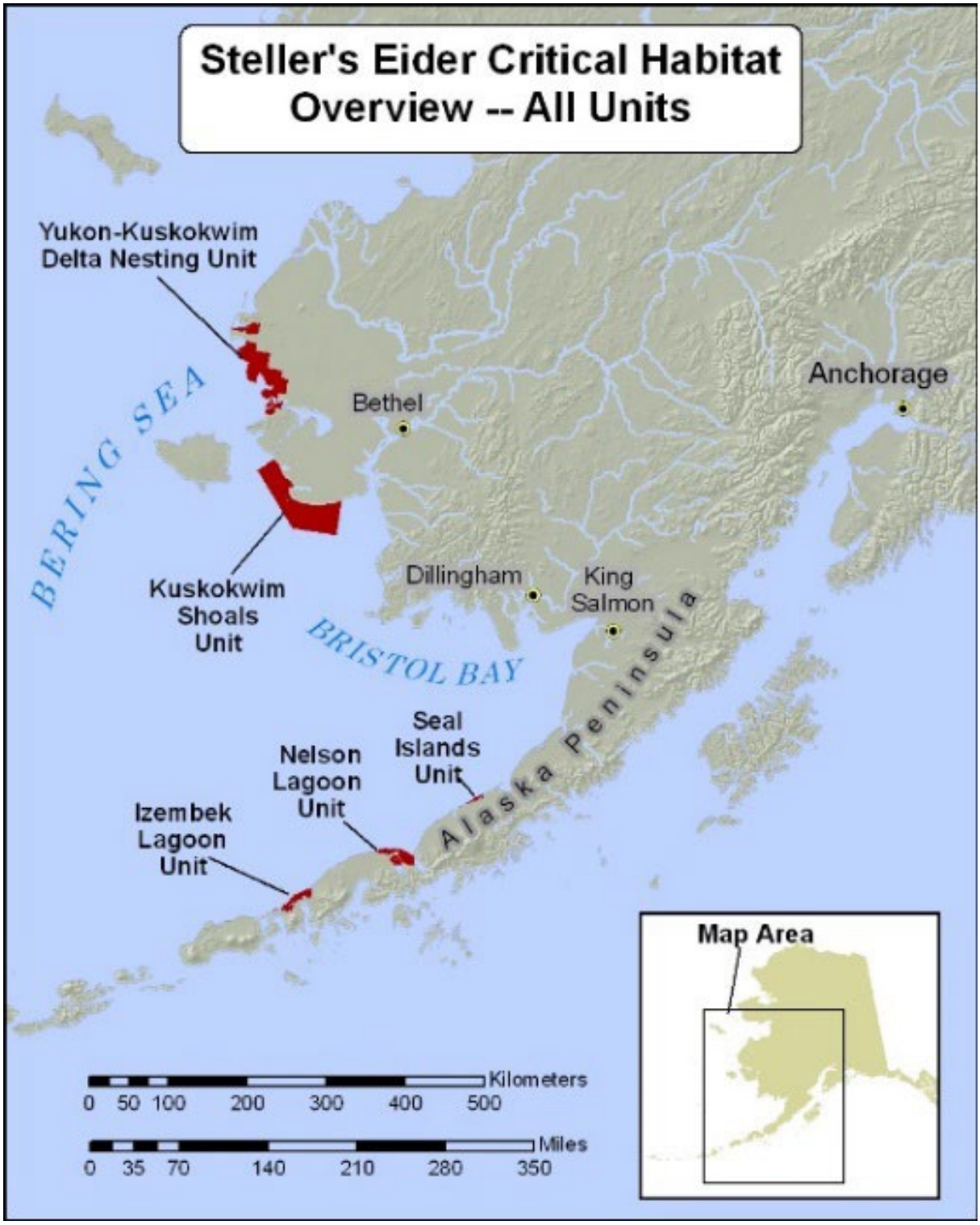
underlying marine benthic community; and for the Wintering Unit (Unit 5), all marine waters less than or equal to 75 m (246.1 ft) in depth, along with associated marine aquatic flora and fauna in the water column, and the underlying marine benthic community. See Sections. 4.3.2.3 and 4.4.2.3 for a discussion of the effects of the alternatives on designated critical habitat.

Table 3-6. ESA-Listed Seabirds Within the Project Area

ESA Listed Species	GOARA	BSAIRA	CSBSRA	U.S. West Coast[1]	Current ESA Status	Current Estimated Abundance	References	Description/Change from 2019 PEA
Short-tailed Albatross (*Phoebastria albatrus*)	X	X		X	E	Although the highest concentrations of short-tailed albatross are found in the Aleutian Islands and Bering Sea (primarily outer shelf) regions of Alaska, subadults appear to be distributed along the west coast of the U.S. more than has been previously reported **(Guy *et al.* 2013)**. The short-tailed albatross population is currently estimated to be about 8,099[2], with approximately 6,804 breeding birds on Torishima Island[2]. Following their dramatic decline to near extinction in the early 1900s, the short-tailed albatross population is small but increasing with an annual growth rate of 8.4%[3].	USFWS (2008) **USFWS (2014a)** O'Connor (2013) **USFWS (2020a)** USFWS (2022) 85 FR 21282	No change in ESA status. Critical Habitat not designated. A draft recovery plan was begun in 2005 and finalized in 2008. The most recent status review was completed in 2014. And a 5-year review was completed in 2020. This species spends most of its life in flight over the Pacific Ocean when not nesting, ranging from the coasts of Russia and Asia, Hawaii, and the Pacific Coast of North America. It is a migratory species and is covered under the MBTA. Juvenile and younger sub-adult birds (up to 2 years old) range much more widely than the adult birds, inhabiting the Sea of Okhotsk, a broader region of the Bering Sea, and the west coast of North America. The most recent 5-year review notes that the short-tailed albatross is making good progress toward meeting delisting criteria and that the challenge to recovery will be in growing new colonies. The review recommended no change to the ESA-listing for this species.
Steller's Eider (*Polysticta stelleri*)	X	X	X		T	From data collected during the Alaska coastal plain aerial survey, the estimated average number of Steller's eiders present on ACP annually from 2007 – 2017 ranged from 68 – 745 (mean = 308, 95% CI = 216 – 422). The number of Steller's eiders estimated to be present annually in the Utqiaġvik Triangle ranged from 30 – 468 (mean = 204, 95% CI = 184 – 225) **(USFWS 2019b)**.	62 FR 31748 66 FR 8850 **USFWS (2019b)** USFWS (2022)	No change in ESA status. Critical habitat was designated in 2001. Most recent status assessment was completed in 2019 and concluded that there is inadequate information to determine if abundance of the northern Alaska subpopulation has changed since listing. AFSC research activities overlap with Steller's eider breeding areas in the CSBSRA, and wintering areas in the BSAIRA and GOARA. In addition**,** IPHC activities my overlap with molting areas in the Y-K Delta. See Section 3.2.3.1.1 for a map discussion of critical habitat.
Spectacled Eider (*Somateria fisheri*)		X	X		T	In 2010, the abundnace estimate of the global population spectacled eiders was determined to be 369,122. More recent studies note that about 9,000 spectacled eider pairs are estimated to nest on Alaska's ACP and at least 40,000 pairs nest in Arctic Russia; these data indicate that the population may have rebounded and may be suitable for delisting.	58 FR 27474 66 FR 9146 85 FR 53840 **Larned *et al.* (2012)** **Lewis *et al.* (2019)** **Dunham *et al.* (2021)** USFWS (2022)	No change in ESA status or critical habitat. In 2020, USFWS announced the intent to complete a 5-year status review of the species. As of June 2023, the review is not yet completed. Critical habitat was designated in 2001 and **includes areas on the Y-K Delta, in Norton Sound, Ledyard Bay, and th**e Bering Sea between St. Lawrence and St. Matthew Islands. These areas total approximately 10,098,827 hectares and overlap with AFSC and IPHC research areas. See Section 3.2.3.1.1 for a map and discussion of spectacled eider critical habitat. During migration from nesting to molting areas, spectacled eiders travel along the coast up to 60 km. They gather to molt in waters up to 36 m deep before heading to wintering areas in the Bering Sea from August to November. There are 3 breeding populations that overwinter south of St. Lawrence Island, where in most years they are constrained to openings in the sea ice.
Marbled Murrelet[4] (*Brachyramphus marmoratus*) CA/OR/WA population				X	T	Global population is ~300,000-400,000 with ~70% in Alaska, 25% in British Columbia, and 5% in CA/OR/WA In 2019 the Oregon population was reported as 10,339 (95% CI = 7,070 and 13,607). **Raphael *et al.* (2007)** The 2005 estimated marbled murrelet population for C/WA/OR was estimated at ~20,200 murrelets (95% CI = 16,000 to 24,500). Washington marbled murrelets declined by 3.9%; between 2001 and 2019.	USFWS (1997) Desimone (2016) ODFW (2018) **Felis *et al.* (2022)** 76 FR 61599 85 FR 21282 **USFWS (2019a)** ODFW (2021)	No change in ESA status. Critical habitat was designated in 1996 and revised in 2011 in forested breeding habitat in Washington, Oregon, and California (76 FR 61599). Because critical habitat is in upland areas it does not overlap with IPHC research activities. The most recent recovery plan was done in 1997. A 5-year status review was completed in 2019 and recommended no change in listing status. The marbled murrelet's breeding range extends from Alaska, south to British Columbia, Washington, and Oregon; to northern Monterey Bay in central California. Birds winter throughout the breeding range. This is a migratory species and is covered under the MBTA.

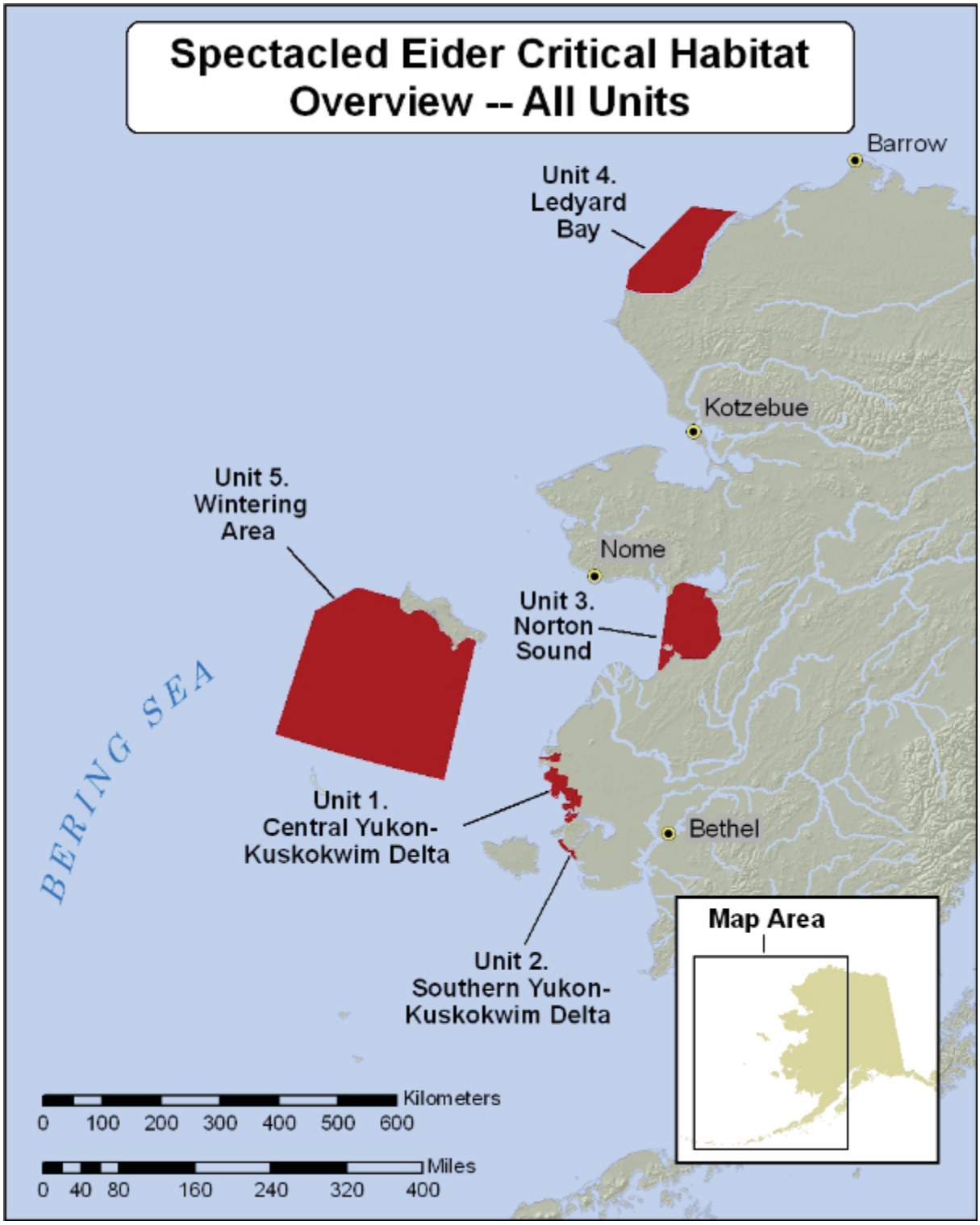
[1]May overlap with IPHC research off of Washington, Oregon and N. California.
[2]Source: the 13th Short-tailed Albatross Recovery Team (START) meeting held on April 12, 2021.
[3]Personal communication S. Fitzgerald Jan. 2022).
[4]Marbled murrelets are listed as a threatened species only in Washington, Oregon, and California. The Alaska population is shown in Table 3-7.

Figure 3-12. Steller's Eider Critical Habitat



Source: USFWS (2022)

Figure 3-13. Spectacled Eider Critical Habitat



Source: USFWS (2022)

3.2.3.2 Non-Listed Seabird Species

There are many seabird species that occur in the three AFSC fisheries research which may potentially interact with research vessels and gear. Table 3-7 summarizes the latest information on the abundance and distribution of seabirds that regularly occur in AFSC or IPHC research areas. Where available current population abundance estimates are provided in the table. Table 3-8 lists additional marine bird species that spend at least part of the time in marine waters potentially impacted by AFSC and IPHC research activities. The tables note as to whether a species is considered to be a 2021 USFWS bird of conservation concern (USFWS 2021c). Sections 3.2.3.2 and 3.2.3.3 of the 2019 PEA (NMFS 2019c) provide additional details, including their preferred prey species, on all of these species.

Table 3-7. Seabirds that Regularly Occur in AFSC and IPHC Research Areas

Species	Occurrence[1]		
	GOARA	BSAIRA	CSBSRA
Black-footed albatross(*Diomedea nigripes*)[2]	Common	Uncommon	Not Found
Laysan albatross (*Diomedea immutabilis*)[2]	Common	Common	Not Found
Sooty shearwater (*Puffinus griseus*)	Abundant	Common	Not Found
Short-tailed shearwater(*Puffinus tenuirostris*)	Common	Abundant	Common
Northern fulmar (*Fulmarus glacialis*)	Abundant	Abundant	Rare
Fork-tailed storm-petrel (*Oceanodroma furcata*)	Abundant	Abundant	Not Found
Leach's storm-petrel (*Oceanodroma leucorrhoa*)	Abundant	Abundant	Not Found
Double-crested cormorant (*Phalacrocorax auritis*)	Common	Common	Not Found
Pelagic cormorant (Phalacrocorax pelagicus)	Abundant	Abundant	Rare
Red-faced cormorant (*Phalacrocorax urile*)[2]	Abundant	Abundant	Not Found
Pomarine jaeger (*Stercorarius pomarinus*)	Uncommon	Uncommon	Common
Parasitic jaeger (*Stercorarius parasiticus*)	Uncommon	Uncommon	Common
Long-tailed jaeger (*Stercorarius longicaudus*)	Rare	Uncommon	Common
Bonaparte's gull (*Larus philadelphia*)	Uncommon	Rare	Not Found
Mew gull (*Larus canus*)	Common	Common	Rare
Herring gull (*Larus argentatus*)	Common	Uncommon	Rare
Glaucous-winged gull (*Larus glaucescens*)	Abundant	Abundant	Not Found
Glaucous gull (*Larus hyperboreus*)	Common	Common	Common
Sabine's gull (*Xema sabini*)	Uncommon	Uncommon	Common
Ivory gull (*Pagophila eburnean*)[2]	Not Found	Uncommon	Uncommon
Black-legged kittiwake (*Rissa tridactyla*)	Abundant	Abundant	Common
Red-legged kittiwake (*Rissa brevirostris*)[2]	Not Found	Abundant	Not Found
Arctic tern (*Sterna paradisaea*)	Common	Common	Uncommon
Aleutian tern (*Sterna aleutica*)[2]	Common	Common	Rare
Common murre (*Uria aalge*)	Abundant	Abundant	Common

Species	Occurrence[1]		
	GOARA	BSAIRA	CSBSRA
Thick-billed murre (*Uria lomvia*)	Common	Abundant	Common
Black guillemot (*Cepphus grylle*)	Not Found	Rare	Uncommon
Pigeon guillemot (*Cepphus columba*)	Common	Common	Uncommon
Marbled murrelet (*Brachyramphus marmoratus*)[2]	Common	Uncommon	Common
Kittlitz's murrelet (*Brachyramphus brevirostris*)[2]	Uncommon	Uncommon	Rare
Ancient murrelet (*Synthliboramphus antiquus*)[2]	Abundant	Abundant	Not Found
Cassin's auklet (*Ptychoramphus aleuticus*)[2]	Abundant	Abundant	Not Found
Parakeet auklet (*Cyclorrhynchus psittacula*)	Abundant	Abundant	Uncommon
Least auklet (*Aethia pusilla*)	Rare	Abundant	Common
Whiskered auklet (*Aethia pygmaea*)[2]	Not Found	Common	Not Found
Crested auklet (*Aethia cristatella*)	Common	Abundant	Common
Rhinoceros auklet (*Cerorhinca monocerata*)	Common	Rare	Not Found
Horned puffin (*Fratercula corniculata*)	Abundant	Abundant	Uncommon
Tufted puffin (*Fratercula cirrhata*)[2]	Abundant	Abundant	Uncommon

[1]Source: NMFS (2019c)
[2]Alaska population only. ESA-listed marbled murrelets from California, Oregon and Washington waters are discussed in Section 3.2.3.1

Table 3-8. Species that Spend at Least Part of the Year in Alaskan Marine Waters[1]

Common Name	Scientific Name	Common Name	Scientific Name
Red-throated loon	*Gavia stellate*	White-winged scoter	*Melanitta fusca*
Pacific loon	*Gavia pacifica*	Black scoter	*Melanitta americana*
Common loon	*Gavia immer*	Common goldeneye	*Bucephala clangula*
Yellow-billed loon[2]	*Gavia adamsii*	Barrow's goldeneye	*Bucephala islandica*
Red-necked grebe	*Podiceps grisegena*	Bufflehead	*Bucephala albeola*
Horned grebe	*Podiceps auritus*	Common merganser	*Mergus merganser*
Brant[2]	*Branta bernicla*	Red-breasted merganser	*Mergus serrator*
Emperor goose[2]	*Chen canagica*	Red-necked phalarope	*Phalaropus lobatus*
Lesser scaup	*Aythya affinis*	Red phalarope	*Phalaropus fulicarius*
Greater scaup	*Aythya marila*	Harlequin duck	*Histrionicus histrionicus*
Canvasback	*Aythya valisineria*	Long-tailed duck	*Clangula hyemalis*
Redhead	*Aythya americana*	Common eider	*Somataria mollissima*
Surf scoter	*Melanitta perspicillata*	King eider	*Somataria spectabilis*

[1]Source: NMFS (2019c)
[2] Birds of Conservation Concern (USFWS 2021c)

3.2.4 Sea Turtles and Sea Turtle Critical Habitat

Four species of sea turtle (leatherback, olive ridley, green and loggerhead) may be encountered in AFSC or IPHC research areas; they are all listed under the ESA. Table 3-9 provides recent abundance information, current ESA status, and potential for occurrence in AFSC and IPHC research areas. Sea turtles are not found in the BSAIRA or CSBSRA, so only occurrence in the GOARA or U.S. west coast is shown in the table. Detailed descriptions of life history and occurrence of these species are provided in Section 3.2.4 of the 2019 PEA (NMFS 2019c). The impacts of the Status Quo and Preferred Alternatives on four species of sea turtles are analyzed in Sections 4.3.2.4 and 4.4.2.4, respectively.

Only one of the turtle species that could be encountered has designated critical habitat in the areas of potential IPHC research activities using longlines and setlines. Figure 3-14 shows the location of leatherback sea turtle designated critical habitat. Sections 4.3.2.4 and 4.4.2.4 discuss the potential impacts of IPHC research on leatherback sea turtle critical habitat.

Table 3-9. ESA-Listed Sea Turtles Within the Project Area

ESA Listed Species	DPS, ESU or Stock	GOARA	U.S. West Coast	Current ESA Status	Current Estimated Abundance[1]	References	Description/Change from 2019 PEA
Leatherback Sea Turtle *(Dermochelys coriacea)*	West Pacific DPS	X	X	E	The most current total index of nesting female abundance of the West Pacific DPS is 1,277 females.	**NMFS and USFWS (2020a)** **Bailey *et al.* (2012)** **Martin *et al.* (2020)** 77 FR 4170	No change in ESA status or critical habitat. West coast critical habitat designated in 2012 (77 FR 4169). Designated critical habitat is made up of two sections of marine habitat where leatherbacks are known to feed on jellyfish. The southern portion stretches along the California coast from Point Arena to Point Arguello east of the 3,000-meter depth contour, while the northern portion stretches from Cape Flattery, Washington to Cape Blanco, Oregon, east of the 2,000-meter depth contour, and includes important habitat associated with the Columbia River plume. This northern section may overlap with IPHC activities (see Section 3.2.4). Leatherbacks are unlikely to be found in Puget Sound, but a major feeding area is located near the mouth of the Columbia River. The PCE is the occurrence of prey species, primarily the order Semaeostomeae (Chrysaora, Aurelia, Phacellophora, and Cyanea), of sufficient condition, distribution, diversity, abundance and density necessary to support individual as well as population growth, reproduction, and development of leatherbacks. The new status review completed in 2020 identified 7 DPSs including the West Pacific and East Pacific DPSs. Based on tracking data from **Bailey *et al.* (2012)**, leatherback turtles tagged along the CA/OR/WA coast are from the West Pacific DPS.
Olive Ridley Sea Turtle *(Lepidochelys olivacea)*	Mexico's Pacific Coast Breeding Populations	X	X	E	1.39 million, weighted yearly average	NMFS and USFWS (1998) NMFS and USFWS (2014) **Eguchi *et al.* (2007)** Hodge and Wing (2000)	No change in ESA status. Critical habitat not designated. The most recent 5-year review was done in 2014. Olive Ridley turtles do not nest in the United States. In the eastern Pacific, Olive Ridleys typically occur in tropical and subtropical waters, as far north as California but occasionally have been documented as far north as Alaska. AFSC research in the GOARA and IPHC research off the U.S. west coast may encounter this species.
Green Sea Turtle *(Chelonia mydas)*	East Pacific DPS		X	T	The DPS exhibits an estimated total nester abundance of 20,112 females at 39 nesting sites. Nesting data indicate increasing trends in recent decades.	**Seminoff *et al.* (2015)** 43 FR 32800 81 FR 20058	No change in ESA status. Critical habitat not designated. The East Pacific DPS includes the Mexican Pacific coast breeding population, which was originally listed as endangered in 1978. Most recent recovery plan was completed in 1998, and the most recent status review was done in 2015. Green turtles are not found in Alaskan waters, but the East Pacific DPS extends from the California/Oregon border southward and may be encountered by IPHC researchers in those areas.
Loggerhead Sea Turtle (*Caretta caretta*)	North Pacific Ocean DPS	X	X	E	8,733 nesting females	**NMFS and USFWS (2020b)** **Martin *et al.* (2020)** 85 FR 53684	No change in ESA status. No critical habitat in AFSC and IPHC research areas. The most recent status review completed in 2020 concluded that abundance continues to be low for the North Pacific Ocean DPS, but that North Pacific loggerhead nesting has increased between 1999 and 2012, at a minimum. The review concluded that the current endangered status of the DPS is warranted. Loggerheads are rare in SE Alaskan waters but may also be encountered by IPHC research off the U.S. west coast.

[1]Sources for abundance are provided in References column for each species.

Figure 3-14. Leatherback Sea Turtle Designated Critical habitat

Source: https://www.fisheries.noaa.gov/resource/map/leatherback-turtle-critical-habitat-map-and-gis-data
Accessed July 10, 2023

3.2.5 Invertebrates

As described in Section 3.2.5 of the 2019 PEA (NMFS 2019c), numerous species of cnidarians (particularly corals and anemones), crustaceans (such as crabs and shrimp), mollusks (including clams and snails), echinoderms (sea stars and sea urchins), sponges, and tunicates are found in AFSC and IPHC research areas. These include one species proposed for listing under the ESA (see Section 3.2.5.1 of this SPEA). Managed and non-managed invertebrate species are discussed in Sections 3.5.2.2 and 3.5.2.3, respectively. Deep sea corals are also found in the research areas and are discussed in Section 3.2.5.3.

3.2.5.1 ESA-Listed Invertebrates

There are currently no ESA-listed invertebrate species found within the research areas; however, on August 18, 2021, the Center for Biological Diversity petitioned NMFS to list the sunflower sea star *Pycnopodia helianthoides* as threatened or endangered under the ESA (Sakashita 2021). The petition was based on risks due to the continued effects of the sea star wasting syndrome (SSWS) and climate change. On December 27, 2021, NMFS announced a 90-day finding indicating that the petitioned action might be warranted and initiated a status review of the species (86 FR 73230). The subsequent October 2022 status report (Lowry *et al.* 2022) agreed that SSWS and climate change represented the two major threats to *P. helianthoides* but added that several other factors also increased overall extinction risk. The review concluded the species is facing a moderate risk of extinction over the foreseeable future (Lowry *et al.* 2022). On March 16, 2023, the sunflower sea star was proposed by NMFS for listing as threatened throughout its entire range, but critical habitat was not proposed at this time (88 FR 16212). Comments on the proposed rule to list the sunflower sea star were to have been received by May 15, 2023. In May 2023, NMFS held in-person public hearings on the proposed listing in Kodiak and Petersburg, Alaska (88 FR 21600). Public comments on the proposed rule and a final ruling on the listing of this species as endangered were not available as of October 2023 during preparation of this Draft PEA.

3.2.5.2 Managed Invertebrate Species

Many invertebrate species in Alaskan waters are considered to be commercially valuable and are managed by either the State of Alaska or NMFS. Some species such as sea urchins, shrimp, sea cucumbers, clams, and certain crab species occur primarily in state waters and are managed exclusively by the ADF&G. There are no specific retention regulations for these species aside from those published by ADF&G. Other species, including some stocks of king crab, Tanner crab, and scallops are managed jointly by ADF&G and NMFS and retention of these species by federal commercial groundfish fisheries is generally prohibited with some exceptions. Octopi and squids are managed by NMFS in federal waters and by ADF&G in state waters. Due to these management agreements, many of these species are targeted by AFSC surveys for stock assessment purposes and may be caught in large numbers during research activities.

Table 3-10 lists the most commercially important invertebrate species that may be encountered during AFSC and IPHC research activities in the GOARA and BSAIRA as well as their primary management jurisdiction. While snow crab may be encountered on the Chukchi Sea and Beaufort Sea continental shelves (McCracken and Rheinsmith 2022), commercial fishing for this species occurs primarily in the Bering Sea; no other managed invertebrates are found in the CSBSRA. IPHC research activities using

longlines and set lines are not expected to affect invertebrates or benthic habitat during activities off of the Washington, Oregon or northern California coasts, so invertebrates from these areas are not discussed.

Section 3.2.5.1 of the 2019 PEA (NMFS 2019c) provides detailed discussions many of the species shown in Table 3-10 and are incorporated herein by reference. However, due to recent reductions in abundance and curtailment of commercial fishing efforts for several species of crab, additional information on abundance and recovery of king, snow, and tanner crabs is provided in Sections 3.2.5.2.1 through 3.2.5.2.3 of this SPEA. As described in the 2022 *Stock Assessment and Fishery Evaluation (SAFE) Report for the King and Tanner Crab Fisheries* (Garber-Yonts *et al.* 2023), the BSAI crab fishery as a whole is experiencing an unprecedented resource and economic crisis. For the first time in the management history of commercial crab fishing in the BSAI, the two largest and most valuable commercial crab fisheries, Bering Sea snow crab and Bristol Bay red king crab fisheries, were simultaneously closed for the 2022/23 season, and the snow crab fishery I the Being Sea has been closed for the 2023/24 season (ADF&G 2023).

Table 3-10. Commercial and Prohibited Invertebrate Species in the AFSC Research Areas

Species	Fishery Management Agency[1]	**Occurrence[1]**	
		GOARA	BSAIRA
Alaskan pink shrimp (*Pandalus eous*)	ADF&G	X	X
Coonstripe shrimp (*Pandalus hypsinotis*)	ADF&G	X	X
Sidestriped shrimp (*Pandalopsis dispar*)	ADF&G	X	X
Spot shrimp (*Pandalus platyceros*)	ADF&G	X	X
Geoduck clam (*Panopea generosa*)	ADF&G	X	
Littleneck clam (*Protothaca stamineais*)	ADF&G	X	X
Razor clam (*Siliqua patula*)	ADF&G	X	X
Giant octopus (*Enteroctopus dofleini*)	ADF&G/NMFS	X	X
Magistrate armhook squid (*Berryteuthis magister*)	ADF&G/NMFS	X	X
Weathervane scallop (*Patinopecten caurinus*)	ADF&G/NMFS	X	X
Green sea urchin (*Strongylocentrotus droebachiensis*)	ADF&G	X	X
Red sea urchin (*Strongylocentrotus franciscanus*)	ADF&G	X	X
Red sea cucumber (*Parastichopus californicus*)	ADF&G	X	X
Blue king crab (*Paralithodes platypus*)	ADF&G/NMFS	X	X
Dungeness crab (*Cancer magister*)	ADF&G	X	X
Golden king crab (*Lithodes aequispinus*)	ADF&G/NMFS		X
Grooved tanner crab (*Chionoecetes tanneri*)	ADF&G/NMFS		X
Red king crab (*Paralithodes camtschaticus*)	ADF&G/NMFS	X	X
Scarlet king crab (*Lithodes cousei*)	ADF&G	X	X
Snow crab (*Chionoecetes opilio*)	ADF&G/NMFS		X
Southern tanner crab (*Chionoecetes bairdi*)	ADF&G/NMFS	X	X
Triangle tanner crab (*Chionoecetes angulatus*)	ADF&G	X	X

[1]Source: NMFS (2019c)

3.2.5.2.1 King Crabs

Detailed information on the life history of red, blue, and golden king crabs can be found in Section 3.2.5.1 of the 2019 PEA (NMFS 2019c). Four red king crab (*Paralithodes camtschaticus*) stocks - Bristol Bay, Pribilof Islands, Norton Sound, and Adak; two blue king crab (*Paralithodes platypus*) stocks - Pribilof District and St. Matthew Island; and two golden (or brown) king crab (*Lithodes aequispinus*) stocks - Aleutian Island and Pribilof Islands are managed under the BSAI Crab FMP. The golden king crab fisheries in the Aleutian and Pribilof islands were actively prosecuted in 2021 (Garber-Yonts *et al.* 2023). However, even though the Bristol Bay red king crab fishery has not been declared by the NPFMC to be overfished, ADF&G closed the fishery for the 2021/22 and 2022/23 seasons. The St. Matthew blue king crab fishery was closed to targeted fishing by ADF&G for the 2016/17 and subsequent crab seasons; in October 2018, NMFS declared the blue crab fishery to be overfished and adopted a rebuilding plan in June of 2020 (85 FR 71272).

Abundance estimates for Bristol Bay red king crab and St. Matthew Island blue king crab from the 2022 Eastern Bering Sea Continental Shelf Trawl Survey increased from 2021 estimates across all size and sex categories (Zacher *et al.* 2022). Mature female Pribilof Islands red king crab estimated abundance declined, while estimated abundance for mature males showed a moderate increase. Pribilof Islands blue king crab abundance remained low. No golden king crab were caught in the 2022 trawl survey (Zacher *et al.* 2022).

Recent declines in Bristol Bay red king crab fisheries are part of a 50+ year history of highly variable stock abundance that included previous fishery closures[6]. The Bristol Bay red king crab fishery was closed in 2021/2022, and the closure of the 2022/23 fishery is the result of consistent declining abundance trends and historically low TAC levels in the fishery over the last several years (Garber-Yonts *et al.* 2023).

3.2.5.2.2 Snow Crabs

Snow crab (*Chionoecetes opilio*) are a circumpolar species. Commercial catches in Alaska are concentrated in the Bering Sea but the species is also found on the Chukchi Sea and Beaufort Sea continental shelves (McCracken and Rheinsmith 2022). In the Bering Sea, snow crab are distributed widely over the shelf and are common at depths less than ~200 meters. Occupancy patterns of snow crab depend on the availability of cold water habitat (Fedewa *et al.* 2020 as cited in (McCracken and Rheinsmith 2022)). Bering Sea snow crab are managed under the Bering Sea/Aleutian Islands Crab FMP.

The Bering Sea snow crab fishery was actively prosecuted during the 2021 season, but on October 19, 2021, NMFS determined and notified the NPFMC that the Eastern Bering Sea snow crab stock was overfished because the estimated mature male biomass was below the minimum stock size threshold specified in the crab (FMP) (88 FR 39216). For the first time in history, the fishery was closed for the 2022/2023 fishing season (McCracken and Rheinsmith 2022). To comply with provisions of the MSA, the NPFMC developed a rebuilding plan to be implemented prior to the start of the 2023/2024 fishing season to facilitate compliance with MSA requirements to rebuild overfished stocks and achieve optimum yield (88 FR 61477). On October 6, 2023, ADF&G announced the closure of the 2023/4 Bering sea snow

[6] https://www.fisheries.noaa.gov/news/statement-alaska-crab-stock-declines Accessed July 11, 2023

crab fishery; the 2023 NMFS trawl survey results for Bering Sea snow crab estimated that the stock is below the ADF&G regulatory threshold for opening the fishery (ADF&G 2023).

The Bering Sea snow crab stock decline was sudden and appears to be linked to extreme oceanographic events. In 2019, a marine heatwave was responsible for numerous marine ecosystem changes. The heatwave likely affected adult and juvenile snow crab survival in a number of ways (e.g., starvation, disease, migration, predation, etc.) leading to the population decline[7]. Ecosystem indicators for crab survival highlight the potential loss of cold-water habitat available to snow crab, as evidenced by record-low cold pool extent and dramatic increases in temperatures occupied by immature snow crab in recent years (Fedewa *et al.* 2022). The highest Arctic Oscillation in history occurred in 2020 and has been associated with poor snow crab recruitment. Northerly shifts in male snow crab centers of distribution in 2021 coincided with a large-scale snow crab population decline (Fedewa *et al.* 2022). In addition, a recently published NMFS analysis attributes this collapse to the 2018-2019 EBS marine heatwave (Szuwalski *et al.* 2023).

In 2022, abundance estimates for mature male and female snow crab were 22% and 33% lower, respectively, than the 2021 estimates (Zacher *et al.* 2022). This is the lowest estimate over the 1975-2022 time series for abundance of mature males, and it is the third lowest estimate for mature female abundance over the period. However, the authors noted evidence of recruitment to the snow crab stock, with estimated immature male and female abundance increasing by 138% and 3,902%, respectively, from 2021 estimates (Zacher *et al.* 2022).

3.2.5.2.3 Tanner Crabs

Detailed information on the life history tanner crabs can be found in Section 3.2.5.1 of the 2019 PEA (NMFS 2019c). Tanner crab (*Chionoecetes bairdi*) are managed under the Bering Sea/Aleutian Islands Crab FMP. ADF&G closed the eastern Bering Sea tanner crab fishery to targeted fishing for the 2016/2017 and subsequent crab seasons (Garber-Yonts *et al.* 2023). The western Bering Sea tanner crab fishery remained open to targeted fishing for the 2021/22 and 2022/23 seasons and the eastern Bering Sea tanner crab fishery was reopened to targeted fishing for the 2022/23 season (Garber-Yonts *et al.* 2023).

Data from the 2022 Eastern Bering Sea Continental Shelf Trawl Survey showed that abundances for tanner crabs generally increased from 2021 east of 166°W (with the exception of mature females), but declined or remained constant west of 166°W (Zacher *et al.* 2022). Mature and immature biomass estimates increased over 2021 values, but remain relatively low (Zacher *et al.* 2022).

3.2.5.3 Non-Managed Species

As described in Section 3.2.5.2 of the 2019 PEA (NMFS 2019c), hundreds of different invertebrate species that are not subject to formal stock assessments or management regimes and are not ESA-listed species have been caught during the course of AFSC and IPHC research activities. Some research surveys only identify these animals to family, order or genus, while others identify these animals to species. The 2019 PEA provides detailed information on the taxa and species (where reported) of non-managed invertebrates that have been caught at quantities of over 1,000 kilograms (kg) (GOARA and BSAIRA) or

[7] https://www.fisheries.noaa.gov/news/statement-alaska-crab-stock-declines Accessed July 11, 2023

500 kg (CSBSRA). Species from the taxa listed in bullets below are included. Sections 4.3.2.5 and 4.4.2.5 of this SPEA describe the potential effects of the alternatives on these non-managed taxa:

- Class Anthozoa – corals and anemones
- Class Ascidiacea – tunicates
- Class Asteroidea – sea stars
- Class Gastropoda – snails ad welks
- Class Holothuroidea – sea cucumbers
- Class Malacostraca – crabs
- Class Ophiuroidea – basket stars and brittlestars
- Class Scyphozoa – jellyfish and sea nettles
- Class Echinoidea – sea urchins and sand dollars
- Phylum Porifera – sponges

3.2.5.4 Deep Sea Corals

As described in Section 3.2.5.3 of the 2019 PEA (NMFS 2019c), numerous deep-sea coral taxa are found in the continental shelf and upper slope of the GOARA and the BSAIRA; some taxa extend to the CSBSRA. Table 3-11 shows the coral taxa and number of species found in AFSC research areas along with their estimated depth range. Gorgonians and black corals are most common in the GOARA while gorgonians and hydrocorals are the most common corals in the BSAIRA. In addition, true soft corals are common on BSAI shelf habitats.

The highest diversity of deep-sea corals in Alaska can be found in the Aleutian Islands (NMFS 2019c) and include six major taxonomic groups and at least 50 species or subspecies of deep-sea corals. In the Aleutian Islands, corals form high density “coral gardens” that are similar in structural complexity to shallow tropical reefs and are characterized by a rigid framework, high topographic relief and high taxonomic diversity. Impacts of the proposed alternatives on these deep-sea corals are presented in Sections 4.3.2.5 and 4.4.2.5 of this SPEA.

Table 3-11. Coral Taxa found in AFSC and IPHC Research areas

Taxa	Common Name	Estimated Number of Species in AFSC Research Areas	Depth Range (m)
Order Scleractinia	True or stony corals	11	24-4620
Order Antipatharia	Black corals	14	401-4784
Order Alcyonacea	True soft corals	9	10-3209
Suborder Stolonifera	Stoloniferan soft corals	6	11-591
Order Gorgonacea	Sea fans	63	6-4784
Order Pennatulacea	Sea pens	10	3-2947
Order Anthothecatae	Hydrocorals	28	11-2130

Source: NMFS (2019c)

3.3 Economic and Social Environment

To assess the potential effects of AFSC research on the economic and social environment, the 2019 PEA (NMFS 2019c) and this SPEA rely on information from the commercial and recreational fisheries to provide a general sense of revenues and economic impact. On an annual basis, NMFS publishes a report titled '*The Fisheries Economics of the United States*' which includes commercial market conditions, total tonnage of commercial fish landed and revenue by region and state, recreational fishing expenditures and levels of participation by region and state, key species, and community profiles. The economic impact of commercial and recreational fishing activities in the U.S. is reported in terms of employment, sales and value-added impacts. The 2019 PEA provided data for the period 2010 – 2015. As of the date the draft version of this SPEA was prepared, the most recent '*Fisheries Economics of the United States'* report (NMFS 2023b) is based on data for the period 2016 – 2020, which were used to assess potential effects of AFSC research on the economic and social environment.

3.3.1 AFSC Operations

AFSC fisheries and ecosystem research activities occur both inside and outside the U.S. EEZ and span across multiple ecological, physical, and political boundaries. NMFS Alaska Regional Office oversees sustainable fisheries that produce about half the fish caught in U.S. waters, contributing more than $7 billion to the national economy and supporting our nation's food security. The Alaska Region's area of responsibility includes nearly 2.4 million km (70% of the total U.S. continental shelf) of the North Pacific Ocean, including the Arctic Oceans (Chukchi and Beaufort seas), GOA, and the eastern Bering Sea[8]. Activities associated with AFSC fisheries and ecosystem research have direct and indirect influence on the economics of U.S. communities and ports through operations as well as associated expenditures on goods and services.

AFSC research provides guidance for federally managed commercial, recreational, and subsistence fisheries. AFSC research is used for stock assessments that provide the NPFMC and NMFS with the scientific information needed to implement the MSA requirement for ACLs that prevent overfishing,

[8] https://www.fisheries.noaa.gov/about/alaska-regional-office; Accessed August 17, 2023.

rebuild overfished stocks, and obtain optimum yield from the fisheries. The goal is to achieve fish harvests that provide the greatest overall benefit to the nation, particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems and the sustained participation of fishing communities.

While the contribution of research-related employment and purchased services is beneficial on an individual basis, the total contribution of research is very small when compared to the value of commercial and recreational fisheries in the communities. Fisheries research is considered beneficial to the economic status of fishing communities through contribution to sustainable fisheries management. AFSC also conducts cooperative research with commercial fishing vessels which generates a certain amount of income for vessel owners and contributes to the local economies.

Fisheries research contributes to local economies through operational support of NOAA vessels and chartered vessels (fuel, supplies, crew wages, shoreside services), operational costs of research support facilities (utilities, supplies, services), and employment of researchers who live in nearby communities. The AFSC's annual spending fluctuates but has ranged between $80 - 96 million for fisheries and ecosystem research over the 2019-2023 period (AFSC Operations Management and Information Staff pers. comm. 2023).

3.3.2 Fishing Communities

The commercial, recreational, and subsistence fisheries of Alaska, and their supporting marine ecosystems, have a critical role in the economic, cultural, and environmental well-being of Alaskan communities and residents. For example, a large number of Alaskan communities exist only because of the presence of fishing (Himes-Cornell and Kasperski 2016). Over 90% of Alaska's rural residents rely on wild-caught subsistence foods for at least part of the year (Himes-Cornell and Kasperski 2016). Accessibility of Alaskan communities involved in fisheries varies tremendously depending on the size of community, location, and local or regional infrastructure. Larger communities such as Anchorage or Dutch Harbor/Unalaska have facilities capable of handling jet aircraft and large marine vessels while most others have only small airstrips or are only accessible by sea. Many small communities have no roads, relying on marine and river transport or by all-terrain vehicles in the summer and snowmobiles in the winter (Himes-Cornell *et al.* 2013).

In terms of size, some of these fishing communities are large municipalities that serve as regional economic hubs, such as Anchorage, while other communities are relatively isolated and only have a few dozen inhabitants. Commercial fishing communities with shoreside processing plants tend to have a higher proportion of males in the population than the state. For example, Akutan (77% male), Dutch Harbor/Unalaska (68% male), and Sand Point (63% male) all have higher proportions of males in 2010 than the state as a whole (52%) (Himes-Cornell *et al.* 2013). Communities that are heavily involved in processing as well as commercial harvesting activities attract large temporary populations of workers, including many Asians and Hispanics, from outside the region. In these communities, temporary workers sometimes outnumber permanent residents. Community leaders reported that an estimated 1,500 people come to Sand Point (resident population of 976 in 2010) each year as seasonal workers or transients, primarily to work in the cannery or on fishing boats. In some places, temporary workers are housed in

group quarters during the fishing season, for example, Akutan (91% of residents) and Sand Point (3 % of residents) (Himes-Cornell *et al.* 2013).

3.3.3 Commercial Fisheries

State fisheries include species harvested within 3 nm of shore and in Alaska's network of rivers and lakes. Federal fisheries in Alaska are those where harvesting occurs beyond 3 nm, in federal waters out to the 200-mile limit (the U.S. EEZ). Commercial fisheries refer to fishing operations that sell their catch for profit. The term does not include subsistence fishermen or saltwater anglers who fish for sport. It also excludes the for-hire sector, which earns its revenue from selling recreational fishing trips to saltwater anglers and imports from other locations.

The Alaska federal fisheries include some of the nation's largest, such as pollock, cod, and crab. The Alaska Region has seven catch share programs including a community development quota (CDQ) program. The Western Alaska CDQ Program apportions a percentage of the TAC for groundfish, and limits for bycatch species, halibut, and crab, to 65 eligible communities in western Alaska that are organized into six CDQ groups. The purpose of the CDQ program is to provide coastal native villages with the opportunity to participate and invest in fisheries in the Bering Sea and Aleutian Islands Management Area and support economic development in western Alaska (NMFS 2023b). The landings revenues for CDQ programs (excluding the Western Alaska CDQ and Aleutian Islands Pollock Fishery programs) totaled $884 million in 2019, exceeding the total landings revenue of any other state and accounting for half of Alaska's landings revenue in 2019 (NMFS 2023b).

In 2020, the COVID-19 pandemic caused large scale disruption to the U.S. economy and global markets (NMFS 2023b). The Fisheries Economics of the United States 2020 report noted an 18% decrease in for-hire trips relative to the baseline period (2015 – 2019) for Alaska as well as a 20% decrease in commercial fishing landings revenue. Alaska reported a total of $3,661,146 in total seafood industry sales in 2020 (NMFS 2023b). Alaska's commercial fishermen landed over 5.1 billion pounds of finfish and shellfish in 2020, a 10% decrease from 2019. In 2020, landings revenue was dominated by walleye pollock (see Table 3-12). In 2020, commercial fisheries generated a total of 43,870 jobs (including imports) (NMFS 2023b).

The State of Alaska levies a Fisheries Business Tax ("raw fish tax") on fisheries businesses and persons who process fisheries resources in, or export unprocessed fisheries resources from Alaska. The tax is based on the price paid to commercial fishers and is collected primarily from licensed processors and persons who export fish from Alaska. Alaska also levies a Fishery Resource Landing Tax on fishery resources processed outside of the State's 3-mile limit and first landed in Alaska, or any processed fishery resource subject to Section 210(f) of the American Fisheries Act. The Fishery Resource Landing Tax is based on the unprocessed value of the resource and is collected primarily from factory trawlers and floating processors outside the state's 3-mile limit who bring products into Alaska for transshipment elsewhere. In fiscal year 2022, the state collected more than $12.4 million in the Fishery Resource Landing Tax[9].

[9] http://tax.alaska.gov/programs/programs/reports/AnnualData.aspx?60631; Accessed August 21, 2023.

Table 3-12. Total Revenue and Landings Revenue of Top Commercial Species

All Species			Top Species (Walleye Pollock)		
Year	**Pounds[1]**	**Revenue[2]**	**Pounds[1]**	**Revenue[2]**	**Price per Pound[3]**
2016	5,586	1,551	3,355	417	0.12
2017	6,006	2,003	3,389	457	0.13
2018	5,404	1,782	3,364	451	0.13
2019	5,631	1,754	3,353	388	0.12
2020	5,062	1,481	3,230	420	0.13

Source: NMFS (2023b).
1 Reported in thousands.
2 Reported in millions of dollars (USD).
3 Reported in dollars per pound (USD).

3.3.4 Recreational Fisheries and Fishing

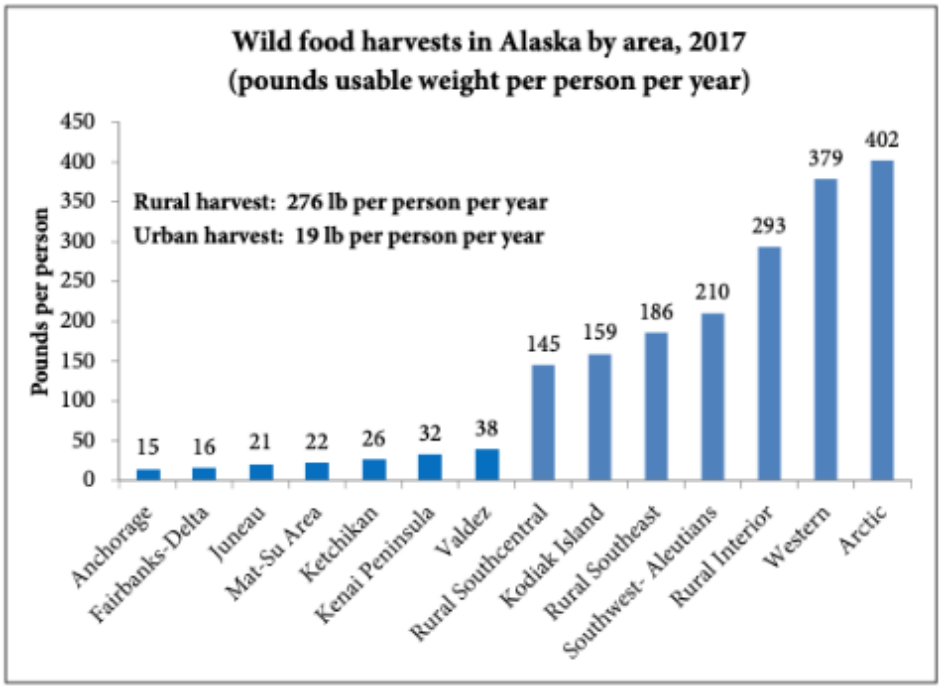
In 2020, the most recent year for which data are available, recreational fishing accounted for 2,342 jobs and 223,196 trips (including for hire, private boats and shore-based fishing). Recreational fishing resulted in $286.8 million in sales, $95 million in income, and $166.7 million in value-added impacts (NMFS 2023b).

3.3.5 Subsistence

Fishing and hunting are important for the cultures and economies of many Alaskan families and communities. Subsistence food harvested by Alaska residents represents about 0.9% of the fish and game harvested annually. While this amount may seem relatively small statewide, subsistence fishing, hunting and gathering provide a major food supply to rural Alaskan residents with an estimated 34 million pounds harvested each year[10] (ADF&G 2017). As shown in Figure 3-15, this estimate equates to approximately 276 pounds per person per year for rural residents. Under federal law, the taking of fish and wildlife on public lands in Alaska for subsistence uses is accorded priority. Under state law, customary and traditional uses of fish and game are protected and must be provided for first before providing for commercial or recreational uses. Therefore, if a harvestable portion of a fish stock or game population is not sufficient for all public uses, subsistence uses are restricted last according to regulation (ADF&G 2017). Assuming a replacement expense of $5.00 - $10.00 per pound, the replacement value of wild food harvests is estimated at $170 - $340 million annually as shown in Table 3-13.

[10] Based on the 2017 Subsistence in Alaska: A Year 2017 Update, the most recent report available as of preparation of the draft version of this SPEA.

Figure 3-15. Wild Food Harvests in Alaska by Area, 2017



Source: ADF&G (2017)

Table 3-13. Wild food harvests in Alaska: Nutritional and Replacement Values

Wild food harvests in Alaska:
Nutritional and replacement values

	Annual wild food harvest (pounds per person)	Annual wild food harvest (total pounds)	Percent of population's required: Protein (46 grams/day)	Calories (2100 kcal/day)	Estimated wild food replacement value @ $5.00/pound	Estimated wild food replacement value @ $10.00/pound
Rural Areas						
Rural Southcentral	145	1,032,896	93%	13%	$5,164,479	$10,328,957
Kodiak Island	159	2,106,866	101%	14%	$10,534,332	$21,068,665
Rural Southeast	186	4,996,351	119%	17%	$24,981,756	$49,963,512
Southwest-Aleutians	210	3,331,143	134%	19%	$16,655,713	$33,311,426
Rural Interior	293	2,797,785	187%	26%	$13,988,923	$27,977,845
Western	379	9,427,608	242%	34%	$47,138,039	$94,276,079
Arctic	402	10,269,886	257%	36%	$51,349,428	$102,698,855
Subtotal	*276*	*33,962,534*	*176%*	*25%*	*$169,812,669*	*$339,625,339*
Urban Areas						
Anchorage Area	15	4,447,633	9%	1%	$22,238,163	$44,476,327
Fairbanks-Delta	16	1,713,258	10%	1%	$8,566,292	$17,132,584
Juneau Area	21	686,167	13%	2%	$3,430,833	$6,861,667
Mat-Su Area	22	2,257,007	14%	2%	$11,285,034	$22,570,068
Ketchikan Area	26	359,357	17%	2%	$1,796,787	$3,593,574
Kenai Peninsula	32	1,829,072	20%	3%	$9,145,362	$18,290,724
Valdez	38	151,750	24%	3%	$758,750	$1,517,499
Subtotal	*19*	*11,444,244*	*12%*	*2%*	*$57,221,221*	*$114,442,442*
Alaska Total	**62**	**45,406,778**	**39%**	**6%**	**$227,033,890**	**$454,067,781**

Source: ADF&G (2017)

4 ENVIRONMENTAL EFFECTS

4.1 Methodology and Impact Criteria

Section 4.1 of the 2019 PEA (NMFS 2019c) describes the methodology used to evaluate potential direct, indirect and cumulative effects of fisheries and ecosystem research. The same methodology is applied here and consists of the following steps:

1. Review and understand the proposed action and alternatives (Section 2).
2. Identify and describe:
    a. Direct effects that would be "caused by the action and occur at the same time and place" (40 CFR § 1508.1(g)(1)), and
    b. Indirect effects that would be "caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable" (40 CFR § 1508.1(g)(2)).
3. Compare the impacts to the baseline conditions described in Section 3 and rate them as major, moderate, or minor.

Criteria shown in Table 4-1 were used in the 2019 PEA are also used to evaluate the SPEA Status Quo and Preferred Alternatives for resources identified in Section 3. The criteria provide guidance to place the impacts of the alternatives in an appropriate context, determine their level of intensity, and assess the likelihood that they would occur. Some evaluation criteria have also been based on legal or regulatory limits or requirements, and best management practices. The evaluation criteria include both quantitative and qualitative thresholds as appropriate to each resource. As described in the 2019 PEA, overall ratings of impacts (e.g., minor, moderate, adverse or beneficial, or no effect) are determined for a given resource by combining the assessment of the impact components.

Different types of impacts are determined for different resources as applicable. All biological resources are analyzed for impacts due to potential mortality/serious injury (M/SI) from surveys. Prey removals and physical disturbance (Level B) are analyzed for marine mammals. Analyses are based on the best available data and as such, may vary in terms of the periods for which data are readily available

Certain categories of effects on the physical environment (changes in water quality near the seafloor and changes to benthic habitat) are not considered further in this SPEA. In the 2019 PEA (NMFS 2019c), potential effects of contamination due to discharges from research vessels, whether accidental or intentional, were evaluated. Accidental discharges may include sewage, ballast water, fuel, oil, miscellaneous chemicals, garbage, and/or plastics. While accidental discharges could still occur during future research, this type of event is expected to be rare. The potential effects of such discharge would be the same as described in the 2019 PEA (minor adverse, see Table 4-1) and are therefore, not evaluated further in this SPEA.

As described in the 2019 PEA, the geographic extent of any physical impacts to benthic habitats caused by AFSC fisheries research activities would be limited to much less than 0.01% of the total area of each of the research areas. Effects would persist to some degree but in general, physical damage to the seafloor would recover within several months, and their intensity, extent, duration, and frequency would be minor adverse following the criteria in Table 4-1.

Table 4-1. Criteria for Determining Effect Levels

Resource Components	Assessment Factor	Effect Level		
		Major	Moderate	Minor
Physical Environment	Magnitude or intensity	Large, acute, or obvious changes easily quantified	Small but measurable changes	No measurable changes
	Geographic extent	> 10% of project area (widespread)	5-10% of project area (limited)	0-5% of project area (localized)
	Frequency and duration	Chronic or constant, lasting up to several months or years (longterm)	Periodic or intermittent, lasting several weeks to months (intermediate)	Occasional or rare, lasting less than a few weeks (short-term)
	Likelihood	Certain	Probable	Possible
Biological Environment	Magnitude or intensity	Measurably affects population trend. Marine mammal mortality or serious injury ≥ 50% of PBR	Population level effects may be measurable. Marine mammal mortality or serious injury of 10% - 50% of PBR[1]	No measurable population change. Marine mammal mortality or serious injury ≤ 10% of PBR[1]
	Geographic extent	Distributed across range of a population	Distributed across several areas that support vital life phase(s) of a population	Localized to one area that support vital life phase(s) of a population or non-vital areas
	Frequency and duration	Chronic or constant, lasting up to several months or years (longterm)	Periodic or intermittent, lasting several weeks to months (intermediate)	Occasional or rare, lasting ≤ a few weeks (short-term)
	Likelihood	Certain	Probable	Possible
Social and Economic Environment	Magnitude or intensity	Substantial contribution to changes in economic status of region or fishing communities	Small but measurable contribution to changes in economic status of region or fishing communities	No measurable contribution to changes in economic status of region or fishing communities
	Geographic extent	Affects region (multiple states)	Affects state	Affects local area
	Frequency and duration	Chronic or constant, lasting up to several months or years (longterm)	Periodic or intermittent, lasting several weeks to months (intermediate)	Occasional or rare, lasting ≤ a few weeks (short-term)
	Likelihood	Certain	Probable	Possible

4.2 Rationale for Discounting Acoustic Disturbance Due to Equipment or Vessels

The impacts of anthropogenic sound on marine mammals have been summarized in numerous, books, articles and reports including Richardson *et al.* (1995), National Research Council (2005), Southall *et al.* (2007) and Southall *et al.* (2019). The distance to which anthropogenic sounds are audible depends on the level of ambient sound, anthropogenic sound source levels, frequency, ambient sound levels, the propagation characteristics of the environment, and sensitivity of the marine mammal (Richardson *et al.* 1995). Animals exposed to natural or anthropogenic sound may experience physical and behavioral effects, ranging in magnitude from none to severe (Southall *et al.* 2007).

Marine mammals exposed to high intensity sound repeatedly or for prolonged periods could experience hearing threshold shift, resulting in the loss of hearing sensitivity at certain frequency ranges (Kastak *et al.* 1999, Schlundt *et al.* 2000, Finneran *et al.* 2002, Finneran *et al.* 2005). Threshold shift results in permanent threshold shift (PTS), where loss of hearing sensitivity is unrecoverable, or temporary threshold shift (TTS), in which case an animal may recover hearing sensitivity over time (Southall *et al.* 2007).

4.2.1 Exposure Thresholds

The 2018 *Revision to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing* (NMFS 2018b), which was summarized in 2022 (NMFS 2022i), uses marine mammal hearing groups defined by Southall *et al.* (2007) with some modifications. These groups and their generalized hearing ranges are shown in Table 4-2. NMFS (2018b) and NMFS (2022i) considered acoustic thresholds by hearing group to acknowledge that not all marine mammals have identical hearing ability or identical susceptibility to sound or sound-induced PTS. NMFS (2018b) also used the hearing groups to establish marine mammal auditory weighting functions. A 2019 publication by Southall *et al.* (2019) considers studies conducted since 2007 to better understand marine mammal hearing; however, the 2018 revised NMFS Technical guidance continues to be used for defining regulatory thresholds for calculating incidental takes of marine mammals under the MMPA (NMFS 2018b, 2022i).

Table 4-3 shows the acoustic thresholds for Level A injury for cetaceans and pinnipeds in water as delineated in the guidance (NMFS 2018b, 2022i). In addition, NMFS currently uses a behavioral threshold (Level B exposure) of 120 decibels (dB) root mean square (rms) for continuous sound sources (i.e., echosounder EK60 used in fisheries surveys) and 160 dB rms for impulsive sound sources. These thresholds are conservative considering that many natural and anthropogenic sound sources such as conditions, geological processes, wind, wave action, rain or hail make important contributions to marine soundscapes (Duarte *et al.* 2021). Wind blowing over the ocean, waves breaking, rain or hail all generate sound that may exceed thresholds but not necessarily result in adverse behavioral effects to marine mammals.

Table 4-2. Generalized Hearing Ranges for Marine Mammal Hearing Groups in Water

Hearing Group	Hearing Range
Low-frequency cetaceans (e.g., baleen whales)	7 Hz to 35 kHz
Mid-frequency cetaceans (e.g., killer whales)	150 Hz to 160 kHz
High-frequency cetaceans (e.g., dolphins)	275 Hz to 160 kHz
Phocids (e.g., seals)	50 Hz to 86 kHz
Otariids and other non-phocid marine carnivores (e.g., sea lions)	60 Hz to 39 kHz

Source: NMFS (2018b).

Table 4-3. Acoustic Thresholds for Auditory (Level A) Injury

Hearing Group	PTS Onset Acoustic Thresholds (Received Level)		
	Impulsive Sources		Non-impulsive Sources
	Peak, L_{pk}, flat (dB re 1 µPa)	Cumulative weighted SEL_{24h} (dB re 1 µPa²·s)	Cumulative weighted SEL_{24h} (dB re 1 µPa²·s)
Low-frequency cetaceans	219	183	199
Mid-frequency cetaceans	230	185	198
High-frequency cetaceans	202	155	173
Phocid pinnipeds in water	218	185	201
Otariid pinnipeds in water	232	203	219

Source: NMFS (2018b).
Notes: Peak sound pressure is "flat" or unweighted. Cumulative sound exposure level has a reference value of 1µPa2s. Cumulative levels should be appropriately weighted for the hearing group for assessment to the threshold.

4.2.2 Sound Levels Generated by Vessels and Acoustic Equipment

Underwater sound from vessels is generated from sources including propeller cavitation, vibration of machinery, flow noise, structural radiation, and auxiliary sources such as pumps, fans, and other mechanical power sources. Vessel sounds associated with research surveys are considered to be continuous noise sources. Marine mammals in the vicinity of surveys may be exposed to these sources. However, due to the transient nature of the exposure to vessel noise, and avoidance and mitigation measures such as the move-on rule described in Section 2.3, exposures would likely be unmeasurable and would not be likely to affect marine mammals that may happen to be in the vicinity (NMFS 2019a). Therefore, the effects of exposure of marine mammals to vessel noise is not considered as a source of disturbance in this SPEA.

As noted in Table 2-2, AFSC researchers use acoustic equipment with various frequency ranges, some as low as 1.5 kHz. The EK60 commonly used in AFSC research operates at frequencies of 38, 70, 120 and 200 kHz, and the EK80, also used by AFSC researchers operates at frequencies ranging from 10-500 kHz. While these frequencies are in the range of cetaceans, phocids and otariids, given the highly directional, e.g., narrow beam widths of acoustic equipment, NMFS does not anticipate animals would be exposed to

underwater sound levels resulting in injury, and the potential for Level B exposures is also reduced. In April 2020, NMFS published interim recommendations (Guan 2020) for sound sources such as multi-beam echosounders and sonar equipment used in geophysical surveys. These sources are similar to those used by AFSC.

Based on information in Crocker and Fratantonio (2016), NMFS developed a user tool to estimate the distances potentially ensonified by echosounders. Assuming a source level of 226 dB referenced at 1 microPascal at 1 meter (dB re 1 µPa at 1 m), frequency of 18 kHz beam width of 7°, and water depth of 200 m, underwater sound from an EK60 echosounder exceeding the behavioral threshold limit of 160 dB would only extend approximately 12 m from the source. The distance remains about the same for all EK60 frequencies and would be an even shorter distance for the higher frequency emitted by the EK80. Considering the mitigation measures to observe for and avoid marine mammals within close proximity to research vessels, the potential sound levels and effects of this type of equipment on marine mammals are considered *de minimis* and are not assessed further in this SPEA.

4.3 Direct and Indirect Effects of the Status Quo Alternative

4.3.1 Effects on the Physical Environment

Table 4-4 summarizes potential effects of the Status Quo Alternative on elements of the physical environment described in Section 3.1.

Table 4-4. Summary of Potential Effects of the Status Quo Alternative on EFH, HAPC, Closed Areas and MPAs

Special Resource Area	Potential Effects of Status Quo Alternative	Discussion
Physical Damage to Benthic Habitat	Minor adverse	Total benthic area potentially affected by bottom trawls across all three research areas (GOARA, BSAIRA, and CSBSRA) would be ~122 km^2, which is about 0.01% of the total of benthic habitat in the research areas (See Table 4-5).
EFH and HAPC	Minor adverse	No change in EFH or HAPC designations. Conclusions from 2019 PEA remain valid.
Closed Areas	Minor beneficial	Restriction of fishing and fishery research in these areas provides an overall beneficial effect.
MPAs		
NMS	N/A	There are currently no designated NMS in Alaskan waters.

4.3.1.1 Physical Damage to Benthic Habitat

Table 4-5 shows the maximum area of benthic habitat that would be potentially affected in each of the research areas under the Status Quo Alternative. The magnitude of the effect is based on the number of bottom trawls, distance towed, and size of the trawl gear used in each survey. As shown in the table, a total of about 122 km^2 of benthic habitat could be affected each year under the Status Quo Alternative; this is a very small percentage of the total habitat available in each research area (see the far left column of Table 4-5). In addition, the areas of impact would be dispersed over a large geographic area and would be temporary or short-term in duration. The overall impacts of the Status Quo Alternative on benthic habitat would be minor adverse according to the impact criteria in Table 4-1.

Table 4-5. Annual Maximum Area of Bottom Habitat Affected by Trawling in GOARA, BSAIRA, and CSBSRA

Survey Name	Tow speed (kts)	Tow Duration (min)	Foot-rope Length (m)	Distance Towed Per Trawl (km)	Area Impacted per Trawl (km^2)	Max No. Tows per Year	Estimated Total Area Trawled (km^2)	Total Size of RA (km^2)	Percent of RA
GOARA									
GOA Shelf and Slope Groundfish Bottom Trawl Survey	3	15	37.4	13.9	0.052	550	29	308,415	0.009%
BSAIRA									
Aleutian Islands Bottom Trawl Survey	3	15	37.4	13.9	0.052	420	22	756,272	0.012%
Bering Sea Shelf Bottom Trawl Survey	3	30	34.1	27.7	0.095	520	50		
Eastern Bering Sea Slope Bottom Trawl Survey	2.5	30	34.1	23.2	0.079	200	16		
CSBSRA									
Chukchi Sea Bottom Trawl Survey	3	30	34.1	27.7	0.095	50	5	216,015	0.002%
Totals						**1740**	**122**	**1,280,702**	**0.010%**

Sources: AFSC personal communication August 2023 and Lauth and Armistead (2014).

4.3.1.2 Effects on EFH, Closed Area and MPAs

As shown in Table 3-1, amendments to several FMPs that have occurred since the 2019 PEA did not change or affect EFH or HAPC in Alaska waters. As described in the 2019 PEA, the overall effect of all survey activities on EFH and HAPC in AFSC research areas would be minor in magnitude, temporary or short-term in duration, and dispersed over huge geographical areas and would therefore be considered minor adverse according to the impact criteria in Table 4-1. This conclusion remains valid and is reflected in Table 4-4. The continued restriction of bottom trawling efforts in closed areas or MPAs remains minor beneficial.

Overall, the effects of recent changes to regulatory regimes in the AFSC research areas are expected to result in minor beneficial effects on physical resources. In addition, AFSC research would be expected to contribute to a better understanding of physical resources within research areas and the effects of recent conservation and management regimes). For example, the research would help better understand biological rates of change of the community (i.e., growth rate and recovery rate) and possibly whether those changes are human-induced or naturally occurring.

4.3.2 Effects on the Biological Environment

4.3.2.1 Effects on Fish

Section 3.2.1 describes fish species, including those listed under the ESA, that occur in AFSC and IPHC research areas. Only the effects of mortality from surveys are analyzed in this SPEA for fish species. While fish may exhibit behavioral changes such as diving towards the seafloor or relocating from the area where research vessels are approaching as a result of underwater sound or the presence of vessels, the few AFSC and IPHC surveys as compared to regular shipping or commercial and recreational fishing activities would not likely produce population-level effects on fish. The use of underwater acoustic equipment such as the EK60/80 echosounders is not likely to cause biologically significant behavioral changes in fish given that most fish species have hearing ranges outside of the frequencies produced by these echosounders. In addition, the narrow beam width of the types of sonar equipment used by AFSC reduces the exposure area such that the potential exposure of fish to these sources would be extremely limited, if at all (Guan 2020) (see Section 4.2). Overall, disturbance and changes in fish behavior due to exposure to underwater sound during AFSC and IPHC research activities are expected to be short-term and would not result in biologically significant effects to fish populations, and sound effects on fish are not considered further in this SPEA. In short, no adverse effects will occur in green sturgeon or salmon critical habitat in the Pacific Northwest. The following subsections describe the potential effects of mortality from surveys under the Status Quo Alternative on ESA-listed fish species and non-listed fish species brought forward from Chapter 3.

4.3.2.1.1 ESA-Listed Fish Species

Table 4-6 brings forward ESA-listed fish species identified in Table 3-2 and summarizes the potential effects of the Status Quo Alternative on these species.

Table 4-6. Summary of Potential Effects of the Status Quo Alternative on ESA-Listed Fish Species

ESA-Listed Species DPS or ESU	Mortality from Surveys	Discussion
Green Sturgeon Southern DPS	Minor adverse	No green sturgeon has been reported as taken in PSIT reports for AFSC and IPHC research activities over the period July 22, 2004 to July 5, 2023. The 2019 BiOp did not anticipate nor did it request any lethal takes, but did determine that the proposed action was likely to adversely affect green sturgeon, and 1 non-lethal take was anticipated (NMFS 2019a). However, because no lethal takes have been documented for over 20 years and a single non-lethal take would not affect the population status, there would be no effect on green sturgeon due to AFSC and IPHC fisheries research.
Chinook Salmon Lower Columbia River ESU Puget Sound ESU Snake River Spring/Fall ESU Snake River Spring/Summer ESU Upper Columbia Spring Run ESU Upper Willamette River ESU	Minor adverse	Table 4-13 shows that a total of 12 Chinook salmon from these ESUs could be caught and suffer mortality during AFSC and IPHC research activities under the Status Quo Alternative. As shown in Table 3-2, estimated abundances of these ESA-listed ESUs range from 9,057 adults in the upper Columbia spring run ESU to 68,061 fish in the lower Columbia ESU. Therefore, removals would be a very small percentage (<0.01%) of abundance and research removals under the Status Quo Alternative would have a minor adverse effect on these ESUs.
Chum Salmon Columbia River ESU Hood Canal Summer ESU	Minor adverse	Table 4-13 shows that a total of 212 chum salmon from these ESUs could be caught and suffer mortality during AFSC and IPHC research activities under the Status Quo Alternative. As shown in Table 3-2, the estimated abundance of the Columbia River ESU is estimated to be 10,644 adults, with 27,452 adults estimated in the Hood Canal summer run ESU. Therefore, removals would be less than 0.6% of the sum of abundances and overall research removals under the Status Quo Alternative would have a minor adverse effect on these ESUs.
Coho Salmon Lower Columbia River ESU	Minor Adverse	Table 4-13 shows that a total of 59 coho salmon from lower Columbia River ESU could be caught and suffer mortality during AFSC and IPHC research activities under the Status Quo Alternative. As shown in Table 3-2, the estimated abundance of this ESU is ~56,000 adults. Therefore, removals would be about 0.1% of the abundance, and overall research removals under the Status Quo Alternative would have a minor adverse effect on these ESUs.
Sockeye Salmon Ozette Lake ESU Snake River ESU	Minor Adverse	Table 4-13 shows that a total of 57 sockeye salmon from these ESUs could be caught and suffer mortality during AFSC and IPHC research activities under the Status Quo Alternative. As shown in Table 3-2, the abundance of the Ozette Lake ESU is estimated to be 2,321 adults, with 1,373 adults estimated in the Snake River ESU. Therefore, removals would be about 1.5% of the sum of the two populations and overall research removals under the Status Quo Alternative would have a minor adverse effect on these ESUs.

ESA-Listed Species DPS or ESU	Mortality from Surveys	Discussion
Steelhead trout Lower Columbia River DPS Middle Columbia River DPS Puget Sound DPS Snake River Basin DPS Upper Columbia River DPS Upper Willamette River DPS	No Effect	As shown in Table 4-8, only one steelhead trout was taken in all AFSC and IPHC research surveys over the period 2016-2022. While the Auke Creek weir has collected steelhead in the past, they were not from ESA-listed DPSs, and the 2019 BiOp concluded that the proposed fisheries research would not be likely to adversely affect any of these ESUs (NMFS 2019a). Similarly, there would be no effect on the DPSs under the Status Quo Alternative.

Green Sturgeon

Green sturgeon are rare in Alaskan waters but have been anecdotally observed in Southeast Alaskan waters (see Section 3.2.1.1). According to PSIT reports dating back to 2004, no green sturgeon have been have taken in AFSC fisheries research in over 20 years. The 2019 BiOp requested 1 non-lethal take of green sturgeon during the previous compliance period. Even though research will continue in Southeast Alaska waters under the Status Quo Alternative, the fact that no takes of green sturgeon have been documented in almost 20 years and even if a non-lethal take were to occur the population status would not be affected. Therefore, AFSC and IPHC research activities in Southeast Alaskan waters would have a minor adverse effect to ESA-listed green sturgeon.

Pacific Salmon and Steelhead Trout

Table 4-6 summarizes the potential effects of the Status Quo Alternative on ESA-listed Pacific salmon and steelhead trout and details of the analysis are provided in this subsection. The analysis of effects of AFSC and IPHC research on ESA-listed salmonids and steelhead trout focuses on the potential mortality of salmon from each listed ESU or DPS that may be found in AFSC and IPHC research areas (see Section 3.2.1.1 and Table 3-2). Table 4-7 shows the total number of Pacific salmonids and steelhead trout caught in AFSC and IPHC research surveys over the period 2016-2022. The 5-step process used to determine if any of these salmon originated from ESA-listed ESUs in Washington and Oregon waters is described in the following subsections.

Table 4-7. Total Number of Salmonids Caught by Region in AFSC and IPHC Research Surveys, 2016-2022

Region	Total Number Salmonids Caught
BSAIRA	61,149
GOARA	49,851
CSBSRA	37
Oregon and Washington	1
Total	**111,038**

Source: AFSC and IPHC October 2023

Step 1 - Removals of Pink Salmon and Steelhead, and Fish Caught in CSBSRA, and Oregon and Washington Waters from Consideration

Table 4-8 breaks out the salmonid catch by species and research study. As shown in Table 4-8, the FISS survey in the BSAIRA did not document any salmonid catches and is not brought forward. The FISS survey in Oregon and Washington waters only caught one salmonid (unidentified) over the 7-year period, so effects of this survey on listed or non-listed Pacific salmon in Oregon and Washington waters are discountable and also are not discussed further. Similarly, only one steelhead trout was caught in all surveys in all regions over the 2016-2022 period; effects of AFSC and IPHC research on listed steelhead DPS are not anticipated. The only salmonids caught in the CSBSRA were from the Arctic Integrated Ecosystem Survey, which only occurred from 2017-2019 and has been discontinued.

Table 4-8 also shows that more pink salmon are caught during AFSC research than other Pacific salmon species. There are no ESA-listed ESUs of pink salmon. Therefore, all pink salmon (57,756 fish) were removed from the totals as shown (Table 4-9). In addition, FISS surveys in Washington and Oregon (one unidentified salmon collected over the 7-year period) and steelhead trout (one steelhead collected in the GOARA over the 7-year period) and all salmonids caught in the CSBSRA during the Arctic Integrated Ecosystem Survey (9 fish in addition to pink salmon) have been subtracted from the totals shown in Table 4-9. These actions reduced the total number of Pacific salmon caught (which could be from an ESA-listed ESU) by ~52% for a total of 53,271 Pacific salmon, some of which could be from an ESA-listed ESU (Table 4-9).

Step 2 – Age Specific Removals

As described in ECO49 Consulting (2017), multiple studies have shown that immature (pre-spawning) salmon captured in the Bering Sea and GOA are likely to be fish that were spawned in Alaska streams and rivers due to timing and location of capture relative to age. These fish would not be from an ESA-listed ESU. For that reason, all fish captured during the Eastern Bering Sea Juvenile Fish Survey Fall were assumed to be immature pre-spawners and were removed from the total (8,211 fish total, see Table 4-9).

Following the procedure and citations described in ECO49 Consulting (2017) regarding age specific removals, the total number of potential ESA-listed salmon caught during AFSC surveys was further reduced by subtracting fish caught during Bering Sea summer and winter acoustic surveys. This equates to removing salmon caught during the Eastern Bering Sea Walleye Pollock Acoustic Trawl Survey Summer (186 fish), the Bering Sea/Bogoslof Walleye Pollock Acoustic Trawl Survey Winter (14 fish), and the Northern Bering Sea Ecosystem Surface Trawl Survey (19,280 fish). Unidentified fish (21 were also removed during this step (see Table 4-9). Table 4-10 summarizes the total number of salmonids potentially originating from ESA-listed ESUs (25,561 fish) after completing this step.

Table 4-8. Total Number of Pacific Salmon and Steelhead Trout Caught in AFSC and IPHC Research Surveys, 2016-2022

Survey	Species (count)							TOTAL
	Chinook	Chum	Coho	Pink	Sockeye	Steelhead	Unidentified	
BSAIRA								
IPHC Fishery Independent Setline Survey (FISS)	0	0	0	0	0	0	0	0
Eastern Bering Sea Groundfish Bottom Trawl Eastern Bering Sea Slope Bottom Trawl Survey Summer Aleutian Islands Bottom Trawl Survey	33	154	0	6	5	0	0	198
Northern Bering Sea Ecosystem Surface Trawl Survey	1,159	13,891	1128	29,779	3,102	0	0	49,059
Eastern Bering Sea Juvenile Fish Survey Fall	83	1,170	248	3,481	6,710	0	0	11,692
Bering Sea/Bogoslof Walleye Pollock Acoustic Trawl Survey Winter	14	0	0	0	0	0	0	14
Eastern Bering Sea Walleye Pollock Acoustic Trawl Survey Summer	3	181	0	2	0	0	0	186
GOARA								
IPHC FISS[1]	11	10	26	0	0	0	21	68
Gulf of Alaska Shelf and Slope Groundfish Bottom Trawl	293	524	17	41	4	0	0	879
Southeast Coastal Monitoring	1,268	14,949	3,886	24,230	3,729	1	0	48,063
Gulf of Alaska Biennial Walleye Pollock Acoustic Trawl Survey Summer	187	202	9	189	2	0	0	589
Gulf of Alaska/Shelikof Walleye Pollock Acoustic Trawl Survey Winter Gulf of Alaska/Shumagin/Sanak Walleye Pollock Acoustic Trawl Survey Winter	249	3	0	0	0	0	0	252
CSBSRA								
Arctic Ecosystem Integrated Survey[1]	5	3	1	28	0	0	0	37
Oregon and Washington Coastal Waters								
IPHC FISS	0	0	0	0	0	0	1	1
TOTAL	**3,305**	**31,087**	**5,315**	**57,756**	**13,552**	**1**	**22**	**111,038**

Source: AFSC October 2023.
[1]This study only occurred only from 2017-2019 and has been discontinued (see Section 2.2).

Table 4-9. Pacific Salmon Caught in AFSC and IPHC Surveys 2016-2022 Minus Pink Salmon, Steelhead Trout, and Fish from the CSBSRA and Oregon and Washington Waters (STEP 1)

Survey	Species					TOTAL
	Chinook	Chum	Coho	Sockeye	Unidentified	
BSAIRA						
Eastern Bering Sea Groundfish Bottom Trawl Eastern Bering Sea Slope Bottom Trawl Survey Summer Aleutian Islands Bottom Trawl Survey	33	154	0	5	0	192
Northern Bering Sea Ecosystem Surface Trawl Survey	1,159	13,891	1,128	3,102	0	19,280
Eastern Bering Sea Juvenile Fish Survey Fall	83	1,170	248	6,710	0	8,211
Bering Sea/Bogoslof Walleye Pollock Acoustic Trawl Survey Winter	14	0	0	0	0	14
Eastern Bering Sea Walleye Pollock Acoustic Trawl Survey Summer	3	181	0	0	0	184
GOARA						
FISS	11	10	26	0	21	68
Gulf of Alaska Shelf and Slope Groundfish Bottom Trawl	293	524	17	4	0	838
Southeast Coastal Monitoring	1,268	14,949	3,886	3,729	0	23,832
Gulf of Alaska Biennial Walleye Pollock Acoustic Trawl Survey Summer	187	202	9	2	0	400
Gulf of Alaska/Shelikof Walleye Pollock Acoustic Trawl Survey Winter Gulf of Alaska/Shumagin/Sanak Walleye Pollock Acoustic Trawl Survey Winter	249	3	0	0	0	252
TOTAL	**3,300**	**31,084**	**5,314**	**13,552**	**21**	**53,271**

Table 4-10. Number of Potentially ESA-Listed Pacific Salmon Caught in AFSC and IPHC Surveys 2016-2022 After Age-Specific Removals (STEP 2)

Survey	Species				TOTAL
	Chinook	Chum	Coho	Sockeye	
BSAIRA					
Eastern Bering Sea Groundfish Bottom Trawl Eastern Bering Sea Slope Bottom Trawl Survey Summer Aleutian Islands Bottom Trawl Survey	33	154	0	5	192
GOARA					
FISS	11	10	26	0	47
Gulf of Alaska Shelf and Slope Groundfish Bottom Trawl	293	524	17	4	838
Southeast Coastal Monitoring	1,268	14,949	3,886	3,729	23,832
Gulf of Alaska Biennial Walleye Pollock Acoustic Trawl Survey Summer	187	202	9	2	400
Gulf of Alaska/Shelikof Walleye Pollock Acoustic Trawl Survey Winter Gulf of Alaska/Shumagin/Sanak Walleye Pollock Acoustic Trawl Survey Winter	249	3	0	0	252
TOTAL	**2,041**	**15,842**	**3,938**	**3,740**	**25,561**

Step 3 – Removals Based on Genetic Stock Composition Analysis

ECO49 Consulting (2017) estimated the percentage of ESA-listed Chinook and chum salmon that might be caught during AFSC fisheries research by considering genetic analyses of these species collected during the federally managed walleye pollock commercial trawl fisheries in the Bering Sea and GOA. Taking into account these genetic stock composition analyses of Chinook and chum salmon, ECO49 Consulting (2017) (and citations therein) estimated that about 24% of Chinook salmon and 87% of chum salmon could be from Pacific Northwest (PNW) stocks. Table 4-11 reduces the numbers of Chinook and chum salmon captured in research surveys that could be from ESA-listed ESUs based on genetic stock composition to reflect these percentages.

Table 4-11. Number of Potentially ESA-Listed Pacific Salmon Caught in AFSC and IPHC Surveys 2016-2022 After Genetic Composition Considerations (STEP 3)

Survey	Species				
	Chinook	Chum	Coho	Sockeye	TOTAL
BSAIRA					
Eastern Bering Sea Groundfish Bottom Trawl Eastern Bering Sea Slope Bottom Trawl Survey Summer Aleutian Islands Bottom Trawl Survey	8	134	0	5	147
GOARA					
FISS	3	9	26	0	38
Gulf of Alaska Shelf and Slope Groundfish Bottom Trawl	70	456	17	4	547
Southeast Coastal Monitoring	304	13,006	3,886	3,729	20,925

Survey	Species				
	Chinook	Chum	Coho	Sockeye	TOTAL
Gulf of Alaska Biennial Walleye Pollock Acoustic Trawl Survey Summer	45	176	9	2	232
Gulf of Alaska/Shelikof Walleye Pollock Acoustic Trawl Survey Winter Gulf of Alaska/Shumagin/Sanak Walleye Pollock Acoustic Trawl Survey Winter	60	3	0	0	63
TOTAL	**490**	**13,784**	**3,938**	**3,740**	**21,952**

Step 4 – *Removals based on Likelihood of Capture*

The Southeast Coastal Monitoring survey focuses on the study of juvenile salmon in the *c*oastal waters of the GOA ecosystem. As shown in Table 4-10, of all AFSC and IPHC surveys this one takes the majority of salmonids. On average, approximately 3% of salmon collected during this survey are from stocks other than Alaska stocks, possibly from PNW ESUs (ECO49 Consulting 2017). For all other GOARA and BSAIRA surveys shown in Tables 4-10 and 4-11, the likelihood of a listed PNW salmonid being captured is less than 1 percent based on the abundance of listed salmon ESUs compared to the abundance of non-listed stocks in Alaska waters that originate in British Columbia and Alaska (ECO49 Consulting 2017). However, to be precautionary the numbers of Pacific salmon captured during all surveys are reduced by 90% (rather than 97% or 99%) as shown in Table 4-12. In addition, numbers were rounded up to the nearest whole fish, where applicable. At the end of Step 4, 2,203 salmon remain that could be from an ESA-listed ESU (Table 4-12).

Table 4-12. Number of Potentially ESA-Listed Pacific Salmon Caught in AFSC and IPHC Surveys 2016-2022 After Likelihood of Capture Considerations (STEP 4)

Survey	Species				TOTAL
	Chinook	Chum	Coho	Sockeye	
BSAIRA					
Eastern Bering Sea Groundfish Bottom Trawl Eastern Bering Sea Slope Bottom Trawl Survey Summer Aleutian Islands Bottom Trawl Survey	1	14	0	1	16
GOARA					
FISS	1	1	3	0	5
Gulf of Alaska Shelf and Slope Groundfish Bottom Trawl	7	46	2	1	56
Southeast Coastal Monitoring	31	1,301	389	373	2,094
Gulf of Alaska Biennial Walleye Pollock Acoustic Trawl Survey Summer	5	18	1	1	25
Gulf of Alaska/Shelikof Walleye Pollock Acoustic Trawl Survey Winter Gulf of Alaska/Shumagin/Sanak Walleye Pollock Acoustic Trawl Survey Winter	6	1	0	0	7
TOTAL	**51**	**1,381**	**395**	**376**	**2,203**

Step 5 – Annualization of Catch

Some surveys are conducted each year (annual), while others are conducted every other year (biennial) (see Table 2-1). Therefore, to determine the catch per species per year over the 7-year period (2016-2022), the frequency of the survey was taken into account; the total catch per species was divided by 3.5 if the survey was conducted biennially or by 7 if annual. As in Step 4, numbers were rounded up to the nearest whole fish. Table 4-13 shows the total number of Pacific salmon caught during AFSC and IPHC surveys that could be from an ESA-listed population after annualization of the catch. As described in ECO49 Consulting (2017), the annualized catch for the period 2016-2022 shown in Table 4-13 is considered to be a proxy for the mortality (take) that might occur in total for each ESA-species across all ESA-listed ESUs for that species. As described in Section 3.2.1.2, ESA-listed fish from six Chinook, two chum, one coho, and two sockeye ESUs have the potential to be caught during AFSC and IPHC research surveys. The numbers of fish shown in Table 4-13 could be from any of these ESUs.

Table 4-13. Annual Estimated Number of Potentially ESA-Listed Pacific Salmon Caught in AFSC and IPHC Surveys (STEP 5)

Survey	Survey Frequency	Species				TOTAL
		Chinook	Chum	Coho	Sockeye	
BSAIRA						
Eastern Bering Sea Groundfish Bottom Trawl Eastern Bering Sea Slope Bottom Trawl Survey Summer Aleutian Islands Bottom Trawl Survey	Biennial	1	4	0	1	6
GOARA						
FISS[1]	Annual	1	1	1	0	3
Gulf of Alaska Shelf and Slope Groundfish Bottom Trawl	Biennial	2	14	1	1	18
Southeast Coastal Monitoring	Annual	5	186	56	54	301
Gulf of Alaska Biennial Walleye Pollock Acoustic Trawl Survey Summer	Biennial	2	6	1	1	10
Gulf of Alaska/Shelikof Walleye Pollock Acoustic Trawl Survey Winter Gulf of Alaska/Shumagin/Sanak Walleye Pollock Acoustic Trawl Survey Winter	Annual	1	1	0	0	2
TOTAL		**12**	**212**	**59**	**57**	**340**

[1]Only a subset of stations are surveyed each year.

4.3.2.1.2 Non-Listed Fish Species

As described in Sections 3.2.1.2, 3.2.1.3, and 3.2.1.4, many species of fish that are caught in AFSC and IPHC research are not listed under the ESA. These include target fish with TAC levels that are managed for commercial fisheries, species that belong to categories defined in regional FMPs, which may or may not have TACs, or for which AFSC conducts stock assessments (see Table 3-3). Prohibited species such as Pacific halibut, Pacific herring, Pacific salmon, steelhead trout, and forage fish such as capelin and eulachon are also caught during research, along with hundreds of other species such as sharks, cods, sculpins and flounders that are not commercially fished. Table 4-14 summarizes the potential effects of the Status Quo Alternative on these groups and details of the analysis are provided in the subsections following the table.

Table 4-14. Summary of Potential Effects of the Status Quo Alternative on Non ESA-Listed Fish

Species Group	Mortality from Surveys	Discussion
Target Species	Minor Adverse	Tables 4-15 and 4-16 show that AFSC research catch of target species over the period 2016-2022 is miniscule when compared to commercial TACs. In all cases AFSC research removals are less than 0.02% of TAC. IPHC does not report the research catch in weight but instead uses extrapolated counts, so the data is not comparable to TAC. Tables 4-17 through 4-19 show the numbers of fish caught in the GOARA, BSAIRA and Washington and Oregon waters. IPHC researchers return all species except Pacific halibut, rockfish, and a portion of Pacific cod to the sea and mortality of the returned species is assumed to be minimal. Overall effects on targets species are minor adverse.
Ecosystem Component Species, including Prohibited Species	Minor Adverse	Table 4-20 shows the AFSC and research catch of Pacific halibut, Pacific herring, capelin and eulachon. Research catch for these species was less than 8 mt on average over the 7-year period. The research catch of non-ESA-listed Pacific salmon was ~15,500 salmonids per year over the same period. The research catch of salmonids is less than 0.01% of the total commercial harvest. No prohibited species other than 68 Pacific salmon caught in the GOARA and 1 steelhead trout caught in Washington and Oregon waters (see Table 4-8) were recorded as captured during any IPHC activities over the 2016-2022 period.
Other Species	Minor Adverse	AFSC and IPHC research catches for some of these species are recorded and are shown in Tables 4-21 and 4-22. Research catch is a very small portion of the overall anticipated biomass of these species and would have only a minor adverse effect.

Target Species (with TACs)

Table 3-3 summarizes the presence and current status of target fish species that may be encountered during AFSC and IPHC research activities. Tables 4-15 and 4-16 summarize the amount of target fish (in mt) caught during AFSC research activities in the GOARA and BSAIRA over the period 2013-2022 and compares the research catch to the TAC permitted for commercial fisheries in 2024 in the GOARA and BSAIRA. There are no managed stocks or commercial fisheries with TACs in the CSBSRA. Therefore, research catch in the CBSRA is discussed below under **Other Fish Species**.

As shown in Tables 4-15 and 4-16, the AFSC research catch amounts in both the GOARA and BSAIRA are miniscule, and in all cases are less than 0.02% of TAC and in most cases approach zero percent of TAC. However, because AFSC does capture some target and managed species, the effect of the status Quo Alternative on these species in the GOARA and BSAIRA due to AFSC research under the Status Quo Alternative is considered minor adverse.

Tables 4-17, 4-18, and 4-19 summarize the IPHC catch of target fish in the GOARA, BSAIRA and in Washington and Oregon coastal waters. The IPHC does not conduct research in the CSBSRA (see Figure 1-2). The IPHC does not report the research catch in weight but instead uses extrapolated counts, so the data is not comparable to TAC. The extrapolated counts are based on observations from 20 consecutive hooks per 100-hook skate, near the beginning of each skate at each survey station.

Numbers presented in Tables 4-17 through 4-19 have been extrapolated based on hooks observed and hooks retrieved: Extrapolated Total equals Total Fish Observed multiplied by Hooks Retrieved, divided by Hooks Observed. The tables show that in the GOARA, the highest numbers (over 1,000 average count over the period 2016-2022) of fish caught include arrowtooth flounder (2,817), sablefish (11,135), pacific cod (17,080), rockfish (all species total 5,180), sharks (16,973), and skates (9,953). In the BSAIRA the highest numbers of target fish caught during IPHC research activities are Pacific cod (12,076) and sablefish (1,113). Table 4-19 shows that with the exception of sablefish (average 1,134 fish caught over 2016-2022) very few target species are caught by IPHC research activities in Washington and Oregon waters. It should be noted that IPHC researchers return all species except Pacific halibut, rockfish, and a portion of Pacific cod to the sea and mortality of the returned species is assumed to be minimal. Therefore, the impacts of IPHC research on target and managed fish species is also determined to be minor adverse.

Table 4-15. AFSC Target Fish Research Catch 2016-2022 in GOARA Compared to 2024 Total Allowable Catch

Species Group	Species	Total AFSC GOARA Research Catch per Year (mt)[1]							Average AFSC Research Catch (mt)	2024 Final GOA TAC (mt)[2]	Average AFSC Research Catch Compared TAC
		2016	2017	2018	2019	2020	2021	2022			
Walleye pollock	Walleye pollock	29.02627	91.40164	19.59727	61.67467	25.53811	38.33634	13.00186	39.79660	168,416	0.02363%
Arrowtooth flounder	Arrowtooth flounder	0.00464	0.05109	0.00353	0.22694	0.00869	0.03829	0.00366	0.04812	93,389	0.00005%
Sablefish	Sablefish	0	0.00777	0	0.00446	0.00022	0.04546	0	0.00827	21,095	0.00004%
Pacific cod	Pacific cod	0.18774	0.05943	0.02256	0.02037	0.00485	0.02758	0.00644	0.04700	16,668	0.00028%
Flathead sole	Flathead sole	0.00898	0.00769	0.00499	0.08529	0.00373	0.00501	0.00301	0.01696	35,839	0.00005%
Pacific ocean perch	Pacific ocean perch	0.00070	6.23409	0	4.54105	0.00168	15.94051	0.00188	3.81713	36,196	0.01055%
Shallow-water flatfish	Northern rock sole	0	0.00198	0.00108	0	0.00035	0.00094	0	0.00095	45,425	0%
	Yellowfin sole	0	0	0	0	0	0	0			
	Southern rock sole	0.01739	0	0.00045	0	0.00029	0.00703	0			
	Starry flounder	0.00215	0	0.00300	0.00439	0	0	0			
	Alaska plaice	0	0.00736	0	0	0	0	0			
	Butter sole	0	0	0	0	0	0	0			
	English sole	0	0	0	0	0	0	0			
Longnose skate	Longnose skate	0	0	0	0.00969	0	0.01439	0.01218	0.00518	2,712	0.00019%
Dusky rockfish	Dusky rockfish	0	0.03727	0	0.36377	0	1.08741	0	0.21264	7,520	0.00283%

Species Group	Species	Total AFSC GOARA Research Catch per Year (mt)[1]							Average AFSC Research Catch (mt)	2024 Final GOA TAC (mt)[2]	Average AFSC Research Catch Compared TAC
		2016	2017	2018	2019	2020	2021	2022			
Thornyhead rockfish	Shortspine thornyhead	0	0	0	0	0	0.01037	0	0.00074	1,628	0.00005%
	Longspine thornyhead	0	0	0	0	0	0.00000	0			
Shortraker rockfish	Shortraker rockfish	0	0.02507	0	0	0	0.13957	0	0.02352	705	0.00334%
Northern rockfish	Northern rockfish	0	0.01324	0	0.00882	0	1.49762	0	0.21710	4,741	0.00458%
Rex sole	Rex sole	0	0.00491	0	0.00385	0	0.01813	0	0.00384	21,079	0.00002%
Rougheye and Blackspotted rockfish	Rougheye rockfish	0	0.02573	0.00155	0.00093	0	0.08128	0	0.00810	781	0.00104%
	Blackspotted rockfish	0.00229	0.00157	0	0.00000	0	0	0			
Atka mackerel	Atka mackerel	0	0.00612	0	0.00117	0	0	0	0.00104	3,000	0.00003%
Deep-water flatfish	Dover sole	0	0.00000	0	0	0	0.00256	0	0.00037	5,719	0.00001%
Big skate	Big skate	0	0.02163	0	0.02293	0	0.00651	0.00555	0.00809	2,867	0.00028%
Other skates	Aleutian skate	0	0	0	0	0	0	0	0	984	0%
	Bering skate	0	0	0	0	0	0	0			
	Skates unidentified	0	0	0	0	0	0	0			
Sharks	Pacific sleeper shark	0.05100	0	0	0	0	0	0	0.00718	4,891	0.00015%
	Spiny dogfish	0	0.01334	0	0.01993	0	0.01347	0.00280			
Other rockfish	Silvergray rockfish	0	0	0	0.01808	0	0.02045	0	0.00398	1,610	0.00025%

Species Group	Species	Total AFSC GOARA Research Catch per Year (mt)[1]							Average AFSC Research Catch (mt)	2024 Final GOA TAC (mt)[2]	Average AFSC Research Catch Compared TAC
		2016	2017	2018	2019	2020	2021	2022			
	Redbanded rockfish	0	0	0	0	0	0	0			
	Harlequin rockfish	0	0.07259	0	0.00033	0	0	0			
	Sharpchin rockfish	0	0	0	0	0	0	0			
Demersal shelf rockfish	Yelloweye rockfish	0	0	0	0	0	0.00361	0	0.00052	283	0.00018%

[1]Source: AFSC October 2023
[2] Source: 88 FR 13238

Table 4-16. AFSC Target Fish Research Catch 2016-2022 in BSAIRA compared to 2024 Total allowable Catch

Species Group	Species	Total AFSC BSAIRA Research Catch per Year (mt)[1]							Average AFSC Research Catch (mt)	2024 Final BSAI TAC (mt)[3]	Average Research Catch Compared to BSAI TAC
		2016	2017	2018	2019	2020[2]	2021	2022			
Walleye pollock	Walleye pollock	65.20883	0	42.68460	0	13.52018	0	48.34907	24.25181	1,321,300	0.00184%
Pacific ocean perch	Pacific ocean perch	0.11930	0	0.80818	0	0.07683	0	2.53034	0.50495	38264	0.00132%
Atka mackerel	Atka mackerel	0.00099	0	0	0	0	0	0	0.00014	66855	0%
Pacific cod	Pacific cod	0.20512	0	0.34243	0	0	0	0.00852	0.07944	131720	0.00006%
Northern rockfish	Northern rockfish	0.49711	0	0.45138	0	0	0	0.00178	0.13575	11000	0.00123%
Arrowtooth flounder	Arrowtooth flounder	0.02656	0	0.00605	0	0.00404	0	0.00641	0.00615	15000	0.00004%
Yellowfin sole	Yellowfin sole	0.21810	0	0.12300	0	0	0	0.06049	0.05737	230656	0.00002%
Flathead sole	Flathead sole	0.01248	0	0.01004	0	0.00070	0	0.03485	0.00830	35500	0.00002%
Rock Soles	Northern	0.00389	0	0.01409	0	0	0	0.00408	0.00158	66000	0%
	Southern	0	0	0	0	0	0	0			
Other flatfish	Rex sole	0	0	0	0	0	0	0.00189	0.00028	4500	0.00001%
	Starry flounder	0	0	0	0	0	0	0.00206			
Alaska plaice	Alaska plaice	0.01011	0	0.24372	0	0	0	0	0.03626	18000	0.00020%

Species Group	Species	Total AFSC BSAIRA Research Catch per Year (mt)[1]							Average AFSC Research Catch (mt)	2024 Final BSAI TAC (mt)[3]	Average Research Catch Compared to BSAI TAC
		2016	2017	2018	2019	2020[2]	2021	2022			
Skates	Alaska skate	0.02747	0	0.03140	0	0	0	0	0.00105	27927	0%
	Whiteblotched	0	0	0	0	0	0	0			
	Aleutian skate	0	0	0	0	0	0	0			
	Commander	0	0	0	0	0	0	0			
	Leopard skate	0	0	0	0	0	0	0			
	Mud skate	0	0	0	0	0	0	0			
	Bering skate	0	0	0	0	0	0	0			
	Skates unidentified	0	0	0	0	0	0	0			
Sablefish	Sablefish	0	0	0	0	0	0	0	0	19469	0%
Kamchatka flounder	Kamchatka flounder	0.00054	0	0	0	0	0	0	0.00008	7435	0%
Other rockfish	Shortspine thornyhead	0	0	0	0	0	0	0	0	1260	0%
Greenland turbot	Greenland turbot	0.00001	0	0	0	0	0	0	0	3364	0%
Shortraker rockfish	Shortraker rockfish	0	0	0	0	0	0	0	0	530	0%
Rougheye rockfish	Blackspotted rockfish	0	0	0	0	0	0	0	0	570	0%
	Rougheye rockfish	0	0	0	0	0	0	0			

[1]Source: AFSC October 2023
[2]The EBS bottom trawl survey was not conducted in 2020.
[23]Source: 88 FR 14926

Table 4-17. IPHC Target Fish Research Catch 2016-2022 in GOARA

Species Group	Species	Total IPHC/FISS GOARA Research Catch Per Year (Extrapolated Count)[1]							Average IPHC/FISS Research Catch (count)
		2016	2017	2018	2019	2020	2021	2022	
Walleye pollock	Walleye pollock	20	40	57	55	70	190	75	72
Arrowtooth flounder	Arrowtooth flounder	2,777	1,781	3,129	3,373	2,342	3,989	2,328	2,817
	Kamchatka flounder	10	1	5	0	0	0	5	20
	Arrowtooth/Kamchatka	115	145	0	5	0	0	0	
Sablefish	Sablefish	6,110	4,583	9,460	17,492	11,682	17,936	10,683	11,135
Pacific cod	Pacific cod	16,361	11,933	21,995	26,363	7,965	23,356	11,588	17,080
Flathead sole	Flathead sole	10	11	35	11	10	20	5	15
Pacific ocean perch	Pacific ocean perch	0	0	0	0	10	0	0	1
Shallow-water flatfish	Northern rock sole	0	0	0	0	0	0	0	2
	Yellowfin sole	0	0	0	5	0	0	5	
	Southern rock sole	0	0	0	0	0	0	0	
	Starry flounder	0	0	0	0	0	0	0	
	Alaska plaice	0	0	0	0	0	0	0	
	Butter sole	0	0	0	0	0	6	0	
	English sole	0	0	0	0	0	0	0	
	Pacific Rock sole	10	10	27	15	15	0	15	
Longnose skate	Longnose skate	6,435	4,888	6,487	8,649	7,741	11,745	5,068	7,288
Dusky rockfish	Dusky rockfish	55	15	32	75	15	35	10	34
Thornyhead rockfish	Shortspine thornyhead	303	240	487	662	449	563	446	169
	Longspine thornyhead	0	0	0	0	0	0	0	
	Unident. thornyhead	5	1	1		85	65	70	
Shortraker rockfish	Shortraker rockfish	697	350	716	1,066	1,682	1,455	943	987

Species Group	Species	Total IPHC/FISS GOARA Research Catch Per Year (Extrapolated Count)[1]							Average IPHC/FISS Research Catch (count)
		2016	2017	2018	2019	2020	2021	2022	
Northern rockfish	Northern rockfish	0	0	0	10	0	0	0	1
Rex sole	Rex sole	0	0	0	0	0	0	0	0
Rougheye and Blackspotted rockfish	Rougheye rockfish	195	203	483	515	401	524	617	147
	Blackspotted rockfish	10	0	0	0	0	5	0	
	Rougheye/Shortraker	10	15	84	5	0	30	0	
Atka mackerel	Atka mackerel	0	0	0	0	0	5	0	1
Deep-water flatfish	Dover sole	0	5	2	5	0	5	10	4
Big skate	Big skate	2,759	1,724	2,187	3,260	1,861	3,375	1,513	2,383
Other skates	Aleutian skate	1,293	714	1,156	1,264	431	1,019	516	196
	Bering skate	96	35	77	154	25	100	25	
	Alaska skate	150	39	273	115	0	20	65	
	Bering/Alaska	0	0	0	5	0	0	0	
	Bering/Aleutian	5		5		0	0	0	
	Skates unidentified	40	13	32	80	15	36	30	
Sharks	Pacific sleeper shark	554	500	369	644	294	400	130	16,973
	Spiny dogfish	27,457	33,650	28,305	52,522	30,880	37,891	24,021	
Other rockfish	Silvergray rockfish	90	85	96	201	110	131	110	259
	Redbanded rockfish	653	487	775	1,600	1,051	988	873	
	Harlequin rockfish	0	0	0	0	0	0	0	
	Sharpchin rockfish	0	0	0	0	0	0	0	
Demersal shelf rockfish	Yelloweye rockfish	2,321	1,734	2,732	4,294	3,397	4,361	3,131	3,139
Quillback rockfish	Quillback rockfish	180	160	361	680	419	712	597	444

[1]IPHC Data Services, August 2023

Table 4-18. IPHC Target Fish Research Catch 2016-2022 in BSAIRA

Species complex	Species	Total IPHC/FISS BSAIRA Research Catch per Year (Extrapolated Numbers)[1]							Average IPHC/FISS Research Catch (count)
		2016	2017	2018	2019	2020	2021	2022	
Walleye pollock	Walleye pollock	505	80	76	99	0	74	265	157
Pacific ocean perch	Pacific ocean perch	0	0	5	0	0	0	0	1
Atka mackerel	Atka mackerel	0	0	0	0	0	0	5	1
Pacific cod	Pacific cod	18,438	13,468	17,186	18,973	0	7,034	9,435	12,076
Northern rockfish	Northern rockfish	50	5	0	0	0	0	0	8
Arrowtooth flounder	Arrowtooth flounder	2,057	1,422	929	1,505	0	251	375	321
	Greenland/Kamchatka/ Arrowtooth	0	15	0	5	0	5	0	
	Kamchatka/ Arrowtooth	0	15	0	20	0	151	0	
Yellowfin sole	Yellowfin sole	15	5	15	30	0	0	5	10
Flathead sole	Flathead sole	5	10	20	5	0	5	10	8
Rock Soles	Northern rock sole	0	0	0	0	0	0	0	1
	Southern rock sole	0	0	0	0	0	0	0	
	Pacific Rock sole	10	0	0	5	0	0	0	
Other flatfish	Rex sole	0	0	0	0	0	0	0	0
	Starry flounder	0	0	0	0	0	0	0	
Alaska plaice	Alaska plaice	0	0	0	0	0	0	0	0

Species complex	Species	Total IPHC/FISS BSAIRA Research Catch per Year (Extrapolated Numbers)[1]							Average IPHC/FISS Research Catch (count)
		2016	2017	2018	2019	2020	2021	2022	
Skates	Alaska skate	4,047	2,606	1,880	1,430	0	295	780	532
	Whiteblotched skate	2,165	4,891	2,797	2,517	0	668	1,226	
	Aleutian skate	1,909	1,066	1,964	1,282	0	469	1,059	
	Commander skate	45	55	0	0	0	0	90	
	Leopard skate	506	239	640	738	0	0	150	
	Mud skate	0	95	0	0	0	5	0	
	Bering skate	190	130	86	25	0	5	10	
	Bering/Alaska skate	5	0	0	0	0	0	0	
	Bering/Aleutian skate	0	11	0	0	0	0	0	
	Skates unidentified	0	310	125	69	0	635	45	
Sablefish	Sablefish	280	736	783	2,225	0	1,573	2,193	1,113
Kamchatka flounder	Kamchatka flounder	15	135	95	110	0	0	144	71
Other rockfish	Shortspine thornyhead	721	1,061	235	576	0	71	394	437
Greenland turbot	Greenland turbot	249	60	70	110	0	35	115	91
Shortraker rockfish	Shortraker rockfish	125	240	65	224	0	45	35	69
	Rougheye/Shortraker	10	65		70	0	19	0	
Rougheye rockfish	Blackspotted rockfish	0	0	5	224	0	0	0	114
	Rougheye rockfish	180	450	308	140	0	50	244	

[1]IPHC Data Services, August 2023

Table 4-19. IPHC Target Fish Research Catch 2016-2022 in Washington and Oregon Waters

Species complex	Species	Total IPHC/FISS WA and OR Research Catch per Year (Extrapolated Numbers)[1]							Average IPHC/FISS Research Catch (count)
		2016	2017	2018	2019	2020	2021	2022	
Walleye pollock	Walleye pollock	0	0	0	0	0	0	0	0
Pacific ocean perch	Pacific ocean perch	0	0	0	0	0	0	0	0
Atka mackerel	Atka mackerel	0	0	0	0	0	0	0	0
Pacific cod	Pacific cod	5	12	3	1	0	0	8	4
Northern rockfish	Northern rockfish	0	0	0	0	0	0	0	0
Arrowtooth flounder	Arrowtooth flounder	22	19	101	13	0	17	7	26
Yellowfin sole	Yellowfin sole	0	0	0	0	0	0	0	0
Flathead sole	Flathead sole	0	0	0	5	0	27	0	5
Rock Soles	Northern rock sole	0	0	0	0	0	0	0	0
	Southern rock sole	0	0	0	0	0	0	0	
Other flatfish	Rex sole	0	0	0	0	0	0	0	0
	Starry flounder	0	0	0	0	0	0	0	
Alaska plaice	Alaska plaice	0	0	0	0	0	0	0	0
Skates	Alaska skate	0	0	0	0	0	0	0	0.5

Species complex	Species	Total IPHC/FISS WA and OR Research Catch per Year (Extrapolated Numbers)[1]							Average IPHC/FISS Research Catch (count)
		2016	2017	2018	2019	2020	2021	2022	
	Whiteblotched skate	0	0	0	0	0	0	0	
	Aleutian skate	0	0	0	0	0	0	0	
	Commander skate	0	0	0	0	0	0	0	
	Leopard skate	0	0	0	0	0	0	0	
	Mud skate	0	0	0	0	0	0	0	
	Bering skate	0	6	0	1	0	0	0	
	Skates unidentified	0	0	0	13	0	1	5	
Sablefish	Sablefish	1368	1839	1105	1963	0	779	887	1,134
Kamchatka flounder	Kamchatka flounder	0	0	0	0	0	0	0	0
Other rockfish	Shortspine thornyhead	20	48	17	47	0	46	15	28
	Unident. thornyhead	0	0	10	0	0	0	0	1
Greenland turbot	Greenland turbot	0	0	0	0	0	0	0	0
Shortraker rockfish	Shortraker rockfish	1	0	0	5	0	0	0	1
Rougheye rockfish	Blackspotted rockfish	0	0	0	0	0	0	0	15
	Rougheye rockfish	53	68	71	8	0	0	5	

[1]IPHC Data Services, August 2023

Ecosystem Component Species

Ecosystem component species caught in AFSC and IPHC research activities include Pacific halibut, Pacific herring, non-ESA-listed Pacific salmon and steelhead trout, and forage fish such as capelin and eulachon. Table 4-20 shows the weight in mt of Pacific halibut, Pacific herring, capelin and eulachon captured during AFSC research activities in the GOARA, BSAIRA, and CSBSRA over the period 2016-2022. Tables 4-7 and 4-8 show the numbers of Pacific salmon and steelhead trout caught during AFSC and IPHC activities over the period 2016-2022. No prohibited species other than 68 Pacific salmon caught in the GOARA and 1 steelhead trout caught in Washington and Oregon waters (see Table 4-8) were recorded as captured during any IPHC activities over the 2016-2022 period.

Table 4-20. AFSC Ecosystem Component Species Research Catch 2016-2022

Species	Total AFSC Research Catch per Year (mt)[1,2]							Average AFSC Research Catch (mt)
	2016	2017	2018	2019	2020	2021	2022	
GOARA								
Eulachon	0.24	0.90	0.38	1.20	3.0	6.75	0.82	1.90
Capelin	0	0.02	0.01	0.30	0.01	0.17	<0.01	0.07
Pacific halibut	0	0	0	11.74	0	11.72	0	3.35
BSAIRA								
Eulachon	<0.01	0	<0.01	0	1.64	0	<0.01	0.24
Capelin	<0.01	0	<0.01	0	<0.01	0	<0.01	<0.01
Pacific halibut	10.01	5.77	8.89	4.83	0	6.90	8.99	6.48
Pacific herring	0	3.23	4.00	5.60	0	4.38	9.90	3.87
CSBSRA								
Capelin	0	0.02	0	<0.01	0	0	0	<0.01

[1]Source: AFSC October 2023.
[2]Catch rounded to nearest hundredth.

Table 4-20 shows that AFSC research catch for these species averaged less than 7 mt per year over the 7-year period. Species with the highest research catch include Pacific halibut and Pacific herring. As described in Section 3.2.1.3, neither of these species are overfished and the research removals would only have a minor adverse effect on the populations.

As shown in Tables 4-7 and 4-8, just over 111,000 Pacific salmon were captured in AFSC and IPHC research efforts over the period 2016-2022. After subtracting out the 340 fish that could be from an ESA-listed ESU (see Table 4-13), this equates to ~110,700 non-ESA-listed salmonids per year caught during research activities. According to ADF&G, the total harvest, for 2023, through September 1 of 2023 was ~215 million salmon[11]. Therefore, the research catch is less than 0.01% of the total commercial salmon harvest and impacts of the Status Quo Alternative on non-listed salmonids can be considered minor adverse.

[11] https://www.adfg.alaska.gov/index.cfm?adfg=commercialbyfisherysalmon.bluesheetsummary, Accessed October 16, 2023

Other Fish Species

Table 4-21 shows the research catch in mt of other fish species caught during AFSC research activities in the GOARA, BSAIRA, and CSBSRA for which a commercial TAC is not applicable. Table 4-22 shows IPHC research catch of these other species in the GOARA, BSAIRA, and Washington and Oregon coastal waters. As shown in the tables, AFSC and IPHC research catch of other fish averaged over 2016-2022 in all three regions is very small and is not expected to have population level effects. Therefore, AFSC and IPHC research is expected to have only minor adverse effects under the Status Quo Alternative on other fish species for which catch data is recorded.

Table 4-21. AFSC Research Catch of Other Fish Species 2016-2022

Species	Total AFSC Research Catch per Year (mt)[1,2]							Average AFSC Research Catch (mt)
	2016	2017	2018	2019	2020	2021	2022	
GOARA								
Giant grenadier	0	0	0	0.08	0	0.02	0	0.01
Pacific grenadier	0	0	0	0	0	0	0	0
Great sculpin	0	<0.01	0	0	0	0	0	<0.01
Yellow Irish lord	0	0	0	0	0	0	0	0
Plain sculpin	0	0	0	0	0	0	0	0
Lingcod	0	0	0	0	0	0	0	0
Canary rockfish	0	0	0	0	0	7.27	0	1.04
Redstripe rockfish	0	0	0	1.33	0	0	0	0.19
BSAIRA								
Giant grenadier	<0.01	0	0	0	0	0	0	<0.01
Popeye grenadier	0	0	0	0	<0.01	0	0	<0.01
Yellow Irish lord	0	0	<0.01	0	0	0	<0.01	<0.01
Bigmouth sculpin	0	0	0	0	0	0	0	0
Plain sculpin	0	0	<0.01	0	0	0	0	<0.01
Darkfin sculpin	0	0	0	0	0	0	0	0
Great sculpin	0.01	0	<0.01	0	0	0	<0.01	<0.01
Warty sculpin	0	0	0	0	0	0	0	0
Western eelpout	0	0	0	0	0	0	0	0
Saffron cod	0	0	<0.01	0	0	0	0	<0.01
Pacific sleeper shark	0	0	0	0	0	0.00	1.30	0.19
Bering flounder	1.33	1.59	0	0	0	0	0	0.42
Pacific grenadier	1.56	0.00	0	0	0	0	0	0.22
Wattled eelpout	1.18	0.00	0	0	0	0	0	0.17
Shortfin eelpout	0	0	0	0	0	0	1.37	0.20
CSBSRA								
Arctic cod	0	0.25	0	0.01	0	0	0	0.04
Saffron cod	0	<0.01	0	<0.01	0	0	0	<0.01

Species	Total AFSC Research Catch per Year (mt)[1,2]							Average AFSC Research Catch (mt)
	2016	2017	2018	2019	2020	2021	2022	
Pacific sandlance	0	<0.01	0	<0.01	0	0	0	<0.01
Polar eelpout								
Rainbow smelt								
Starry flounder								
Yellowfin sole	0	<0.01	0	0.02	0	0	0	<0.01
Slender eelblenny	0	<0.01	0	0.01	0	0	0	<0.01
Bering flounder	0	<0.01	0	<0.01	0	0	0	<0.01
Arctic staghorn sculpin	0	<0.01	0	<0.01	0	0	0	<0.01
Alaska plaice	0	0	0	<0.01	0	0	0	<0.01
Variegated snailfish	0	<0.01	0	<0.01	0	0	0	<0.01

[1]Source: AFSC October 2023.
[2]Catch rounded to nearest hundredth.

Table 4-22. IPHC Research Catch of Other Fish Species 2016-2022

Species	Total IPHC Research Catch per Year (extrapolated count)[1]							Average IPHC Research Catch (count)[2]
	2016	2017	2018	2019	2020	2021	2022	
GOARA								
Giant grenadier	0	0	0	0	0	0	0	0
Pacific grenadier	0	0	0	0	0	0	0	0
Rattails	758	482	1,035	1,764	214	546	180	711
Great sculpin	379	495	471	1,038	818	1,042	586	690
Yellow Irish lord	1,919	1,750	2,475	3,564	629	1,748	1,404	1,924
Plain sculpin	5	0	0	0	0	15	0	3
Spotted ratfish	70	45	74	152	88	71	30	76
Lingcod	779	717	1,048	1,033	1,215	1,536	1,021	1,050
BSAIRA								
Giant grenadier	0	0	0	0	0	0	0	0
Popeye grenadier	0	0	0	0	0	0	0	0
Rattails	4,172	6,549	849	1,720	0	588	3,902	2,540
Yellow Irish lord	4,364	3,850	3,462	5,106	0	2,661	2,008	3,064
Bigmouth sculpin	5	15	0	0	0	5	0	4
Plain sculpin	0	0	0	316	0	0	0	45
Darkfin sculpin	0	0	0	0	0	0	0	0
Great sculpin	580	180	302	174	0	249	334	260

Species	Total IPHC Research Catch per Year (extrapolated count)[1]							Average IPHC Research Catch (count)[2]
	2016	2017	2018	2019	2020	2021	2022	
Warty sculpin	60	0	36	0	0	0	0	14
Western eelpout	0	0	0	0	0	0	0	0
Saffron cod	0	0	0	0	0	0	0	0
Arctic Cod	0	0	0	0	0	0	0	0
Washington and Oregon								
Giant grenadier	0	0	0	0	0	0	0	0
Popeye grenadier	0	0	0	0	0	0	0	0
Rattails	0	10	0	0	0	0	0	2
Yellow Irish lord	0	0	0	0	0	0	0	0
Bigmouth sculpin	0	0	0	0	0	0	0	0
Plain sculpin	0	0	0	0	0	0	0	0
Darkfin sculpin	0	0	0	0	0	0	0	0
Great sculpin	0	0	2	0	0	0	0	1
Warty sculpin	0	0	0	0	0	0	0	0
Western eelpout	0	0	0	0	0	0	0	0

[1]Source: AFSC October 2023.
[2]Rounded up to nearest whole number.

4.3.2.2 Effects on Marine Mammals

Section 3.2.3 describes ESA-listed and non-listed marine mammals that may be affected by AFSC and IPHC research activities. Section 4.1. discusses the criteria used to assess effects on marine mammals. The types of effects on marine mammals due to fisheries and ecosystem research include:

- Mortality or serious injury (M/SI). NMFS interprets the regulatory definition of serious injury (i.e., any injury that will likely result in mortality) as any injury that is "more likely than not" to result in mortality, or any injury that presents a greater than 50 % chance of death to a marine mammal (NMFS 2022j, 2023c). Thus, a serious injury is classified as leading to the death or likely death of the animal;
- Capture or entanglement (i.e., in research gear) of a marine mammal that may result in non-serious (non-lethal) injury (referred to under the MMPA as non-serious Level A take) if the animal is released alive; or
- Physical disturbance of marine mammals due to the presence of research vessels, gear or humans (referred to under the MMPA as Level B take).

AFSC and IPHC research will not result in:

- Auditory injury or permanent threshold shift (PPT). PPT is not possible from acoustic gear used for research; or

- Behavioral disturbance or TTS associated with acoustic equipment. The types of equipment used in research would not be used in a manner that would exceed NMFS regulatory hearing thresholds (see Section 6.3).

AFSC surveys use gear such as trawl nets, longlines or gill nets that have the potential to kill or injure (both serious and non-serious) marine mammals (see Table 2-1). Lethal or non-lethal incidental encounters with marine mammals are possible during the use of the following gear: beam, Eastern otter, commercial or Nephrops bottom trawl nets; Cantrawl or Nordic 264 surface trawl nets; commercial, Aleutian wing, Methot or anchovy mid-water trawl nets; or gillnets. These gear types are used during or in conjunction with certain AFSC or IPHC studies (see Table 2-1). Marine mammals can also become hooked or entangled during the use of longline gear, which has the potential to result in lethal or non-lethal interactions. Harassment of pinnipeds hauled out may also occur, as a result of visual disturbance from vessels conducting AFSC research. These direct effects along with indirect effects due to removal of prey are assessed herein.

Many of AFSC's surveys also use active acoustic devices; however, as described in Section 4.2, acoustic equipment is not used in a manner that would exceed NMFS' regulatory thresholds for acoustic harassment (i.e., equipment is used at frequencies above 200 kHz which is above marine mammal hearing thresholds (180 kHz)).

Table 4-23 summarizes the potential effects of the Status Quo Alternative on ESA-listed and non-listed marine mammals. Sections 4.3.2.2.1, 4.3.2.2.2, and 4.3.2.2.3 describe the context for these conclusions which relate to historical records or potential for injury or mortality from surveys, physical disturbance, and level of fish catch as a measure of potential changes in food availability.

Table 4-23. Summary of Potential Effects of the Status Quo Alternative on ESA-Listed and Non-Listed Marine Mammals

Species and Stock or DPS	Potential Effects of the Status Quo Alternative			Discussion
	Injury or Mortality from Surveys	Physical Disturbance	Changes in Food Availability	
ESA-Listed Species				
Sperm Whale CA/OR/WA Stock	Minor adverse	Minor adverse	No effect	Potential for lethal interaction or non-serious injury due to entanglement; however, no population-level effect. Depredation indicates close proximity to vessels and potential physical disturbance. No effect on food availability given the small amounts of fish research catch.
Humpback Whale Central America DPS Mexico DPS	Minor adverse	Minor adverse	No effect	Potential for lethal interaction or non-serious injury due to entanglement; however, no population-level effect. Depredation indicates close proximity to vessels and potential physical disturbance. No effect on food availability given the small amounts of fish research catch.
Blue Whale ENP Stock	No effect	No effect	No effect	No history of interactions resulting in take under MMPA or ESA. While observations of fin and sei whales (not blue or bowhead) are documented, interactions did not cause disturbance to species (depredation likely). No effect on food availability given the small amounts of fish research catch.
Fin Whale CA/OR/WA Stock	No effect	No effect	No effect	
Sei Whale ENP Stock	No effect	No effect	No effect	
Bowhead Whale Western Arctic Stock	No effect	No effect	No effect	
Beluga Whale Cook Inlet DPS	Minor adverse	Minor adverse	No effect	No history of interactions resulting in take under MMPA or ESA. Potential for lethal interaction or non-serious injury due to entanglement; however, no population-level effect. Vessel presence may have potential physical disturbance. No effect on food availability given the small amounts of fish research catch.

Species and Stock or DPS	Potential Effects of the Status Quo Alternative			Discussion
	Injury or Mortality from Surveys	Physical Disturbance	Changes in Food Availability	
Killer Whale ENP Southern Resident	No effect	No effect	No effect	Species does not occur in primary research areas. No history of interactions resulting in take under MMPA or ESA.
North Pacific Right Whale ENP Stock	No effect	Minor adverse	No effect	No history of interactions resulting in take under MMPA or ESA. Potential for minor disturbance due to physical presence of vessels. No effect on food availability given the small amounts of fish research catch.
Ringed Seal Arctic Subspecies	Minor adverse	Minor adverse	No effect	No history of interactions resulting in take under MMPA or ESA. Potential for minor disturbance due to physical presence of vessels. No effect on food availability given the small amounts of fish research catch.
Bearded Seal Beringia DPS	Minor adverse	Minor adverse	No effect	
Steller Sea Lion Western U.S. DPS	Minor adverse	Minor adverse	No effect	
Northern sea otter SW Alaska Stock	No effect	No effect	No effect	Species considered rare in primary research areas. No history of interactions resulting in take under MMPA or ESA.
Polar Bear SBS and CBS Stocks	No effect	No effect	No effect	
Pacific Walrus Alaska Stock	No effect		No effect	
Non ESA-Listed Species				
Harbor Porpoise Southeast Alaska Stock GOA Stock Bering Sea Stock	Minor adverse	Minor adverse	No effect	Potential for lethal interaction or non-serious injury due to entanglement; however, no population-level effect. Vessel presence may have potential physical disturbance. No effect on food availability given the small amounts of fish research catch.

Species and Stock or DPS	Potential Effects of the Status Quo Alternative			Discussion
	Injury or Mortality from Surveys	Physical Disturbance	Changes in Food Availability	
Dall's Porpoise Alaska Stock CA/WA/OR stock	Minor adverse	Minor adverse	No effect	Potential for lethal interaction or non-serious injury due to entanglement; however, no population-level effect. Vessel presence may have potential physical disturbance. No effect on food availability given the small amounts of fish research catch.
Pacific White-Sided Dolphin CA/WA/OR Stock North Pacific Stock	Minor adverse	Minor adverse	No effect	
Risso's Dolphin CA/OR/WA Stock	Minor adverse	Minor adverse	No effect	
Common Bottlenose Dolphin CA/OR/WA Offshore	Minor adverse	Minor adverse	No effect	
Common Dolphin CA/OR/WA Stock	Minor adverse	Minor adverse	No effect	
Northern Right Whale Dolphin CA/OR/WA Stock	No effect	No effect	No effect	Species considered rare in primary research areas. No history of interactions resulting in take under MMPA.
Gray Whale ENP Stock	No effect	No effect	No effect	No history of interactions resulting in take under MMPA. While observations of whales are documented, interactions did not cause disturbance to species No effect on food availability given the small amounts of fish research catch.
Killer Whale ENP Northern Resident West Coast Transient ENP Offshore AT1 Transient ENP GOA, AI and BS Transient ENP Alaska Resident	No effect on all stocks except Minor adverse for Alaska Resident stock	No effect on all stocks except Minor adverse for Alaska Resident stock	No effect	Potential for lethal interaction or non-serious injury due to entanglement; however, no population-level effect. Depredation indicates close proximity to vessels and potential physical disturbance. No effect on food availability given the small amounts of fish research catch.

Species and Stock or DPS	Potential Effects of the Status Quo Alternative			Discussion
	Injury or Mortality from Surveys	Physical Disturbance	Changes in Food Availability	
Short-finned Pilot Whale CA/OR/WA Stock	Minor adverse	Minor adverse	No effect	Potential for lethal interaction or non-serious injury due to entanglement; however, no population-level effect. Depredation indicates close proximity to vessels and potential physical disturbance. No effect on food availability given the small amounts of fish research catch.
Baird's Beaked Whale CA/OR/WA Stock Alaska Stock	No effect	No effect	No effect	No history of interactions resulting in take under MMPA. No effect on food availability given the small amounts of fish research catch.
Cuvier's Beaked Whale CA/OR/WA Stock Alaska Stock	No effect	No effect	No effect	
Stejneger's Beaked Whale CA/OR/WA Stock Alaska Stock	No effect	No effect	No effect	
Other Beaked Whales CA/OR/WA Stocks	No effect	No effect	No effect	
Beluga Whale Beaufort Sea DPS Eastern Chukchi Sea DPS Eastern Bering Sea DPS Bristol Bay	Minor adverse only for Beaufort Sea and Chukchi Sea stocks	Minor adverse only for Beaufort Sea and Chukchi Sea stocks	No effect	Potential for lethal interaction or non-serious injury due to entanglement; however, no population-level effect. Vessel presence may have potential physical disturbance. No effect on food availability given the small amounts of fish research catch.
Humpback Whale Hawaii DPS	Minor adverse	Minor adverse	No effect	Potential for lethal interaction or non-serious injury due to entanglement; however, no population-level effect. Depredation indicates close proximity to vessels and potential physical disturbance. No effect on food availability given the small amounts of fish research catch.
Minke Whale CA/OR/WA Stock Alaska Stock	No effect	No effect	No effect	No history of interactions resulting in take under MMPA. No effect on food availability given the small amounts of fish research catch.

Species and Stock or DPS	Potential Effects of the Status Quo Alternative			Discussion
	Injury or Mortality from Surveys	Physical Disturbance	Changes in Food Availability	
California Sea Lion United States	Minor adverse	Minor adverse	No effect	Potential for lethal interaction or non-serious injury due to entanglement; however, no population-level effect. Vessel presence may have potential physical disturbance. No effect on food availability given the small amounts of fish research catch.
Steller Sea Lion Eastern U.S. DPS	Minor adverse	Minor adverse	No effect	
Northern Fur Seal Pribilof/Eastern Pacific Stock California Stock	Minor adverse	Minor adverse	No effect	
Northern Elephant Seal California Breeding Population	Minor adverse	Minor adverse	No effect	
Harbor Seal California Stock OR/WA Coast Stock WA North Inland Waters Stock Southern Puget Sound Stock Hood Canal Stock Clarence Strait Stock Dixon/Cape Decision Stock Sitka/Chatham Strait Stock Lynn Canal/Stephens Passage Stock Glacier Bay/Icy Strait Stock Cook Inlet/Shelikof Strait Stock Prince William Sound Stock South Kodiak Stock North Kodiak Stock Bristol Bay Stock Pribilof Islands Stock Aleutian Islands Stock	Minor adverse	Minor adverse	No effect	
Spotted Seal Bering Alaska Stock	Minor adverse	Minor adverse	No effect	
Ribbon Seal Alaska Stock	Minor adverse	Minor adverse	No effect	

Species and Stock or DPS	Potential Effects of the Status Quo Alternative			Discussion
	Injury or Mortality from Surveys	Physical Disturbance	Changes in Food Availability	
Northern Sea Otter Southcentral Alaska Stock Southeast Alaska Stock Washington Stock	No effect	Minor adverse	No effect	No history of interactions resulting in take under MMPA. Potential for minor disturbance due to physical presence of vessels. No effect on food availability given the small amounts of fish research catch.

4.3.2.2.1 Mortality

Historical Level A and M/SI Takes During AFSC and IPHC Research

To determine the potential for interaction during AFSC and IPHC research activities, a variety of factors are considered including a summary of historical interactions between marine mammals and AFSC and IPHC research (specifically the period since 2019), historical marine mammal interactions between commercial fisheries that may use the same gear (as listed in the 2023 List of Fisheries [LOF]), and other biological factors such as feeding behavior, distribution or propensity to travel in groups. For the purposes of this assessment, the term take is referenced below as defined by the MMPA and ESA and in this NEPA assessment is considered an adverse effect according to the criteria defined in Table 4-1.

As summarized in the 2019 final rule (NMFS 2019d), from 1999-2019 there have been ten takes of marine mammals during AFSC and IPHC research. Six takes occurred during bottom longline efforts which involved harbor seals (2), a Dall's porpoise (1), and Steller sea lions (4). In 2011, two Dall's porpoises were taken occurred during surface trawls (Cantrawl). One take of a northern fur seal occurred in 2009 during the Gulf of Alaska Biennial Shelf and Slope Bottom Trawl (using the Poly Nor'Eastern). In 2014, one take of a harbor seal occurred during the ADF&G Large Mesh Trawl Survey.

Table 4-24 compares the total number of takes authorized over the 5-year period (2019 – 2024; NMFS (2019d)) to the actual number of M/SI and non-serious Level A takes that have occurred during AFSC and IPHC research between October 2019 and October 2023. As of October 2023, a total of five takes have been reported during AFSC and IPHC longline surveys since 2019. Two takes were classified as non-serious injury Level A because the whales (one sperm and one humpback whale) were released alive and swam away. Two unidentified pinnipeds were killed (2019 and 2021) and one killer whale was killed in 2023. No takes have occurred during trawl surveys between 2019 and October 2023. The total M/SI and non-serious Level A takes reported since 2019 are fewer than what was authorized in the 2019 rule, with the exception of one humpback whale take for which take was not authorized. Additional details on the take events between 2019 and October 2023 are provided herein.

Table 4-25 presents marine mammal observation data during the AFSC trawl surveys and IPHC longline surveys for the period 2019 – 2022 based on AFSC's annual reports (AFSC 2020b, 2021a, 2022a). The majority of marine mammal observations were recorded during AFSC trawl surveys (n= 328 – 350 marine mammals observed). The 2021 trawl surveys reported the highest number of marine mammals observations (n=184) while only 17-30 marine mammals were observed during trawl surveys in 2022. A total of 184 marine mammals were observed during IPHC longline surveys between 2019 and 2022, with the highest number (n=91) reported in 2022. The number of trawl tows and longline sets is presented by year at the top of Table 4-25. Based on the data summarized in Table 4-25, it does not appear the number of tows or sets is indicative of the number of marine mammals observed. For example, while 91 marine mammals were observed during longline surveys in 2022, there were only 811 sets that year, which was the least number of sets for the 4-year period. As noted in the footnotes to Table 4-25, mitigation measures applied by AFSC and IPHC staff during the period 2019-2022 included visual monitoring for marine mammals, altering vessel course or speed to avoid animals, or the move on rule (i.e., canceling or not starting a set and moving to a different location). These actions and other standard mitigation measures were successful in avoiding take of the marine mammals listed in Table 4-25.

Table 4-24. Comparison of Authorized Takes 2019-2024 to Reported Marine Mammal M/SI or Non-Serious Level A takes 2019 through October 2023

Species	2019 – 2024 Authorized 5-year Takes[a]				Annual Recorded Takes[b]					5-Year Authorized Total All Gears	2019-2023[b] Actual Reported Total All Gears
	AFSC		IPHC	AFSC							
	Trawl	Longline	Longline	Gillnet	2019	2020	2021	2022	2023[b]		
Sperm Whale (North Pacific Stock)	-	1	1	-	-	-	1[c]	-	-	2	1
Humpback Whale	-	-	-	-	-	-	1[c]	-	-	0	1
Beluga Whale											
Beaufort Sea Stock	1	-	-	-	-	-	-	-	-	1	
Eastern Chukchi Stock	1	-	-	-	-	-	-	-	-	1	0
Bottlenose Dolphin CA/OR/WA Offshore Stock	-	-	1	-	-	-	-	-	-	1	0
Common Dolphin	-	-	1	-	-	-	-	-	-	1	0
Pacific White-Sided Dolphin	5	-	-	1	-	-	-	-	-	6	0
Risso's Dolphin	-	-	1	-	-	-	-	-	-	1	0
Killer Whale (Alaska resident)	-	1	1	-	-	-	-	-	1[d]	2	1
Short-finned Pilot Whale	-	-	1	-	-	-	-	-	-	1	0
Harbor Porpoise											
SE Alaska Stock	-	-	-	-	-	-	-	-	-	1[e]	0
GOA Stock	1	-	-	1	-	-	-	-	-	2	1
Bering Sea Stock	1	-	-	-	-	-	-	-	-	1	0
Dall's Porpoise	10	2	-	1	-	-	-	-	-	14[e]	0
Northern Fur Seal											
Eastern Pacific Stock	10	2	1	1	-	-	-	-	-	13-18	0
California Stock	1	1	5	1	-	-	-	-	-	3-8	0

Species	2019 – 2024 Authorized 5-year Takes[a]				Annual Recorded Takes[b]					5-Year Authorized Total All Gears	2019-2023[b] Actual Reported Total All Gears
	AFSC		IPHC	AFSC							
	Trawl	Longline	Longline	Gillnet	2019	2020	2021	2022	2023[b]		
California Sea Lion	-	-	1	-	-	-	-	-	-	1	0
Steller Sea Lion											
Eastern DPS	5	1	5	1	-	-	-	-	-	7-12[f]	0
Western DPS	10	2	1	13-18	-	-	-	-	-	18[f]	0
Bearded Seal	2	-	-	-	-	-	-	-	-	2	0
Harbor Seal	12	-	5	2	-	-	-	-	-	19	0
Spotted Seal	2	-	1	-	-	-	-	-	-	3	0
Ringed Seal	2	1	1	-	-	-	-	-	-	4	0
Ribbon Seal	2	-	-	-	-	-	-	-	-	2	0
Northern Elephant Seal	1	-	-	-	-	-	-	-	-	1	0
Unidentified pinniped	3	2	1	-	1[g]	-	1[g]	-	-	6	2
Unidentified small cetacean	2	-	-	1	-	-	-	-	-	3	0

Key: A "–" symbol indicates zero.

[a] Source: NMFS (2019d)
[b] Source: AFSC (2020b, 2021a, 2022a); PSIT Database Accessed September 2023. Reported takes for 2023 are based on records through October 2023, the date of preparation of this document.
[c] Released alive; non-serious Level A take based on (NMFS 2023c). The sperm whale take occurred during the AFSC GOA/EBS/AI Longline Stock Assessment Survey. The humpback whale take occurred during the IPHC FISS survey near Ketchikan.
[d] Take occurred in the Bering Sea during the AFSC GOA/EBS/AI Longline Stock Assessment Survey.
[e] For harbor porpoise in southeast Alaska, one total take by M/SI is authorized over the 5-year period for trawl and gillnet gears combined. A maximum of one take by M/SI is authorized over the 5-year period for the CA/OR/WA stock of Dall's porpoise (NMFS 2019d).
[f] Total authorized taking by M/SI for northern fur seal over the 5-year period (21) includes stock-specific limits of a maximum authorized take of 18 individuals from the eastern Pacific stock or of 8 individuals from the California stock. Total authorized taking by M/SI for Steller sea lion over the 5-year period (25) includes stock-specific limits of a maximum authorized take of 12 individuals from the eastern stock or of 18 individuals from the western stock (NMFS 2019d).
[g] Take occurred during the AFSC GOA/EBS/AI Longline Stock Assessment Survey.

Table 4-25. Annual Marine Mammal Observations Not Resulting in Take During AFSC Trawl and AFSC/IPHC Longline Research 2019-2022

Species	2019[a]		2020[a]		2021[a]		2022[a]		4-Year Total Observations by Species and Gear Type	
	Trawl	Longline	Trawl	Longline	Trawl	Longline	Trawl	Longline	Trawl	Longline
Total Tows or Sets	**1,335**	**1,705**	**181**	**2,042**	**181**	**2,042**	**952**	**811**	**2,649**	**6,600**
Sperm Whale (North Pacific Stock)	-	2		10[e]	-	18	-	23	-	**43**
Humpback Whale	1[b]	3	1	2	23[f]	1	3-10	9	**28-38**	**15**
Sei/Fin Whale	2-8[b]	-	2	-	-	-	-	-	**4-10**	-
Fin Whale	50[c]	-	5[b]	-	29[d]	1	1	1	**85**	**2**
Gray Whale	-	-	-	-	55[d]	-	-	-	**55**	-
Beluga Whale (Stock not specified)	-	-	-	-	-	-	-	-	-	-
Bottlenose Dolphin (CA/OR/WA Offshore)	-	-	-	-	-	-	-	-	-	-
Common Dolphin	-	-	-	-	-	-	-	-	-	-
Pacific White-Sided Dolphin	-	-	-	-	5	-	-	-	**5**	-
Risso's Dolphin	-	-	-	-	-	-	-	-	-	-
Killer Whale (Alaska resident)	1	10	8[d]	14	28[d]	-	>5[d,g]	55[h]	**>42[d]**	**79**
Short-finned Pilot Whale	-	-	-	-	-	-	-	-	-	-
Harbor Porpoise (Stock not specified)	-	-	-	-	-	-	-	-	-	-
Dall's Porpoise	21[b]	-	20	-	31	18	8-14	-	**80-86**	**31**

Species	2019[a]		2020[a]		2021[a]		2022[a]		4-Year Total Observations by Species and Gear Type	
	Trawl	Longline	Trawl	Longline	Trawl	Longline	Trawl	Longline	Trawl	Longline
Northern Fur Seal (Stock not specified)	-	-	-	-	2	-	-	2	**2**	**2**
California Sea Lion	-	10	-	-	-	-	-	1	-	**11**
Steller Sea Lion (DPS not specified)	-	-	-	-	10[b]	1	-	1	**10**	-
Bearded Seal	-	-	-	-	-	-	-	-	-	-
Harbor Seal	-	-	-	-	-	1	-	-	-	**1**
Spotted Seal	-	-	-	-	-	-	-	-	-	-
Ringed Seal	-	-	-	-	-	-	-	-	-	-
Ribbon Seal	-	-	-	-	-	-	-	-	-	-
Northern Elephant Seal	-	-	-	-	-	-	-	-	-	-
Unidentified pinniped	1	-	-	-	-	-	-	-	**1**	-
Unidentified cetacean	14[b]	-	1	-	1	-	-	-	**16**	-
4-Year Total Observations by Gear Type	**90-96**	**25**	**37**	**26**	**184**	**40**	**>17-30**	**91**	**328-350**	**184**

[a] Source: AFSC (2020b, 2021a, 2022a); None of the observations noted in the table resulted in take under the MMPA or ESA.
[b] Move on rule implemented.
[c] Move on rule implemented during one out of eleven observations.
[d] Vessel altered course to avoid interaction.
[e] Move on rule implemented during one out of nine observations.
[f] Move on rule implemented during one out of six observations.
[g] Three encounters total; one encounter with two whales a second encounter with three whales and the third encounter described as "several" whales.
[h] During the 2021 IPHC longline survey, there were 18 encounters with killer whales. During each encounter, significant depredation was noted, including some sets described as "ineffective" due to the significant amount of depredation.

Bottom, Mid-water, and Surface Trawls

Capture or entanglement in research trawl gear may occur whenever marine mammals are swimming near the gear, either intentionally while foraging or unintentionally while migrating. Any animal captured in a net is at risk of drowning unless it can be quickly freed. Animals can also be captured or entangled in netting or tow lines. Lines wrapped around the animal or its fins can immobilize or injure it by cutting into or through blubber, muscles and bone or by constricting blood flow or severing appendages. Immobilization can cause immediate drowning or internal injuries. The animal's ability to feed may also be affected by gear entanglement (Andersen *et al.* 2008). Interaction that does not result in the immediate death of the animal by drowning can also cause serious injury (i.e., >50% chance of resulting in mortality) or non-serious injury (i.e., Level A and/or Level B harassment).

Beginning in 2024, of the 26 surveys that will be discontinued, 14 surveys use trawl gear (see Section 2.1). In addition, five trawl surveys will have a reduced level of effort. For example, beginning in 2024, the Gulf of Alaska Shelf and Slope Groundfish Bottom Trawl Survey will be reduced from 820 to 550 stations, the Gulf of Alaska Ichthyoplankton Survey will be reduced from 250 to 150 tows. In the Eastern Bering Sea Groundfish Bottom Trawl Survey, DAS will be reduced from 130 to 75 but total number of trawls remains the same at 376. Conversely, only one survey, the Aleutian Islands Bottom Trawl Survey, will increase in effort from 420 to 550 tows. Five new studies are planned using bottom, mid-water or surface trawl as described in Section 2.1 and Tables 2-1 and 2-2. Overall, AFSC anticipates fewer trawls for the future 5-year period compared to what was planned for 2019-2024.

As noted in the 2019 final rule (NMFS 2019d), AFSC has had two historical interactions with marine mammals and bottom trawling; one with a northern fur seal in 2009 and the second with a harbor seal in 2014. The survey during which the bottom trawl gear encountered a harbor seal will be discontinued.

As shown in Table 2-1, many AFSC studies employ mid-water or surface trawls. Similar to bottom trawls, marine mammals can be caught or entangled in mid-water or surface trawl lines and nets. Table 2-2 provides details on the gear, timing and location of these surveys. Since 2003, only two takes have occurred during surface trawls, both involving Dall's porpoise (NMFS 2019d). For the most recent reporting period, 2019 – October 2023, no takes with any type of trawl surveys have occurred.

As evident in Table 4-25, some marine mammal species have been observed during trawl surveys, including: humpback whales; sei or fin whales; gray whales; killer whales; Dall's porpoises; northern fur seals; Steller sea lions; and unidentified pinnipeds or cetaceans. However, implementation of mitigation measures described in Chapter 2 were successful in avoiding any adverse physical interactions with the species observed.

In consideration of historical interactions with commercial fisheries and AFSC surveys, as well as species-specific vulnerability, takes associated with trawl gear (either historic takes or the estimated takes for the 5-year period 2024-2029) are the basis for concluding a marine mammal species may experience a minor adverse effect as summarized in Table 4-23. No marine mammal populations will be adversely affected by exposure to trawl surveys used in AFSC research given the small number of mammals that could be killed relative to their populations. In addition, for the most recent reporting period since 2019, there have been no takes with marine mammals due to AFSC trawls.

Longlines and Hook and Line Surveys

Longlines are strings of baited hooks that are either anchored to the bottom (to target groundfish) or are free-floating (to target pelagic species). Marine mammals may be hooked or entangled in longline gear resulting in interactions that could cause death due to drowning, strangulation, severing of carotid arteries or the esophagus, infection, an inability to evade predators, or starvation due to an inability to catch prey (Hofmeyr *et al.* 2002). Bottom longlines pose less of a threat to marine mammals due to their deployment on the ocean bottom but can still result in entanglement in buoy lines or hooking.

Hook and line is a general term fishing methods that employ short fishing lines with hooks. This gear is similar to methods commonly used by recreational fishers using bait or lures in various ways to attract target species. This type of gear has less potential for marine mammal interaction but the use of baited hooks in the presence of marine mammals carries some risk. However, the scale of hook and line operations in relation to longline operations and the lack of extended, unattended soak times mean that use of other hook and line gear is much less likely to result in marine mammal interactions (84 FR 46788). The 2023 LOF categorizes the Alaska commercial sablefish longline fishery as Category II, characterized as having "occasional" interaction with sperm whales, Steller sea lions (both DPS) and northern elephant seals[12].

For the most recent reporting period 2019 through October 2023, the AFSC and IPHC encounters with marine mammals that resulted in mortality, serious injury or non-serious injury occurred during longline surveys, namely AFSC's sablefish longline survey in GOA/EBS/AI and IPHC's longline FISS survey in GOA. Table 4-24 summarizes takes associated with longline surveys since 2019 while Table 4-25 presents a summary of the observations of marine mammals during longline surveys that did not result in M/SI or non-serious Level A take. Details on the gear, timing, duration, and locations of AFSC and IPHC longline surveys are provided in Tables 2-1 and 2-2.

Since 2019, there have been three documented mortalities including two unidentified pinnipeds (2019 and 2021) and one killer whale (2023). Based on the observations documented in the 2019 annual report (AFSC 2020b), the pinniped mortality was most likely a sea lion which had apparently been hooked in the lower jaw. The animal was observed during gear retrieval and floated away and presumably sunk. No sightings of sea lions during setting or gear retrieval or any other time during the survey at GOA sampling stations (AFSC 2020b). Based on the 2021 annual report (AFSC 2021a), an unidentified pinniped was documented during the AFSC longline survey near Yakutat Bay (58.683 N, 140.713 W). The animal was most likely a sea lion and was observed lifeless and presumed dead. No protected species were observed during the retrieval of the first set (AFSC 2021a).

In July 2021, a vessel conducting the AFSC's Alaska Longline Survey had a direct interaction (entanglement) with a sperm whale (AFSC 2022b). The interaction resulted in a live release; the whale swam away with no visible gear wrapped around it and is assumed to have survived with no major effects. The whale was observed resting and breathing at the surface for a brief time after which it dove and was not observed further. The entire encounter lasted approximately 10 minutes. The preliminary determination was that the encounter can be considered a non-serious injury because the animal self-

[12] https://www.fisheries.noaa.gov/national/marine-mammal-protection/list-fisheries-summary-tables#table-1%C2%A0category-i; Accessed October 20, 2023.

released and all gear (hooks and line) was accounted for after the event. The onboard crew reported the entanglement to the NMFS 24-hr Alaska Marine Mammal Stranding Network Hotline and AKRO Office of Protected Resources Staff.

A post-incident review determined that mitigation measures during the study were sufficient but that the work was occurring in an area commonly used by sperm whales. It was determined that this might not be a random occurrence during these longline surveys and it is likely that entanglement of a sperm whale could happen again. Recommendations for future work in this area commonly used by sperm whales were to convert the sampling gear to pots and to participate in Southeast Alaska Sperm Whale Avoidance Project to improve fleet communication efforts to help avoid sperm whales.

The post-incident review concluded that: "This occurrence of an entanglement of one sperm whale does not alter the conclusions in Section 8.6 of the 2019 BiOp for AFSC and IPHC Fisheries and Ecosystem Research that stressors resulting from research activities would not be expected to appreciably reduce the likelihood of the survival and recovery of sperm whales in the wild by reducing the reproduction, numbers, or distribution of that species" (NMFS 2019a). The report also concluded that the event was not random and is likely to happen again in the future.

On August 4, 2021, a vessel conducting the IPHC 2021 FISS survey in Ernest Sound, Southeast Alaska, had a significant interaction (entanglement) with a humpback whale. As shown in Figure 4-1, the encounter resulted in alive release but the whale swam away with line wrapped near its dorsal fin (AFSC 2021b).

Figure 4-1. Humpback Whale Post Entanglement

Source: AFSC (2021b)

Visibility at the time of the interaction was 3.2 km and wave heights were about 2 m. There was no sign of whale activity in the morning while setting, but visibility at that time was poor. Once the crew realized that an animal had been entangled, they carefully hauled back the gear until it was about 25 m from the boat; at that time the entangled animal was identified as a humpback whale, and the crew noted that line was wrapped twice around the dorsal fin and once around the head and mouth area. The crew was unable to untangle or cut the wrapped gear from the whale. As it struggled to stay afloat and breathe. Eventually the whale snapped the gear and swam away, still entangled. During the event the IPHC Setline Coordinator was informed and attempts were made to reach the Alaska Marine Mammal Stranding Network. NOAA staff were contacted and instructed the crew to stop trying to free the whale of the remaining gear; hoping the whale would be able to free itself, or if observed to be still entangled, an entanglement team could be sent out later. An analysis of effects summarized in AFSC (2021b) concluded that mitigation measures followed during the survey were sufficient and no additional measures would have avoided the entanglement or improved the response.

The research took place in an area where humpback whales are common but the post-incident analysis concluded that the entanglement was a random occurrence and not likely to be repeated during the FISS. The post-incident report did not attempt to determine the DPS of the encountered whale. However, as based on an analysis of the occurrence of ESA-listed humpbacks off Alaska presented in NMFS (2021b), only 2% of humpback whales found in Southeast Alaska waters are likely to be from the threatened Mexico DPS; the remaining 98% are from the non-listed Hawaii DPS.

In 2023, the AFSC longline survey documented a dead killer whale with its tail wrapped in the groundline during retrieval on June 7th. The event took place in the Bering Sea (56.4616, -171.5883). The animal became entangled while apparently depredating the groundline. The groundline was cut as the crew could not safely unwrap the dead whale, and the remainder of fishing gear was hauled from the opposite end. With the whale detached from the groundline, the vessel finished hauling from the other end, however, a portion of the end of this line was collected for a possible tissue sample and genetic identification of the whale. The CS, acting as the PSO, and the vessel captain were on watch for marine mammals while setting gear. There were no whales present. While hauling gear, approximately 25 orcas (likely two pods) were observed surrounding the vessel, and depredation was evident. The survey has been experiencing heavy depredation at previous stations by what appears to be two pods of killer whales following the vessel (Pers. Comm., AFSC staff June 7, 2023; PSIT Database entry at 15:30 on June 7, 2023).

Depredation by whales, in particular killer whales and sperm whales, occurs frequently during AFSC and IPHC longline surveys. As an example of this behavior, while no takes occurred during any AFSC or IPHC surveys in 2020, depredation occurred frequently during longline surveys. Based on information in the 2020 annual report (AFSC 2021a), killer whales depredated on the longline at 17 stations; ten in the Bering Sea and seven in the GOA. Sperm whales were observed depredating on the longline at 20 stations in the GOA. In general, depredating whales stayed at least 0.25 nm away from the survey vessel and depredation occurred deep within the water column out of sight. Mitigation procedures were followed when depredation was suspected and the longline was hauled back as quickly as possible when whales were observed. There were no observations of adverse whale interactions throughout the entire survey. An unidentified sea lion was taken on the longline in the Gulf of Alaska. The incident occurred at Station 523, southeast of Kodiak Island (AFSC 2020b). Similar whale depredation events are documented in annual reports between 2019 and 2022. Considering depredation is likely to continue during future AFSC

and IPHC surveys, effects on those species known for depredating research longlines (i.e., sperm and killer whales) are considered minor adverse as summarized in Table 4-23.

In summary, interactions with marine mammals during the use of longline have been documented since 2019 as shown in Table 4-24. In three cases, mortality was evident (two unidentified pinnipeds and one killer whale) while two interactions occurred that did not result in mortality or serious injury because the whales (one sperm and one humpback whale) were released alive and swam away freely. Based on the historical interactions with commercial fisheries, AFSC and IPHC research and considering the potential overlap in research areas with marine mammals that may become entangled in longlines or hook and line gear, AFSC and IPHC research has the potential to result in minor adverse effects on those marine mammals for the period 2024-2029 as shown in Table 4-24. For many species, given the lack of historical takes due to AFSC and IPHC research, the level of requested M/SI and non-lethal (non-serious) Level A harassment takes are an overestimate. No marine mammals will experience population level effects even if exempted takes under the MMPA or ESA result in mortality. For these reasons, effects associated with potential M/SI or non-serious injury are considered minor adverse.

Gillnets and Tangle Nets

Gillnets have vertical panels of netting buoyed with floats at the top and weighted at the bottom. Fish are caught by the gills in the netting. Tangle nets are similar to gillnets but are considered to be more selective and less lethal to fish than gillnets because of smaller mesh sizes that allow fish to be caught by nose or jaw which allow fish to be resuscitated (84 FR 46788). As described for purse seines, animals can be caught in the gillnet itself or entangled in the net or lines associated with the net.

Gillnets are only used by the AFSC for the Little Port Walter Research Station and Experimental Hatchery (50 sets) and the Bristol Bay Red King Crab Settlement Survey (48 stations), both of which are deployed by small boats close to shore. Additional details on the gear, timing, duration, and locations of these surveys are provided in Table 2-1.

Commercial drift gillnet salmon fisheries in Bristol Bay and GOA are considered to be Category II, defined as having a risk of M/SI greater than 1% but less than 50% of the species' PBR (NOAA 2021). The AFSC does not use commercial drift gillnets in its fisheries research program (NMFS 2019d). However, marine mammal interactions with gillnets are well documented (Reeves et al., 2013; Lewison et al., 2014; Zollett, 2009; as cited in 81 FR 38516). Considering the documented risk to marine mammals due to gillnets, AFSC is requesting a small number of non-serious (non-lethal) Level A and M/SI takes under the MMPA. Effects due to potential interaction of some species with gillnets is considered minor adverse given there is no history of takes from gillnets used in AFSC research and even if an interaction with a gillnet were to result in a mortality, there would not be a population-level effect on any given marine mammal population listed in Table 4-23.

All Other Gear Types

As shown in Table 1-1, AFSC uses a variety of trap nets and pots to conduct research. However, there is not a reasonable potential for non-serious Level A injury or M/SI of marine mammals due to these gear types used by the AFSC (NMFS 2019d). Therefore, these gears are not considered further in this application. All other gears used in AFSC fisheries research (e.g., a variety of water sampling devices, transducers, hydrophones, towed cameras, plankton nets [including Methot trawls], CTDs, ROVs, UxS,

SCUBA, etc.) do not have the potential for marine mammal interactions and are also not considered further.

4.3.2.2.2 Physical Disturbance Due to Research

There are numerous pinniped haulouts throughout GOARA and BSAIRA where animals hauled out or in the water nearby may be disturbed by the physical presence of vessels, gear or humans in the vicinity. As described in the 2019 final rule (NMFS 2019d), physical disturbance would result in no greater than Level B harassment. Behavioral responses may be considered according to a scale based on the method developed by Mortenson (1996 as cited in NMFS (2019d)) including: 1) Alert – changing position, brief movement of head, and craning head or neck; 2) Movement – moving away from the source or retreating over the beach; and 3) Flight – all movement (flushes) into the water. NMFS considers responses corresponding to Levels 2–3 to constitute Level B harassment (NMFS 2019d).

Level B harassment of pinnipeds was estimated in the 2019 final rule based on the proximity of rookery and haulout locations to research survey stations and track lines. Analysis was limited to activities that occurred within a 5-km buffer zone from the shoreline. A 2-km zone around point data represented the extent of the vessel and survey activity around the point. For track lines such as the Alaska longline survey and the GOA acoustic trawl survey, a 0.9 km buffer around the line represented the potential interaction area. Take interactions were then tallied if the buffered line or point data from the research activities intersected within a 0.5 nm buffer zone around any identified rookery or haul-out. Level B disturbance was assumed to occur based on the number of animals expected to be present within the buffer zones close to survey locations. The number of animals was estimated based on count data for Steller sea lions and based on a density value multiplied by the buffered haulout area for harbor seals.

AFSC does not believe that any research activities will result in physical disturbance of pinnipeds other than Steller sea lions (Western DPS only) or harbor seals. Under the MMPA, Level B take estimates are likely overestimates because research may occur infrequently or be of short duration. The potential for Level B harassment under the MMPA is used as the rationale for concluding that for the pinnipeds listed in Table 4-26, disturbance effects due to the presence of vessels are considered minor because they would be temporary and not result in changes to fecundity, survival or longterm health.

Table 4-26. Total Requested Level B Takes by Physical Disturbance 2024-2029

Species	Stock	Estimated Annual Level B Disturbance Takes[1]
Harbor seals	Clarence Strait	28
	Dixon/Cape Decision	30
	Sitka/Chatham Strait	864
	Lynn Canal/Stephens Passage	45
	Glacier Bay/Icy Strait	20
	Cook Inlet/Shelikof Strait	2,554
	Prince William Sound	3,063
	South Kodiak	3,761
	North Kodiak	885
	Bristol Bay	132
	Pribilof Islands	28
	Aleutian Islands	290
Steller sea lion	Western DPS (GOARA)	3,082
	Western DPS (BSAIRA)	112

[1]Based on approach described here and in the 2019 final rule (NMFS 2019d).

4.3.2.2.3 Changes in Food Availability Due to Research Survey Removal of Prey and Discards

Section 4.3.2.1 describes the effects of AFSC and IPHC research on fish and other marine mammal prey species. In addition to the small total biomass taken (see Tables 4-19 through 4-22), research surveys tend to target smaller size classes of fish than are preferred by marine mammals. Research catches are also distributed over a wide area because of the random sampling design covering large sample areas. Fish removals by research are therefore highly localized and unlikely to affect the spatial concentrations and availability of prey for any marine mammal species. This is especially true for pinnipeds, which are opportunistic predators that consume a wide assortment of fish and squid. For these reasons it is determined that removal of prey biomass during AFSC and IPHC surveys will not change food availability and will have no effect on overall prey sources for marine mammals.

4.3.2.2.4 Effects on Marine Mammal Habitat and Critical Habitat

The 2019 PEA and associated BiOp (NMFS 2019a) identified changes in food availability due to removal of prey by research survey gear as the stressor that could result in effects on marine mammal habitat. The 2019 BiOp determined that changes in water quality and turbidity due to seafloor disturbance by research gear and contamination from discharges and unauthorized spills would not be likely to adversely affect any ESA-listed species in the action area (NMFS 2019a). As described in Chapter 3, the ESA-listed species found in the action area consume krill, copepods, and various species of fish and invertebrates. Some of these species are removed by AFSC and IPHC research activities, however the amounts of removal are quite small relative to commercial catch (see Tables 4-19 through 4-22).

Section 6.2.4 of the 2019 BiOp evaluated the effects of this removal of prey species on ESA-listed marine mammals and fish. The 2019 BiOp notes that direct competition between research activities and prey availability is unlikely for blue, fin, sei, bowhead, humpback, and sperm whales and ESA-listed fish. The small quantities of potential prey items for these species that are removed by AFSC or IPHC research activities have a negligible effect on the overall abundance and availability of their prey. The small amount numbers of cod and sculpin removed by AFSC studies in the CSBSRA and BSAIRA are unlikely to affect availability of these prey for ringed seals (NMFS 2019a). Bearded seals consume mostly benthic crustaceans and are able to switch their diet to pelagic schooling fishes when readily available. AFSC research does not target benthic invertebrates and removes even smaller amounts of these organisms than fish (NMFS 2019a). However, loss of sea ice affecting the nutrient cycle (NMFS 2019a) and collapse of crab populations also have the potential to affect food availability for seals.

However, there is overlap between AFSC/IPHC research removals of prey species for Steller sea lions, North Pacific right whales, and Cook Inlet beluga whales. The 2019 BiOp analyzed these removals under the context of effects to critical habitat and made the following conclusions:

- Cook Inlet beluga critical habitat – NMFS concluded that the reduction in prey availability due to research activities is very small, dispersed spatially and temporally, and likely to have minimal impact on critical habitat. This conclusion is still valid and is incorporated here by reference;
- North Pacific Right whale critical habitat – Species of large zooplankton are essential features of critical habitat for North Pacific right whales in areas where the whales feed. AFSC fisheries and ecosystem research surveys have very little impact on invertebrate species. While AFSC survey activities do occur in designated critical habitat for North Pacific right whales and could potentially impact benthic infauna and epifauna due to the use of bottom contact gear, pelagic zooplankton are unlikely to be affected; and
- Steller sea lions critical habitat – Steller sea lions primarily prey on Atka mackerel, Pacific cod, and walleye pollock; these species are also taken in AFSC fisheries activities (NMFS 2019a). However, the research catch represents a very small fraction of the fisheries metrics and sustainable harvest limits in these areas, and are considered minor in magnitude. The low levels of prey removal during research are dispersed over large geographic areas and not annually repeated in the same location. In addition, the footprint of each trawl action is small because research tows are very short in duration, typically 20-30 minutes at depth.

As described in Chapter 3, since the 2019 PEA was published critical habitat has been designated in feeding areas for the Western North Pacific and Mexico DPSs of humpback whales. Potential impacts on this designated critical habitat could occur due to prey removals during AFSC fisheries research that might take place within the critical habitat. Humpbacks consume roughly 50% large zooplankton, along with small pelagic and miscellaneous fish (NMFS 2019a). The 2019 PEA and BiOp concluded that direct competition between research activities and humpback whale prey availability is unlikely (NMFS 2019a). The analyses and conclusions are valid also for the newly designated humpback whale critical habitat with regards to the removal of prey PBF. Therefore, due to the nature of humpback whale critical habitat and its essential features, research activities are not likely to significantly impact critical habitat.

Critical habitat has also been designated for the Beringia DPS of bearded seals and the Arctic subspecies of ringed seals since publication of the 2019 PEA and associated BiOp. For both species PBFs to be protected include sea ice habitat and availability of prey species. Sea ice habitat would not be affected by AFSC research activities such as trawling, longlining, or benthic sampling because they do not occur during ice covered seasons or in areas with ice cover. As described in Section 6.2.3.2.1 of the 2019 BiOp, due to the nature, location, and timing of AFSC research activities, only Steller sea lions would be expected to be affected by exposure to terrestrial disturbance from the physical presence of researchers while they are hauled out.

The small quantities of fish or benthic crustaceans removed or affected by AFSC research in the BSAIRA and CSBSRA (see Section 4.3.2.1 and Tables 4-19 through 4-22) are unlikely to reduce the availability of these prey for ringed and bearded seals. As stated in the 2019 BiOp, research removals of cod and sculpin species that are prey for ringed seals are far less than 1% of the estimated biomass of these fish in the entire CSBSRA (NMFS 2019a). Bearded seals primarily consume crustaceans, which are taken in even smaller numbers by these research activities (NMFS 2019a). Therefore, the even smaller amounts of removals or disturbance to prey species that may occur in bearded and ringed seal critical habitat would not be expected to significantly impact bearded and ringed seal critical habitat.

In summary, the low level of fish and other prey removals from AFSC and IPHC research activities as well as their temporary and dispersed nature across the action area reduce the likelihood of competition for prey to all ESA-listed species and designated critical habitat so as to be considered minor adverse.

4.3.2.3 Effects on Seabirds

Section 3.2.3 describes seabird species, including those listed under the ESA, that occur in AFSC and IPHC research areas. The direct mortality from trawl and longline/setline gear and indirect effects of behavioral disturbance due to vessels and research gear and research removals of prey are analyzed in this SPEA for seabird species. Table 4-27 summarizes the potential effects of the Status Quo Alternative on ESA-listed and non-listed seabirds.

4.3.2.3.1 Mortality from Surveys

Incidental mortality of seabirds by hooking/capture during AFSC research activities using longlines or trawls has been documented (see Table 4-27). According to the AFSC protected species annual reports (AFSC 2020b, 2021a, 2022a, 2023) and entries in the PSIT database, IPHC research activities have not caused incidental mortality to any seabirds over the period 2016-2023.

According to the PSIT reports and AFSC's annual prohibited species reports (AFSC 2020b, 2021a, 2022a, 2023) all seabird mortalities shown in Table 4-27 occurred during the GOA/EBS/Aleutian Islands Longline Survey. This survey is conducted annually each summer. Under the Status Quo Alternative, 75 stations with 160 sets are rotated between the GOARA and BSAIRA each year for this study (see Table 2-1). The two Steller's eiders were encountered during a Northern Bering Sea Ecosystem Surface Trawl Survey in 2021; the encounter was non-lethal (see Section 4.3.2.3.3). This survey is conducted annually every fall and under the Status Quo Alternative employs surface trawls and bongo nets (see Table 2-1).

As shown in Table 4-28, black-footed albatross are the most frequently recorded bird species caught in AFSC research gear, along with small numbers of Laysan albatross. Northern fulmars and common

murres are also caught but are not officially reported by AFSC. The level of mortality from AFSC research interactions for all non-ESA-listed species is expected minor compared to their estimated population numbers (NMFS 2019c).

Black-footed and Laysan albatross are considered to be Birds of Conservation Concern in Alaska. Both of these species are more abundant than the short-tailed albatross (see Section 4.3.2.3.2 for impacts on short-tailed albatross), and the Black-footed and Laysan albatross are not listed under the ESA. However, they have been used to determine the effectiveness of the mitigation measures put in place in the fishing industry to reduce impacts to seabirds overall.

Table 4-27. Summary of Potential Impacts of the Status Quo Alternative on Seabirds

Species	Potential Impact of the Status Quo Alternative			Discussion
	Injury or Mortality from Surveys	Behavior Modification	Changes in Prey Availability	
ESA-Listed Species				
Short-tailed Albatross	Minor adverse	Minor adverse	No effect	AFSC and IPHC have no documented historical takes of this species during research operations. However, the research does take Laysan and black-footed albatross (Table 4-28), which can be considered a proxy for short-tailed albatross takes. Many short-tailed albatross are observed during research efforts (Table 4-29), so a take of this species is possible and effects would be minor adverse. Short-tailed albatross molt in shallow passes around the Aleutian Islands in summer and may be subjected to behavioral disturbance from research vessels; mitigation measures will reduce the severity of this impact. As described in Section 4.3.2.3.4, prey removals due to research would not have an effect on short-tailed albatross. Critical habitat has not been designated for short-tailed albatross.
Steller's Eider	Minor adverse	Minor adverse	No effect	Although over the period 2016-2022, AFSC research activities have only documented two non-lethal encounters with Steller's eiders, it is possible that eiders could be taken by encounters with research vessels or gear. Therefore, impacts of fisheries research on mortality of this species would be minor adverse. Steller's eiders breed near research activities in the CSBSRA and spend their non-breeding time around the Aleutian Islands and Kodiak Island and may be subjected to behavioral disturbance from research vessels; mitigation measures will reduce the severity of this impact. Designated critical habitat in the Y-K Delta and Nelson and Izembek lagoons would not be affected by AFSC research activities. As described in Section 4.3.2.3.4, prey removals due to research would not have an effect on Steller's eiders.

Species	Potential Impact of the Status Quo Alternative			Discussion
	Injury or Mortality from Surveys	Behavior Modification	Changes in Prey Availability	
Spectacled Eider	Minor adverse	Minor adverse	No effect	Although AFSC and IPHC research has not documented any encounters with this species, other non-affiliated research and commercial fishing vessels have taken numerous spectacled eiders. Therefore, takes by AFSC or IPHC research are possible and mortality due to surveys is considered to be minor adverse for the species. Spectacled eiders breed in coastal areas of the BSAIRA and CSBSRA and may be subjected to behavioral disturbance from research vessels; mitigation measures will reduce the severity of this impact. Designated critical habitat in Ledyard Bay and Norton Sound would not be affected. As described in Section 4.3.2.3.4, prey removals due to research would not have an effect on spectacled eiders.
Marbled Murrelet (CA/OR/WA Population)	Minor adverse	Minor adverse	No effect	Marbled murrelets can become entangled in longline gear such as the setlines used by IPHC during FISS projects. IPHC occupies stations within Puget Sound and within coastal areas where individuals from the ESA-listed populations could be encountered. As described in Sections 4.3.2.3.2 and 4.3.2.3.3, behavior modifications are anticipated to be minor adverse and there would be no effect anticipated from IPHC studies on marbled murrelet prey availability. Upland critical habit in Puget sound and other coastal areas would not be affected.
Non ESA-Listed Species				
Seabirds that Regularly Occur in AFSC and IPHC Research Areas	Minor adverse	Minor adverse	No effect	As described in Section 4.3.2.3.1, black-footed albatross are frequently caught in AFSC research activities and takes of small numbers of Laysan albatross and northern fulmars and common murres have also been documented. However, the level of mortality is minor compared to their population numbers. As described in Section 4.3.2.2, behavioral disturbance could occur to these species due to researcher vessel and the presence of researchers but effects would be mitigated. As described in Section 4.3.2.3.2, prey removals due to research would not have an effect on these species.

Species	Potential Impact of the Status Quo Alternative			Discussion
	Injury or Mortality from Surveys	Behavior Modification	Changes in Prey Availability	
Species that Spend at Least Part of the Year in Alaskan Marine Waters	Minor adverse	Minor adverse	No effect	AFSC and IPHC researchers have not documented encounters with any of the species shown in Table 3-8. An occasional lethal take of these species might occur during research activities but the level of mortality would be considered minor compared to their population numbers. As described in Section 4.3.2.2, behavioral disturbance could occur to these species when they are in the project area but effects would be mitigated. As described in Section 4.3.2.3.2, prey removals due to research would not have an effect on these species.

Table 4-28. Documented AFSC Seabird Encounters, 2016-2023

Species	Recorded Encounters[1]							
	2016	2017	2018	2019	2020	2021	2022	2023[2]
Black-footed albatross[3]	4	4	6	1	10	9	4	1
Laysan albatross[3]	4	0	0	0	0	1	1	1
Steller's eider[4]	0	0	0	0	0	2	0	0

[1]Source: PSIT Database received July 2023.
[2]Data through July 5, 2023.
[3]All recorded albatross encounters were lethal.
[4]Both Steller's eiders were released alive and uninjured.

4.3.2.3.2 Behavior Modification

Behavioral modifications due to vessel and researcher presence during AFSC and IPHC can result in displacement of birds and disruption of feeding and resting activities. Behavior modifications may not result directly in injury or mortality but can cause reduced fitness through energy expenditure and decreased ability to forage (USFWS 2022). Dehnhard *et al.* (2020) found that common eiders were displaced when small boats approached within 771 m and the birds initiated flight when the boats came within 177 m. However, if the disturbance is brief it may not have a direct adverse effect on the birds (USFWS 2022). However, longer, more frequent disturbance or disruptions to birds that are congregating could cause the birds to: increase their energetic expenditures; be displaced from optimal feeding areas; be injured; or suffer mortality. This is especially true for times when the birds are vulnerable such as when feeding, wintering, molting, or when there are dependent young nearby.

The AFCS has established standard methods to avoid Interactions with protected species (see Section 2.3). By following these measures, impacts to seabirds due to disturbance by research vessels and the presence of researchers under the Status Quo Alternative is expected to be a minor adverse effect.

4.3.2.3.3 Changes in Prey Availability

Many seabird species are opportunistic feeders and would not be affected by the small removals of prey species due to AFSC research activities. Section 4.3.2.1.2 analyzes the effects of AFSC and IPHC research activities on prohibited species that include two potential seabird prey species: Pacific herring and capelin. Table 4-20 shows the AFSC research catch of these prey species over the period 2016-2022. Removals of capelin (less than 70 kg per year on average), and herring (less than 4 mt per year on average) are low compared to the expected biomass of these species and research removals would have only a minor adverse effect on the fish species themselves, and therefore, would not affect their overall availability as prey to seabirds. In addition, AFSC trawling efforts would impact a total of about 122 km^2 of benthic habitat under the Status Quo Alternative (see Section 4.3.1.1). However, this is only a very small percentage of the overall available benthic habitat and research would not affect benthic crustaceans and mollusks at levels that would affect their availability as prey for seabirds.

4.3.2.3.4 Effects on ESA-Listed Seabirds and Critical Habitat

Short-Tailed Albatross

Under the Status Quo Alternative, studies conducted by AFSC using trawls and by IPHC using setlines during the FISS surveys could impact short-tailed albatross. However, to date both AFSC and IPHC have had zero historical takes of this species (USFWS 2022). While IPHC and AFSC researchers have recorded many observations of short-tailed albatross (Table 4-29), they have not recorded any lethal or non-lethal takes of these birds. However, researchers have documented lethal takes of Laysan and black-footed albatross (see Table 4-28); these two species are more abundant in the research areas than the short-tailed albatross and are often considered to be a proxy for estimating harm to short-tailed albatross. As the population of short-tailed albatross increases, the likelihood of death or injury to short-tailed albatross from encounters with AFSC and IPHC research gear may also increase, even if research efforts do not increase or otherwise change.

Therefore, to be precautionary the 2022 BiOp (USFWS 2022) determined a 10-year average take of one short-tailed albatross via longline or trawl cable interaction, and concluded that hook-and-line fishery research would result in a relatively low probability of injury or mortality to short-tailed albatross. This is not expected to change under the Status Quo Alternative described in this SPEA. In addition, as shown in Table 2-3, mitigation measures to protect seabirds during trawl and longline surveys will be followed. Therefore, the impacts of AFSC and IPHC research under the Status Quo Alternative mortality of on short-tailed albatross are expected to be minor adverse.

Short-tailed albatross molt in shallow passes around the Aleutian Islands in summer (USFWS 2022). During their extended molt they could be susceptible to behavioral disturbance (see Section 4.3.3.2). However, mitigation measures are in place to protect these birds and effects of the Status Quo Alternative due to behavioral modifications are expected to be minor adverse.

The diet of short-tailed albatross includes squid, shrimp, fish such as bonitos, flying fishes, sardines, flying fish eggs, and crustaceans (USFWS 2022). AFSC and IPHC research activities are not expected to affect the availability of prey for short-tailed albatross.

As described in section 3.2.3.1.1, critical habitat has not been designated for short-tailed albatross.

Table 4-29. Short-tailed Albatross Observations During AFSC AND IPHC Surveys 2019-2022

Year	Survey Name	No. of Birds Observed	Distance From Vessel (m)	Description
2019	IPHC FISS	9	2-75	Several birds observed feeding on discarded bait, guts, or bycatch near boat.
	TOTAL	**9**		
2020	Gulf of Alaska Shelikof/Shumagin/Sanak/ Bogoslof Walleye Pollock Acoustic Trawl Survey Winter	1	25	Observed after trawl retrieved on deck and secured.
	IPHC FISS	11	5-150	One bird approached vessel at end of set. Others observed while retrieving "seacat". They stayed in the area for entire haul and were no closer than 150 m to vessel.
	TOTAL	**12**		
2021	Gulf of Alaska Biennial Walleye Pollock Acoustic Trawl Survey Summer	2	100	Scientist spotted one bird sitting on water near codend as net was being set. Saw again when retrieving net. Bird did not interact with net. Second bird spotted sitting on water near where CTD was deployed.
	Gulf of Alaska Shelf and Slope Groundfish Bottom Trawl Survey	2	100-300	Flying around vicinity of station. No feeding behavior or direct interaction. Feeding on previously discarded catch at end of tow.
	IPHC FISS	55	5-50	All noted as "significant observations"
	TOTAL	**59**		
2022	Eastern Bering Sea Walleye Pollock Acoustic Trawl Survey Summer	2	20-100	Bird seen flying around codend upon retrieval. No interaction. During haulback a short-tailed albatross landed on the water near the floating codend. ID was clear due to its large size and pink bill. It flew back and forth between ~20m off the stern of the ship and the area around the codend while hauling back.
	IPHC FISS	140	5-150	Juveniles, immatures, subadults and adults all were observed. Some were observed to be following the boat. One had a silver metal band on left foot. Several were observed feeding off of discards.
	TOTAL	**142**		

Source: AFSC (2020b, 2021a, 2022a, 2023).

Steller's Eider

Since 2016, AFSC research vessels have had only one interaction with ESA-listed Steller's eiders (see Table 4-28). On September 12, 2021, during the AFSC Northern Bering Sea Ecosystem Surface Trawl survey, two Steller's eiders were observed overnight on the deck of a trawler chartered for research. One

eider left the vessel during the night (it is assumed) and the remaining eider was released at sunrise. There were no known mortalities (email dated October 7, 2021 from S. Fitzgerald of NMFS). There have been no documented encounters of IPHC research vessels and Steller's eiders.

Even though 1) mitigation measures are in place, 2) there is minimal spatial overlap of Steller's eiders with research activities, and 3) the duration, extent and magnitude of research surveys are much lower than commercial fishing efforts (which have had documented lethal takes of Steller's eiders), it is possible that Steller's eiders could be taken by vessel strikes or interactions with gear during AFSC and IPHC surveys. Therefore, AFSC and IPHC research efforts would have a minor adverse effect on mortality of this species.

Steller's eiders breed near research activities in the CSBSRA and spend their non-breeding time around the Aleutian Islands and Kodiak Island[13], where their behavior may be affected by the presence of vessels and researchers. As described in Section 4.3.2.3.2, eiders exhibited displacement behaviors when approached by small boats. However, mitigation measures (see Section 2.3) will be employed to reduce disturbance and effects would be minor adverse under the Status Quo Alterative.

Steller's eiders are generalists that prey on a wide variety of invertebrates, bivalves, herring eggs, and even algae. AFSC and IPHC research activities are not expected to affect the availability of prey for Steller's eiders.

AFSC research in the BSAIRA occurs well offshore of designated Steller's eider critical habitat in the Y-K Delta and Nelson and Izembek lagoons in the Aleutians (see Section 3.2.1.1). Regardless of the boundaries of the critical habitat units, all waters greater than 9 m deep are not considered to be critical habitat for this species. Therefore, AFSC research activities are not expected to directly affect this designated critical habitat.

Spectacled Eider

AFSC and IPHC research activities have not documented any encounters with spectacled eiders. However, on October 19, 2020, at least 12 spectacled eiders collided with a federally funded Distributed Biological Observatory (DBO) research cruise in Alaska, with only one eider apparently surviving (USFWS 2021a). The takes occurred during calm seas, at night while the vessel was in a shipping lane in Bering Strait. While this was not an AFSC-affiliated research activity, USFWS (2022) analyzed the potential for similar encounters with AFSC research vessels and estimated an incidental take of 12 spectacled eiders over a two year period. This is not anticipated to change under the Status Quo Alternative and impacts on spectacled eiders due to mortality from surveys are considered to be minor adverse.

Spectacled eiders are benthivorous sea ducks that primarily feed on bottom dwelling bivalve mollusks and crustaceans (USFWS 2022). As described in Section 4.3.2.3.3, AFSC research trawling efforts would have no effect on the availability of benthic prey items to spectacled eiders.

Spectacled eiders breed in coastal areas of the BSAIRA and CSBSRA[14], where their behavior may be affected by the presence of vessels and researchers. As described in Section 4.3.2.3.2, eiders exhibited

[13] https://www.allaboutbirds.org/guide/Stellers_Eider/maps-range#, Accessed October 19, 2023.
[14] https://www.allaboutbirds.org/guide/Spectacled_Eider/maps-range Accessed October 19, 2023.

displacement behaviors when approached by small boats. However, mitigation measures (see Section 2.3) will be employed to reduce disturbance and effects would be minor adverse under the Status Quo Alterative.

AFSC conducts research in Ledyard Bay and Norton Sound areas that may occur immediately offshore of critical habitat areas designated for spectacled eiders. AFSC research activities are not expected to affect onshore breeding, molting and staging critical habitat areas for spectacled eiders.

Marbled Murrelet

Marbled Murrelets breed and forage in coastal areas of the GOARA and Washington and Oregon and northern California[15], where they may overlap with AFSC and IPHC research activities. As described in Section 3.2.3.1, only the CA/OR/WA population is listed as threatened under the ESA. This species breeds in upland forested areas and individuals can be found year-round in coastal areas. While research conducted by IPHC in coastal Washington, Oregon or northern California waters would not affect their upland breeding areas or critical habitat (see Section 3.2.3.1.1), the research does have the potential to encounter non-breeding marbled murrelets from this this population.

As described in USFWS (2017b) marbled murrelets can become entangled in longline gear such as the setlines used by IPHC during FISS projects. As shown in Figure 1-2, IPHC occupies stations within Puget Sound and within coastal areas of Washington, Oregon and northern California, where they may encounter foraging marbled murrelets. However, even if marbled murrelets are present in the general vicinity of research activities using setlines, aggregations of other, larger birds congregating around longlining activity would likely deter marbled murrelets from approaching the research gear; marbled murrelets are not expected to be close enough to the setline fishing gear to risk contact resulting in substantial levels of mortality (USFWS 2017b), and mitigation measures shown in Table 2-3 would further reduce the possibility of impacts to marbled murrelets. Therefore, the effect of the Status Quo Alternative on mortality of these birds would be minor adverse. As described in Sections 4.3.2.3.2 and 4.3.2.3.3, behavior modifications are anticipated to be minor adverse and there would be no effect anticipated from IPHC studies on marbled murrelet prey availability.

4.3.2.4 Effects on Sea Turtles

AFSC research could affect turtles though entanglement in gear causing mortality or serious injuries, and/or effects on prey. As described in the 2019 PEA (NMFS 2019c), sea turtles, in particular leatherback sea turtles, may occasionally be found near Puget Sound and at the mouth of the Columbia River where IPHC activities occur. There is potential for sea turtle to suffer mortality due to entanglement in IPHC setlines off the coasts of Washington, Oregon, and California.

Available information on sea turtle hearing suggests that their underwater hearing capabilities are limited in functional hearing bandwidth and in absolute hearing sensitivity. Turtles have been shown to respond to low frequency sound. Data suggest that sea turtle hearing is functionally sensitive between about 100 Hz and 1.2 kHz (Ketten and Bartol 2006, Dow Piniak *et al.* 2012), which is well below the frequencies of acoustic instruments used in fisheries research (18-133 kHz). The higher frequency sounds are unlikely to be audible to sea turtles and therefore unlikely to have any effects. In addition, as described in Section

[15] https://www.allaboutbirds.org/guide/marbled_murrelet, Accessed October 19, 2023

4.2, the narrow, highly directional band width of acoustic devices used by AFSC researchers further limits the distance of effects, similar to marine mammals (see Section 4.3.2.2). Impacts from acoustic devises used by AFSC would not be expected and are not discussed further.

Table 4-30 summaries the potential effects of AFSC research on sea turtles due to mortality from entanglement in gear and/or collisions with vessels.

Table 4-30. Summary of Potential Impacts of the Status Quo Alternative on ESA-Listed Sea Turtles

ESA-Listed Species	Mortality from Surveys	Discussion
Leatherback Sea Turtle	Minor adverse	While expected to be rare, encounters with IPHC setline gear causing potential injury or mortality to these species are possible.
Olive Ridley Sea Turtle	Minor adverse	
Green Sea Turtle	Minor adverse	
Loggerhead Sea Turtle	Minor adverse	

AFSC and IPHC research activities have has no history of interactions with sea turtles. The 2019 BiOp (NMFS 2019a) concluded that "*Because sea turtles occur in the Gulf of Alaska only rarely (less than one detected occurrence per year since 1960), we do not expect individual sea turtles to co-occur with AFSC or IPHC research activities in Alaska. Therefore, it is extremely unlikely that sea turtles would be exposed to stressors caused by these research programs in Alaska".* However, because a number of IPHC setline surveys under the FISS program take place in Puget Sound, near the mouth of the Columbia River, and at other locations along the Washington, Oregon and California coasts (see Figure 1-2), there is a slight potential for these studies to encounter or entangle a sea turtle. The risk is low, and the overall effect of the Status Quo Alternative on sea turtle mortality would be minor adverse.

West coast critical habitat for leatherback sea turtles was designated in 2012 (see Section 3.2.4 and Figure 3-14). Designated critical habitat for leatherback sea turtles consists of two sections of marine habitat where leatherbacks are known to feed on jellyfish, and potentially overlap with IPHC activities near the mouth of the Columbia River. As described in the 2019 BiOp, removals of turtle prey species such as jellyfish during IPHC research off of the coasts of Washington and Orgon is not expected. Therefore, the only potential effect of AFSC research on sea turtles would be due to injury or mortality from encountering research gear, and there would be no effect on leatherback designated critical habitat under the Status Quo Alternative.

4.3.2.5 Effects on Invertebrates

AFSC trawling efforts and IPHC FISS studies using setlines in the GOARA and BSAIRA under the Status Quo Alternative have the potential to affect invertebrate species in these regions though direct mortality. Table 4-31 summarizes the potential impact of the Status Quo Alternative on the ESA-Candidate sunflower star and other commercially important invertebrates (see Table 3-10).

Table 4-31. Summary of Potential Impacts of the Status Quo Alternative on ESA-Candidate and Commercially Important Invertebrates

Species	Mortality from Surveys	Discussion
ESA-Candidate Species		
Sunflower sea star	No effect	No catches of sunflower sea stars in ASC or IPHC research have been documented over the period 2016-2022 (see Tables 4-32 and 4-33).
Commercially Important Species		
Alaskan pink shrimp	Minor adverse	As shown in Table 4-32, pink shrimp are caught in AFSC trawling efforts. Catches are all less than 0.5 mt and effects on the species can be considered minor.
Coonstripe shrimp	No effect	No catches of Coonstripe shrimp in AFSC or IPHC research have been documented over the period 2016-2022 (see Tables 4-32 and 4-33).
Sidestriped shrimp	Minor adverse	As shown in Table 4-32, pink shrimp are caught in AFSC trawling efforts. Catches are all less than 0.5 mt and effects on the species can be considered minor.
Spot shrimp	No effect	As shown in Table 4-32, spot shrimp are very rarely captured in AFSC trawling efforts. Research trawling would be expected to have no effect on populations of this species in the GOARA and BSAIRA.
Geoduck clam	No effect	No research catches have been documented over the period 2016-2022 (see Tables 4-32 and 4-33).
Littleneck clam	No effect	No research catches have been documented over the period 2016-2022 (see Tables 4-32 and 4-33).
Razor clam	No effect	No research catches have been documented over the period 2016-2022 (see Tables 4-32 and 4-33).
Giant octopus	Minor adverse	As shown in Table 4-32 and 4-33, giant octopus are caught in AFSC and IPHC research efforts. Catches are minimal effects on the species can be considered minor.
Magistrate armhook squid	Minor adverse	As shown in Table 4-32, this species is caught in AFSC trawling efforts. Catches are all less than 1 mt and effects on the species can be considered minor.
Weathervane scallop	Minor adverse	As shown in Table 4-32, this species is caught in AFSC trawling efforts. Catches are all less than 0.5 mt and effects on the species can be considered minor.
Green sea urchin	Minor adverse	As shown in Tables 4-32 and 4-33, this species is caught in AFSC trawling efforts, and sea urchins (not differentiate) are caught in IPHC research. Catches are all less than 5 mt and effects on the species can be considered minor.
Red sea urchin	No effect	As shown in Table 4-32, this species is very rarely captured in AFSC trawling efforts. Research trawling would be expected to have no effect on populations of this species in the GOARA and BSAIRA.
Red sea cucumber	Minor adverse	As shown in Tables 4-32 and 4-33, this species is caught in AFSC trawling efforts, and in IPHC research. Catches are minimal and effects on the species can be considered minor.
Blue king crab	Minor adverse	As shown in Table 4-32, this species is caught in AFSC trawling efforts. Catches are all less than 0.1 mt and effects on the species can be considered minor.
Dungeness crab	Minor adverse	As shown in Table 4-32, this species is caught in AFSC trawling efforts. Catches are all less than 0.3 mt and effects on the species can be considered minor.
Golden king crab	Minor adverse	As shown in Tables 4-32 and 4-33, this species is caught in AFSC trawling efforts, and in IPHC research. Catches from trawling are less than 1 mt per year and only 5 golden king crabs have been caught (all

Species	Mortality from Surveys	Discussion
		in 2021) by IPHC setlines. Effects on the species can be considered minor.
Grooved tanner crab	Minor adverse	As shown in Table 4-32, this species is caught in AFSC trawling efforts. Catches are all less than 0.4 mt and have not occurred since 2017. Effects on the species can be considered minor.
Red king crab	Moderate adverse	As shown in Tables 4-32 and 4-33, this species is caught in AFSC trawling efforts, and in IPHC research. Catches from trawling and setlines are variable up to nearly 9 mt and 25 crab counted, respectively in 2016 and have dropped off, likely as the population has been reduced. Given the reduction in population and recent closures of commercial fishing for this species, effects on this species can be considered moderate.
Scarlet king crab	No effect	As shown in Table 4-32, this species is very rarely captured in AFSC trawling efforts. Research trawling would be expected to have no effect on populations of this species in the GOARA and BSAIRA.
Snow crab	Moderate adverse	As shown in Tables 4-32, this species is caught in AFSC trawling efforts. Catches from trawling and setlines are ranging from 0 to ~29 mt over 2016-2022. Even as the population has been reduced, catches during AFSC trawling reached nearly 10 mt. Given the recent die off of these crabs (see Section 3.2.5.2.2) and the recent (2023/24) closures of commercial fishing for this species, effects of research can be considered moderate.
Southern tanner crab	Moderate adverse	As shown in Tables 4-32 and 4-33, this species is caught in AFSC trawling efforts, and in IPHC research. Catches from trawling and setlines are variable up to nearly 3.5 mt and 20 crab counted, respectively in 2016. As described in Section 3.2.5.2.3, increases in the EBS population have been seen and the fishery was open for targeted fishing for the 2022/23 season. However, because mature and immature biomass levels remain low, effects on this species can be considered moderate.
Triangle tanner crab	No effect	This species has not been taken in AFSC research trawls since 2016 when under 1.5 mt was recorded. Effects of research removals on the population are not expected.

Tables 4-32 and 4-33 summarize the invertebrate catch during AFSC trawling efforts (reported in mt) and in IPHC FISS efforts (catch reported as count) over the period 2016-2022. Species with catches over 1 mt in the AFSC are shaded in Table 4-32. Subsections below the tables describe the potential impacts on invertebrate species in more detail.

Table 4-32. Invertebrate Species Caught during AFSC Trawling Efforts 2016-2022

Species[2]	Total Bottom Trawl Catch/Year (mt)[1]								
	2016	2017		2018	2019		2021		2022
	BSAIRA	GOARA	BSAIRA	BSAIRA	GOARA	BSAIRA	GOARA	BSAIRA	BSAIRA
Alaskan pink shrimp	0.22	0.19	0.17	0.14	0.26	0.10	0.20	0.17	0.16
Sidestriped shrimp	0.03	0.11	0.00	0.00	0.19	0.00	0.16	0.00	0.01
Spot shrimp	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00
Giant octopus	0.90	0.04	0.06	0.48	0.64	0.22	0.05	0.19	0.45
Magistrate armhook squid	1.36	0.13	0.00	0.39	0.21	0.00	0.36	0.00	0.75
Weathervane scallop	0.02	0.01	0.04	0.10	0.02	0.07	0.01	0.38	0.32
Green sea urchin	1.27	0.01	3.68	2.49	0.01	3.19	0.00	0.89	4.68
Red sea urchin	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
Red sea cucumber	0.00	0.02	0.00	0.00	0.07	0.00	0.11	0.00	0.00
Blue king crab	0.19	0.00	0.27	0.18	0.00	0.29	0.00	0.21	0.25
Dungeness crab	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.07	0.01
Golden king crab	0.87	0.01	0.00	0.81	0.01	0.00	0.04	0.00	0.16
Grooved tanner crab	0.37	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Red king crab	8.80	0.02	2.88	1.18	0.04	3.31	0.03	1.72	1.79
Scarlet king crab	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Snow crab	8.94	0.00	21.10	28.80	0.00	21.67	0.00	6.80	9.61
Southern tanner crab	3.35	0.17	2.78	2.44	0.35	1.52	0.23	1.88	1.47
Triangle tanner crab	1.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Source: AFSC October 2023.
[1]The large bottom trawl studies that take the most invertebrates are only conducted biennially in the GOARA and were not conducted in 2016, 2018, 2020 or 2022. No bottom trawling was conducted in 2020 in either region. No invertebrates were caught in the CSBSRA over the 7-year period.
[2]Only species with any recorded catch over the 7-year period are shown. Shading highlights species with catch over 1 mt in at least one year.

Table 4-33. Invertebrate Species Caught During IPHC FISS Efforts 2016-2022

Species[1]	Total FISS Catch/Year (count)													
	2016		2017		2018		2019		2020		2021		2022	
	GOAR A	BSAIR A	GOAR A	BSAIR A	GOAR A	BSAIR A	GOAR A	BSAIR A	GOAR A	BSAIR A	GOAR A	BSAIR A	GOAR A	BSAIR A
Giant octopus	10	10	20	36	16	5	110	15	5	0	15	0	5	0
Octopus (unidentified)	100	90	2	20	44	30	240	10	30	0	10	30	10	25
Scallop	52	0	13	0	32	45	189	5	55	0	0	0	19	10
Sea Urchin	35	70	32	65	42	25	35	0	35	0	75	0	76	5
Sea cucumber	35	70	32	65	42	25	35	0	35	0	75	0	76	5
Golden king crab	0	0	0	0	0	0	0	0	0	0	0	5	0	0
Red king crab	25	0	10	0	6	0	10	0	0	0	5	0	0	0
Tanner crab	0	20	0	0	10	0	10	0	10	0	5	0	0	0

Source: AFSC October 2023.
[1]Only species with any recorded catch over the 7-year period are shown.

4.3.2.5.1 ESA-Candidate Species

There are no ESA-listed invertebrates in AFSC and IPHC research areas in Alaska. However, as described in Section 3.2.5.1, the sunflower sea star has been proposed for as threatened throughout its entire range. The listing has not been finalized as of October 2023. No sea stars have been taken in AFSC or IPHC research activities in Alaska over the period 2016-2022 (see Tables 4-32 and 4-33). Effects on this candidate species under the Status Quo Alternative are not expected.

4.3.2.5.2 Commercially Important Species

As shown in Table 4-31, for the majority of commercially important invertebrates, effects of AFSC and IPHC research activities under the Status Quo Alternative will have either no effect, or minor adverse effects. However, for red king crabs, snow crabs, and southern tanner crabs impacts of research removals on these already diminished populations would be moderate adverse. Section 3.2.5.2.1 through 3.2.5.2.3 discuss the current population and commercial fishery closures for these species that support the basis for this conclusion.

4.3.3 Effects on the Social and Economic Environment

Major factors that could be influenced by the AFSC research program under the Status Quo Alternative include:

- Collection of scientific data used in sustainable fisheries management;
- Economic support for fishing communities;
- Collaborations between the fishing industry and fisheries research; and
- Fulfillment of legal obligations specified by laws and treaties.

To assess the effects of AFSC research on socioeconomics in these areas, this SPEA relies on information from the commercial and recreational fisheries to provide a general sense of revenues and economic impact. NMFS's report titled *'The Fisheries Economics of the United States'* (NMFS 2023b) provides information on commercial market conditions, total tonnage of commercial fish landed and revenue by region and state, recreational fishing expenditures and levels of participation by region and state, key species, and community profiles which has been summarized in Section 3.3 of this SPEA.

Annual expenditures of the AFSC for fisheries and ecosystem research have ranged from $80 - 96 million for fisheries and ecosystem research over the 2019-2023 period (AFSC Operations Management and Information Staff pers. comm. 2023). This funding is used to support field surveys, data collection and analysis, permitting, reporting and other administrative functions. Through direct expenditures on fisheries and ecosystem research, AFSC contributes to the communities and ports in Alaska (see Section 3.3.2). While the contribution of research-related employment and purchased services is beneficial on an individual basis, the total contribution of research is very small when compared to the value of commercial and recreational fisheries in the communities. Fisheries research is considered a minor beneficial effect to the economic status of communities within the research areas.

4.3.3.1 Collection of Scientific Data Used in Sustainable Fisheries Management

Stock assessments in the GOARA, BSAIRA and CSBSRA rely on the data collected from longterm standardized resource surveys conducted by NOAA fishery research vessels. Fishery managers use the extended time-series of data to identify trends and to inform fisheries management decision-making. This information is essential for establishing annual species-specific sustainable harvest limits. Harvest limits that are set too high may lead to overfishing of specific stocks and more restrictive management measures in the future to rebuild those stocks. Harvest limits that are set too low do not allow a maximum sustainable harvest that benefits commercial and recreational fisheries and the communities and services that support them. In addition, the predictability and reliability of longterm data sets and the harvest limits they support is essential for economic stability in the fisheries over time.

4.3.3.2 Economic Influence of Research

As described in Section 3.3.1, the AFSC has spent approximately $80 - 96 million in annual operations costs over the past five years. These funds provide both primary and secondary economic influences on the communities and ports in the region. These funds are distributed among the five AFSC research stations within the AFSC Action Area. The operating budget directly supports employees and operations of facilities at these locations. Funds are spent annually on collecting data at sea over a geographic area extending from the CSBSRA to GOARA and select areas offshore of Washington and Oregon. Funds are expended for ship and aircraft time, equipment and logistics, contracts, crew wages, and taxes and fees. NOAA-owned ships, charters, and leased research vessels operate from several home ports, and are serviced in many others. Some commercial fishing operations are compensated for participation in cooperative research projects through grants or shares in fishing quotas that they sell on the market.

4.3.3.3 Collaborations Between the Fishing Industry and Fisheries Management

Cooperative research is an important element in establishing communication, trust, and information exchanges between scientists, fisheries managers, and the fishing industry. Cooperative research is used

to: a) increase the precision and expand the scope of resource surveys; b) provide supplemental information about fishing operations; c) incorporate fishing expertise into the design and implementation of research; and d) build mutual understanding and respect among scientists and people in the fishing industry. Collaboration in the development of new gear and techniques encourages participation in developing sustainable fishing practices and contributes to a broader understanding of management for marine resources.

4.3.3.4 Fulfillment of Obligations to Communities Specified by Laws and Treaties

A list of applicable laws, and actions taken to date to fulfill those laws, is provided in Table 1-1. Chapter 6 of the 2019 PEA (NMFS 2019c) describes each law in detail. These obligations include the 1996 amendment to the MSA, which requires assessment, specification, and description of the effects of conservation and management measures on participants in fisheries, and on fishing communities (NMFS 2007a); and EO 12898 on environmental justice, which directs agencies to assess actions that may disproportionately affect low income and minority populations. The fisheries research programs conducted by AFSC and IPHC help fulfill these obligations.

4.3.3.5 Summary of Effects on the Social and Economic Environment

The Status Quo Alternative would contribute important scientific information for sustainable fisheries management of the valuable commercial and recreational fisheries in Alaskan waters. These contributions benefit commercial and recreational fisheries and the communities that support them. The fishing industry generates billions of dollars' worth of sales, thousands of commercial fishing-related jobs, and provides millions of people across the country with highly valued seafood. Recreational fishers also participate and support fishing service industries (see Section 3.3). Direct employment, purchase of fuel, vessel charters, and supplies for AFSC fisheries research would also result in minor benefits to fishing communities along the coast. AFSC fisheries research also builds trust and encourages cooperation between the fishing industry and NMFS scientists and fisheries managers. For these reasons, the overall effects of AFSC-affiliated research under the Status Quo Alternative is considered to have longterm, minor to moderately beneficial effects on social and economic resources.

4.4 Direct and Indirect Effects of Preferred Alternative

As described in Chapter 2 and shown in Tables 2-1 and 2-2, the Preferred Alternative includes the studies described under the Status Quo Alternative, with the discontinuation of certain projects and gear, addition of several new projects, and modifications to existing projects.

4.4.1 Effects on the Physical Environment

The effects of the Preferred Alternative on benthic habitat would be similar to or fewer than those described for the Status Quo Alternative (see Section 4.3.1.1 and Table 4-4). Under the Preferred Alternative of this SPEA, 12 surveys conducting a total of 980 bottom trawl tows would be discontinued (see Section 2.2), and 50 bottom trawls would be removed from the *Spring Eastern Bering Sea Ichthyoplankton Survey* (see Table 2-1). Additionally, the number of bottom trawls in the GOARA would be reduced during the *Gulf of Alaska Shelf and Slope Groundfish Bottom Trawl Survey* (550 trawls reduced from 820) In the BSAIRA two studies would have reduced DAS under the Preferred Alternative *Eastern Bering Sea Groundfish Bottom Trawl survey* (75 DAS reduced from 130) and the *Fishing*

Technology Studies to Reduce Bycatch and Habitat Effects of Fishing (7 DAS reduced from 14; see Table 2-1); however the total number of trawls in each of these surveys would remain the same.

The following additional surveys or increases in existing bottom trawling effort would be added under the preferred Alternative (see Table 2-1 for details):

- *Aleutian Islands Bottom Trawl Survey* using the Poly Nor'Eastern bottom trawl – increased effort to 550 trawls from 420 trawls;
- *Northern Bering Sea Effects of Trawling Study* – employing a Poly Nor'Eastern bottom trawl (100 tows) would be added in the BSAIRA;
- *Gulf of Alaska (Science-Industry Rockfish Research Collaboration in Alaska) SIRCCA Trawl Survey* – 50 tows using a nephrops trawl which is towed on the seabed to target nephrops;
- *Northern Bering Sea Bottom Trawl Survey* would add 144 tows of a Poly Nor'Eastern bottom trawl in the Northern Bering Sea;
- Several new studies or additions to existing studies employing beam trawls:
    - *Alaska RKC Growth and Survival* Survey – 10 beam trawls in the GOARA conducted from a skiff or small boat;
    - *Kodiak Age-0/1 Pacific Cod Nursery Habitat* – 64 beam trawls conducted in the GOARA from a small boat;
    - *Northern Bering Sea Ecosystem Surface Trawl Survey* – 50 beam trawl tows would be added to the BSAIRA survey;
    - *Northern Bering Sea Integrated Ecosystem Research Survey* – 75 beam trawls would be added in the Northern Bering Sea; and
    - *Arctic Ecosystem Distributed Biological Observatory* – 50 beam trawls would be added in the CSBSRA.

Therefore, while ~675 bottom trawls (using beam, Poly Nor'Eastern, or nephrops gear that would contact the bottom) would be added under the Preferred Alternative, ~1,300 bottom trawl tows would be discontinued. Overall impacts of the Preferred Alternative on benthic habitat would be minor adverse and fewer than those described for the Status Quo Alternative (see Section 4.3.1 and Table 4-4).

The effects of the Preferred Alternative on special resource areas would also be similar to those of the Status Quo Alternative (Section 4.3.1). The additional studies proposed under Alternative 2 (see Table 2-1) would not change the effects of the research activities on physical properties of the environment. Also, the reductions in bottom trawling noted above and described in Section 2.2 would further reduce potential impacts on EFH and HAPC. Effects of the proposed research under the Preferred Alternative would be minor beneficial for the physical environment, EFH, Closed Areas and NMS.

4.4.2 Effects on the Biological Environment

4.4.2.1 Effects on Fish

As described in Section 4.3.2.1 only the effects of mortality from surveys are analyzed in this SPEA for fish species. The following subsections describe the potential impacts of the Preferred Alternative on ESA-listed and non-ESA-listed fish species found in the action area.

4.4.2.1.1 Effects on ESA-Listed Fish

Green Sturgeon

As described in Section 4.3.2.1.1, green sturgeon are rare in Alaskan waters but have been anecdotally recorded in Southeast Alaskan waters. No green sturgeon have been taken during AFSC fisheries research in over 20 years. No studies that would be expected to incidentally catch green sturgeon have been added to or expanded in Southeast Alaska waters under the Preferred Alternative. Therefore, it is unlikely that green sturgeon would be caught under the Preferred Alternate. The effect conclusion remains the same as that for the Status Quo Alternative (see Table 4-6). Fisheries research under the Preferred Alternative would have a minor adverse effect on green sturgeon.

Pacific Salmon

Section 4.3.2.1.1 describes surveys that may take ESA listed fish under the Status Quo Alternative and Table 4-8 shows the studies that have incidentally caught Pacific salmon and steelhead trout under the Status Quo Alternative, and the numbers of these fish caught in each study over the period 2016-2022. Table 4-34 shows the studies that have taken salmonids in the past and their current status under the Preferred Alternative, plus any new studies (from Table 2-1) that have the potential to incidentally catch salmonids. Based on information provided in the table and the discussion below, potential impacts of the Preferred Alternative on ESA-listed salmonids would be similar to the Status Quo Alternative, or minor adverse.

As shown in Table 4-34, of all AFSC and IPHC surveys that have documented catch of salmonids, the Southeast Alaska Coastal Monitoring study has the potential to capture the highest number of salmonids from ESA-listed ESUs (301). Under the Preferred Alternative, DAS for this study would increase but overall tows would not, so potential effects on ESA-listed salmonids would be the same as the Status Quo Alternative. Two new studies in the GOARA use beach seines. However, none of the studies shown in Table 4-34 that have documented catches of salmonids employ beach seines in their study design. It is not anticipated that the newly added 164 beach seine hauls in these two studies would catch a sufficiently large number of ESA-listed salmon to change the effect from minor adverse.

Table 4-34. Status Quo Surveys That Have Incidentally Caught Salmonids Compared to Preferred Alternative Surveys

Survey Name	Difference between Status Quo Alternative and Preferred Alternative	Total Number of Salmonids Caught Under the Status Quo Alternative (2016-2022)[1]	Total Number of Potentially ESA-Listed Salmonids Caught Under the Status Quo Alternative (2016-2022)[2]
BSAIRA			
IPHC FISS	No change.	0	0
Eastern Bering Sea Groundfish Bottom Trawl	DAS reduced to 75 DAS from 130. Eastern otter trawl. No change in total number of trawls.	198	6
Eastern Bering Sea Slope Bottom Trawl Survey Summer	No change		
Aleutian Islands Bottom Trawl Survey	***Number of trawls using Poly Nor'Eastern increased to 550 from 420.***		
Northern Bering Sea Ecosystem Surface Trawl Survey	***50 tows using beam trawl added***.	49,059	0[3]
Eastern Bering Sea Juvenile Fish Survey Fall	No change	11,692	0[3]
Bering Sea/Bogoslof Walleye Pollock Acoustic Trawl Survey Winter	No change	14	0[3]
Eastern Bering Sea Walleye Pollock Acoustic Trawl Survey Summer	No change	186	0[3]
Northern Bering Sea Effects of Trawling Study	***New study - 100 Poly Nor'Eastern tows***	-	-
Northern Bering Sea Bottom Trawl Survey	***New study - 144 Poly Nor'Eastern tows***	-	-
Northern Bering Sea Integrated Ecosystem Research Survey;	***New study - 75 surface trawls using a Nordic 264, 75 beam trawls, 35 midwater trawls using an anchovy trawl or equivalent.***	-	-
GOARA			
IPHC FISS	No change	68	3
Gulf of Alaska Shelf and Slope Groundfish Bottom Trawl	Number of trawls reduced from 820 to 550	879	18

Survey Name	Difference between Status Quo Alternative and Preferred Alternative	Total Number of Salmonids Caught Under the Status Quo Alternative (2016-2022)[1]	Total Number of Potentially ESA-Listed Salmonids Caught Under the Status Quo Alternative (2016-2022)[2]
Southeast Alaska Coastal Monitoring	DAS increased from 1 to 7 to 12-28. Number of tows and gear remain the same.	48,063	301
Gulf of Alaska Biennial Walleye Pollock Acoustic Trawl Survey Summer	No change	589	10
Gulf of Alaska/Shelikof Walleye Pollock Acoustic Trawl Survey Winter	No change	252	2
Gulf of Alaska/Shumagin/Sanak Walleye Pollock Acoustic Trawl Survey Winter	No change		
Kodiak Age-0/1 Pacific Cod Nursery Habitat	***New study - 64 beam trawls and 64 beach seines***	**-**	**-**
Gulf of Alaska Large-Scale Age-0/1 Pacific Cod Nursery Habitat	***New study - 100 beach seine hauls***	**-**	**-**
Arctic Ecosystem Integrated Survey[1]	Discontinued	37	0
Washington and Oregon			
IPHC FISS	No change	1[4]	N/A[5]
Total		**111,038**	**340**

[1]See table 4-8.
[2]See Table 4-13.
[3]Due to age specific removals.
[4]The fish caught was a salmonid but it was not identified to species.
[5]While the fish caught may have been from an PNW ESA-listed ESU, the frequency of catch (one fish caught over 7 years) was too low to assume an effect.

Similarly, the information provided in Tables 2-1 and 4-8 shows that the studies collecting the highest number of salmonids employ surface or midwater trawls. The addition of 64 beam trawls in the new GOARA Kodiak Age-0/1 Pacific Cod Nursery Habitat study are not expected to collect large numbers of salmonids. In the BSAIRA, the addition of 130 Poly Nor'Eastern bottom trawl tows to the Aleutian Islands Bottom Trawl Survey and two new studies that would add a total of 244 tows of Poly Nor'Eastern would not be expected to catch large numbers of salmonids. The Northern Bering Sea Integrated Ecosystem Research Survey is a new study that adds 75 surface trawls and 35 midwater trawls. However, based on the analysis provided in Section 4.3.2.1.1, due to age-specific removals any salmonids caught in this new survey would not be expected to be from ESA-listed ESUs.

Steelhead Trout

As described in Section 4.3.2.1.1 and shown in Table 4-7, only one steelhead trout was recorded as incidentally caught during AFSC or IPHC research over the period 2016-2022. The steelhead catch was documented during AFSC's Southeast Coastal Monitoring Survey in the GOARA. While the DAS for this survey increased from 1-7 under the Status Quo Alternative to 12-28 under the Preferred Alternative, the number of tows and overall level of effort of trawling for this survey remains the same. Therefore, steelhead trout are not expected to be taken at a higher rate under the Preferred Alternative. Conclusions regarding effects on steelhead trout are the same as those shown in Table 4-6: no effect.

4.4.2.1.2 Effects on Non ESA-listed Fish

As described in Section 4.3.2.12 and summarized in Table 4-14, the Status Quo Alternative would have only minor adverse effects on target fish, prohibited species and all other fish species found in the AFSC and IPHC research areas. In all cases research catch under the Status Quo has been shown to be a very small percentage of commercial harvest or anticipated biomass. The Preferred Alternative, which removes or adds some studies and gear to the Status Quo (see Section 2.2), would not be expected to change this determination because the amount of research capture is already so low. Therefore, the Preferred Alternative would be expected to have only minor adverse effects on non-ESA-listed fish species encountered by AFSC and IPHC research.

4.4.2.2 Effects on Marine Mammals and Marine Mammal Critical Habitat

For the purposes of this assessment, the term take is referenced below as defined by the MMPA and ESA and in this NEPA assessment is considered an adverse effect according to the criteria defined in Table 4-1.

The effects of the Preferred Alternative on marine mammals would be similar to or potentially less than those described for the Status Quo Alternative (see Section 4.3.2.2 and Table 4-23). Under the Preferred Alternative of this SPEA, 13 surveys conducting a total of ~1,080 trawl tows (including surface, mid-water and bottom trawl) as well as ~ 30 longline sets (Deep Water Groundfish Surveys and the Barotrauma and Tagging of Deep Water Rockfish) would be discontinued (see Section 2.1). Table 4-35 summarizes the change (either an increase or decrease) in the number of trawls (including surface, mid-water or bottom trawl) or longline under the Preferred Alternative. In total, beginning in 2024, there would be a net change of ~ 650 fewer trawls (i.e., ~1,080 discontinued, ~320 reduced in effort and ~ 900 additional) as shown in Table 4-35). Under the Preferred Alternative, the would be a minor net increase of

~ 8 longline sets due to the potential IPHC Catch Protection Survey in the GOARA (20 longline sets) and the increase of about 15 longline sets during the GOA/EBS/Aleutian Islands Longline surveys.

Table 4-35. Changes to Status Quo Surveys Under the Preferred Alternative that May Encounter Marine Mammals

Survey Name	Difference between Status Quo Alternative and Preferred Alternative
BSAIRA	
Total Discontinued Trawls in BSAIRA (see list in Section 2.1)	
IPHC FISS Longline	No change.
Eastern Bering Sea Groundfish Bottom Trawl	DAS reduced to 75 DAS from 130. No change in number of trawls.
BSAIRA Fishing Technology Studies to Reduce Bycatch and Habitat Effects of Fishing	Bottom trawl using commercial gear reduced from 14 to 7 DAS. No change to total number of trawls
Eastern Bering Sea Ichthyoplankton Survey Spring	50 bottom trawls and 50 mid-water trawls eliminated
Northern Bering Sea Ecosystem Surface Trawl Survey	***50 tows using beam trawl added***
Northern Bering Sea Effects of Trawling Study	***New study - 100 Poly Nor'Eastern tows***
Northern Bering Sea Bottom Trawl Survey	***New study - 144 Poly Nor'Eastern tows***
Northern Bering Sea Integrated Ecosystem Research Survey	***New study - 75 surface trawls using a Nordic 264, 75 beam trawls, 35 midwater trawls using an anchovy trawl or equivalent.***
Arctic Ecosystem Distributed Biological Observatory	***50 beam trawl tows added***
GOARA	
IPHC FISS Longline	No change
Aleutian Islands Bottom Trawl Survey	***No. of trawls using Poly Nor'Eastern increased to 550 from 420***
Gulf of Alaska Shelf and Slope Groundfish Bottom Trawl	No. of trawls reduced from 820 to 550
Gulf of Alaska Ichthyoplankton Survey Spring	No. of trawls reduced from 250 to 150
Kodiak Age-0/1 Pacific Cod Nursery Habitat	***New study - 64 beam trawls***
GOA/EBS/Aleutian Islands Longline Surveys	***Increased from 75 to 90 stations***
IPHC Catch Protection Survey	***20 sets added***
Washington and Oregon	
IPHC FISS Longline	No change
Net Change in Trawls	**Net Decrease of ~ 650 trawls[1] compared to Status Quo**
Net Change in Longline	**Net Increase of ~ 8 longline sets compared to Status Quo**

[1]Includes 980 trawls from discontinued studies.

As summarized in the 2019 final rule (NMFS 2019d), from 1999-2019 there were ten takes of marine mammals during AFSC and IPHC research. Six takes occurred during bottom longline efforts which involved harbor seals (2), a Dall's porpoise (1), and Steller sea lions (4). In 2011, two Dall's porpoises were taken occurred during surface trawls (Cantrawl). One take of a northern fur seal occurred in 2009 during the Gulf of Alaska Biennial Shelf and Slope Bottom Trawl (using the Poly Nor'Eastern), a survey which will be reduced from 820 stations to 550 stations beginning in 2024. In 2014, one take of a harbor seal occurred during the ADF&G Large Mesh Trawl Survey which will also be discontinued in 2024.

As shown in Table 4-24, as of October 2023, a total of five takes have been reported during AFSC and IPHC longline surveys since 2019. Two takes were classified as non-serious injury Level A because the whales (one sperm and one humpback whale) were released alive and swam away. Two unidentified pinnipeds were killed (2019 and 2021) and one killer whale was killed in 2023. No takes occurred during trawl surveys between 2019 and October 2023. The total M/SI and non-serious Level A takes reported since 2019 are fewer than what was authorized in the 2019 rule, with the exception of one humpback whale take for which take was not authorized (see Section 4.3.2.2).

As summarized in Table 4-25 under the Status Quo Alternative, while there have been many observations of marine mammals during AFSC trawl surveys (n= 328 – 350 marine mammals observed), mitigation measures applied by AFSC and IPHC staff during the period 2019-2022 including visual monitoring, altering vessel course or speed to avoid animals, or the move on rule (i.e., moving a set to a different location) were effective in avoiding adverse interactions (and therefore "take" under the MMPA or ESA) with marine mammals. While there remains a risk of encountering marine mammals during AFSC trawl surveys in the future, the reduction in overall trawl effort anticipated for the future period 2024-2029 is expected to result in less risk to marine mammals compared to the number and extent of trawling under the Status Quo. Nonetheless, the effects of the Preferred Alternative are still considered minor adverse due to the potential to entangle marine mammals.

The risk of entanglement or hooking marine mammals during IPHC or AFSC longline surveys is also considered minor adverse under the Preferred Alternative due to the risk of M/SI or non-serious (i.e., non-lethal) Level A take during planned research for the period 2024-2029. The increase of ~ eight longline sets is not likely to be measurably different that the Status Quo Alternative overall in terms of the potential to kill or injure marine mammals. In other words, while the risk of mortality, serious or non-serious injury exists under the Preferred Alternative still exists, based on the history or mortality and non-serious injury of marine mammals (see Table 4-23 and Section 4.3.2.2), the number of animals which could be killed in each population is not likely to result in a population level effect. Physical disturbance of certain pinnipeds could occur under both alternatives but is considered minor adverse given how infrequently and the extent to which this could occur across a population. In summary, overall effects on marine mammals under the Preferred Alternative are considered either no effect or minor adverse as summarized in Table 4-23.

4.4.2.2.1 Effects on Marine Mammal Critical Habitat

Considering the overall net reduction of ~ 650 trawl surveys under the Preferred Alternative (effectively an overall reduction in the extent of surveys across marine mammal habitats), the relatively low amount of fish and invertebrate (i.e., marine mammal prey) catch even under Status Quo is considered very small

catch compared to commercial catch (see Tables 4-20 through 4-22), and the temporary and dispersed nature of AFSC and IPHC research across the action area, there will be minor adverse effects on marine mammal habitat.

4.4.2.3 Effects on Seabirds and Seabird Critical Habitat

As described in Section 4.3.2.3, effects of the alternatives on seabirds analyzed in this SPEA include direct mortality, and the indirect effects of behavioral disturbance and prey removals. Section 4.3.2.3 analyzed these effects under the Status Quo Alternative and found effects on all species to be minor adverse for mortality and behavior modification, and determined there would be no effect of the alternative on prey availability (see Table 4-27).

Section 2.2 and Table 2-1 depict how the Preferred Alternative differs from the Status Quo Alternative regarding surveys and gear added or removed. The following surveys, which were shown in Section 4.3.2.3 to directly affect seabirds under the Status Quo Alternative, are different under the Preferred Alternative:

- GOA/EBS/Aleutian Islands Longline Survey – As described in Section 4.3.2.3.1, under the status Quo Alternative all seabird mortalities (see Table 4-27) occurred during this survey. Under the Preferred Alternative the level of effort of this survey would increase from 75 stations with 160 sets to 90 stations with 160 sets (see Table 2-1). While total DAS is not increased, the addition of 15 new stations to this project does increase the risk of seabird interactions the level of mortality anticipated is likely be minor for all ESA-listed and non-listed species compared to their estimated population numbers (NMFS 2019c) (see discussion in Section 4.3.2.2.1). Similarly, disturbance and prey removal effects would also not be expected to change as overall level of effort (80 DAS) would not be changed.
- Northern Bering Sea Ecosystem Surface Trawl Survey - two Steller's eiders were encountered during a Northern Bering Sea Ecosystem Surface Trawl Survey in 2021; the encounter was non-lethal (see Section 4.3.2.3.3). As shown in Table 2-1, 50 beam trawls are added to this survey under the Preferred Alternative; overall DAS would not be increased so it is possible that the beam trawl tows would be at stations already occupied under the Status Quo. Under the Status Quo Alternative, the survey only employed surface trawls and bongo nets. The addition of beam trawling is not likely to increase the potential mortality effect above minor adverse. Disturbance and prey removal effects would also not be expected to change as overall level of effort (25 DAS) is not increased.
- Other new surveys shown in Table 2-1 employing beach seines, UxS, echosounders, "slinky pots", other pot gear and scuba surveys are not expected to increase the potential effects to seabirds over those described for the Status Quo Alternative.

The following surveys have recorded numerous observations of short-tailed albatross under the Preferred Alternative (see Table 4-29):

- IPHC FISS;
- Gulf of Alaska Shelikof/Shumagin/Sanak/Bogoslof Walleye Pollock Acoustic Trawl Survey Winter;

- Gulf of Alaska Biennial Walleye Pollock Acoustic Trawl Survey Summer;
- Gulf of Alaska Shelf and Slope Groundfish Bottom Trawl Survey;
- Eastern Bering Sea Walleye Pollock Acoustic Trawl Survey Summer.

None of these studies are changed under the Preferred Alternative so potential encounters with or effects on short-tailed albatross are the same as those described in Section 4.3.2.3.4 for the Status Quo Alternative.

Therefore, for all seabird species, both ESA-listed and non-listed, potentially encountered during AFSC and IPHC research activities, conclusions regarding effects of the Preferred Alternative are the same as those described in Table 4-28 and analyzed in Section 4.3.2.3. In addition, the changes to research activities proposed under the Preferred Alternative regarding designated critical habitat for Steller's eiders, spectacled eiders and marbled murrelet would not differ; the preferred Alternative is not expected to directly affect any designated Seabird critical habitat.

4.4.2.4 Effects on Sea Turtles and Sea Turtle Critical Habitat

Effects on sea turtles would be the same under the Preferred Alternative as those described for the Status Quo Alternative in Section 4.3.2.4. While encounters are expected to be very rare under either alternative, they are possible and would be considered minor adverse for potential mortality due to surveys under the preferred Alternative (see Table 4-30).

4.4.2.5 Effects on Invertebrates

The conclusions shown in Table 4-31 for effects of the Status Quo Alternative on invertebrate remain valid under the Preferred Alternative. However, because of the concern over crab species in the Bering Sea, the following paragraphs provide additional analysis of potential impacts of the Preferred Alternative on Red king crab, snow crab, and tanner crab. In addition, new studies under the preferred Alternative that seek to provide additional information on these crabs species will provide beneficial effects that may counter some concerns regarding research catch.

As shown in Table 4-32, more red king crabs, snow crabs, and tanner crabs are caught in AFSC BSAIRA trawling operations as compared to those in the GOARA. As shown in Table 2-1, bottom trawls in the following studies would not be reduced but DAS would:

- Eastern Bering Sea Groundfish Bottom Trawl Survey - reduced to from 130 to 75 DAS; and
- Fishing Technology Studies to Reduce Bycatch and Habitat Effects of Fishing - reduced from 14 to 7 DAS.

However, the following BSAI studies would have increased bottom trawling effort under the Preferred Alternative:

- Aleutian Islands Bottom Trawl Survey – increased to 550 from 420; and
- Northern Bering Sea Ecosystem Surface Trawl Survey – 50 beam trawl tows added.

The following new studies in the BSAIRA employing bottom trawls would be added:

- Northern Bering Sea Effects of Trawling Study – 100 Poly Nor'Eastern bottom trawl tows

- Northern Bering Sea Bottom Trawl Survey – 144 Poly Nor'Eastern bottom trawl tows;
- Northern Bering Sea Integrated Ecosystem Research Survey –75 beam trawls.

While overall trawling efforts in the BSAIRA are increased, studies such as the new Alaska Collaborative Crab Tagging Survey, the Bristol Bay Red King Crab Settlement Survey, and the Alaska Slinky Pot Research will provide information and overall beneficial effects to the crab populations. Overall effects of the Preferred Alternative on these crab species would be moderate adverse under the Preferred Alternative.

4.4.3 Effects on the Social and Economic Environment

As described for the Status Quo Alternative (see Section 4.3.3), the AFSC and IPHC fisheries research programs have the most potential to affect the social and economic environment through contribution to the fisheries management process under the Preferred Alternative. The best available information currently available on fisheries socioeconomics was published in February 2023 (NMFS 2023b) and is for the period 2016-2020. Under the Preferred Alternative, the longterm, standardized resource surveys conducted by the AFSC and IPHC would continue to provide a rigorous scientific basis for the development of fisheries stock assessments and federal fishery management actions in the Alaska region.

AFSC fisheries research also provides information on ecosystem characteristics that is essential to management of commercial fisheries. The scientific information provided by the AFSC is used not just for current management decisions but also to conserve resources and anticipate future trends, ensure future fishing utilization opportunities, and assess the effectiveness of the agency's management efforts. The scientific data provided through the longterm and short-term fisheries research conducted and associated with the AFSC has played an important role in the development of fisheries and conservation policies through informing the fisheries management process.

Cooperative research under the Preferred Alternative will remain an important element in establishing communication, trust, and information exchanges between scientists, fisheries managers, and the fishing industry. Cooperative research is used to: a) increase the precision and expand the scope of resource surveys; b) provide supplemental information about fishing operations; c) incorporate fishing expertise into the design and implementation of research; and d) build mutual understanding and respect among scientists and people in the fishing industry. Collaboration in the development of new gear and techniques encourages participation in developing sustainable fishing practices and contributes to a broader understanding of management for marine resources.

AFSC-affiliated fisheries and ecosystem research conducted under the Preferred Alternative would provide a rigorous scientific basis for fisheries managers to set fishery harvests within optimum yield while protecting the recovery of overfished resources and ultimately rebuilding these stocks to appropriate levels. It also contributes directly and indirectly to local economies, promotes collaboration and positive relationships between NMFS and other researchers as well as with commercial and recreational fishing interests, and helps fulfill NMFS obligations to communities under U.S. laws and international treaties.

The direct and indirect effects of the Preferred Alternative on the social and economic environment would be certain to occur, minor to moderate in magnitude depending on the community, longterm, and would

be widely dispersed throughout the Alaska region. According to the impact criteria established in Table 4-1, the direct and indirect effects of the Preferred Alternative on the social and economic environment would be minor to moderate and beneficial.

5 CUMULATIVE EFFECTS OF THE ALTERNATIVES

This section provides an update to the evaluation of potential cumulative effects of AFSC fisheries and ecosystem research that was published in the 2019 PEA (NMFS 2019c). A brief summary of notable events or external activities that may interact with research that have occurred since 2019 as well as reasonably foreseeable future events and activities that may occur between 2024 and 2029 are included in this analysis of the Status Quo and Preferred Alternatives described in Section 2. A publication by Murray *et al.* (2014) provides a detailed discussion of cumulative effects on marine ecosystems from human-caused activities. This section discusses both human-caused and natural stressors that may result in cumulative effects on resources within AFSC research areas.

5.1 Spatial and Temporal Scope

The cumulative effects analysis considers external actions that can potentially influence the geographic areas where AFSC and IPHC surveys occur as illustrated in Figures 1-1 and 1-2. Some actions that originate outside of the AFSC research areas, such as discharge of pollutants, or actions that influence populations of HMS, could potentially contribute to cumulative effects within the geographic areas of interest; such actions are considered in the analysis of cumulative effects. Other actions considered in the analysis of cumulative effects may be geographically widespread, such as those that could potentially result in climate change or ocean acidification. Although discussions of past actions primarily focus on the last five years, the availability of existing information and the period of time that must be considered to understand the baseline conditions vary between resource components. All analyses project five years into the future. The temporal scope of this analysis generally considers notable events and actions that have occurred or are anticipated to occur during the period 2019 through 2029.

5.2 Relevant Past, Present and Reasonably Foreseeable Future Actions and Events Within the Research Areas

Relevant past and present external actions and events that may interact with AFSC fisheries and ecosystem research may include both human controlled activities (such as shipping or marine debris), and natural events such as predation or climate change. Reasonably Foreseeable Future Actions (RFFAs; human activities or natural events) are those that:

- Have already been or are in the process of being funded, permitted, or described in coastal zone management plans;
- Are included as priorities in government planning documents; or
- Are likely to occur or continue based on environmental data, or historical patterns.

Judgments concerning the probability of future impacts must be informed rather than based on speculation. RFFAs to be considered must also fall into the temporal and geographic scope described below.

Reasonably foreseeable future actions and natural events were screened for their relevance to the alternatives proposed in this SPEA. Because the regulations in 40 CFR 1508.1(g) state that the actions and events must be considered "reasonably foreseeable," not just possible, only those actions that are sufficiently likely to occur have been included for analysis. Future actions and events were categorized as

sufficiently likely to occur based on whether they have undergone or are currently being evaluated by state or federal agencies, or whether permits have been issued authorizing the activity (i.e., undersea cable projects). Other activities and natural events categorized as sufficiently likely to occur include those that have occurred for several years previously and are likely to continue occurring such as commercial and recreational fisheries, tourism or shipping. Due to the large geographic scope of the research areas, the identification of RFFAs was conducted on a broad scale (i.e., by overall broad categories).

The 2019 PEA (NMFS 2019c) conducted a comprehensive analysis of the cumulative effects of AFSC and IPHC research efforts on the physical, biological and social environments that remain valid. In addition the 2019 BiOp (NMFS 2019a) analyzed the effects of actions external to AFSC and IPHC research activities as part of the Environmental Baseline (Section 5 of the 2019 BiOp). The 2019 PEA and the 2019 BiOp considered the following RFFAs that remain applicable:

- Non-AFSC Research including research from other NOAA branches
- Federal and State Managed Commercial Fisheries
- Non-Commercial Fisheries
- Military Operations in the GOA
- Oil and Gas Activities
- Vessel Traffic and Shipping
- Ocean Disposal Discharges
- Dredging
- Geophysical/Geotechnical Studies
- Subsistence Harvest
- Marine Mammal Conservation Measures
- Unusual Mortality Events (marine mammals)
- Climate Change
- Ocean Acidification

5.3 Climate Change

5.3.1 Warming Ocean Temperatures

Sea-level rise, warming ocean temperatures, fluctuations in ocean chemistry changes, and other greenhouse gas-driven changes to the U.S. west coast, Alaska, and Arctic regions are occurring and are projected to have significant consequences for the coastal economy, communities, ecosystems, culture, and heritage. These consequences will affect areas within the AFSC and IPHC research areas. Climate change is increasing ocean temperature and levels of carbon dioxide resulting in ocean acidification and shifting weather patterns (Koetse and Rietveld 2009, Hoegh-Guldberg and Bruno 2010, Hare *et al.* 2016). The increase in temperature and changes in weather patterns may shift currents carrying waste and debris. In marine ecosystems, changes in temperature, ocean circulation, stratification, nutrient input, oxygen

content, ocean acidification and increased atmospheric carbon dioxide may have significant biological effects (Donney *et al.* 2012). In 2014, the Intergovernmental Panel on Climate Change (IPCC) cautioned that longterm changes to sea-surface temperature and marine chemistry would have severe impacts on marine ecosystems (IPCC 2014). Their latest publication states with high confidence that climate change has caused substantial damages and irreversible losses in terrestrial, freshwater, and coastal and open ocean marine ecosystems (IPCC 2022).

An anomalously warm water mass began to form in the North Pacific and GOA during autumn 2013 due to a lack of cyclonic storms that usually mix and subsequently cool the water column. This warm water mass was aptly named "the Blob". The Blob spread across the entire North Pacific in spring 2014, producing temperature anomalies of 3 to 4.5°C by summer 2014. This resulted in a complete replacement of the "cold water, lipid-rich" food chain with a "warm-water, lipid poor" food chain. By winter (January to March) 2015, the sea surface temperature pattern across the Pacific resembled the positive Pacific Decadal Oscillation pattern and this sea surface temperature pattern continued through all of 2015 and 2016. The 2014–2016 marine heatwave in the GOA continued, with warm conditions documented through 2019 (Suryan *et al.* 2021). Suryan *et al.* (2021) noted effects in nearshore intertidal areas to offshore oceanic regions with abrupt changes across trophic levels; many responses persisted up to at least 5 years after the onset of the heatwave. Given anticipated increases in marine heatwaves under current climate projections, it remains uncertain when or if the GOA ecosystem will return to a heatwave state (Suryan *et al.* 2021).

A 2018 report by Sievanen *et al.* (2018) synthesized current scientific understanding about the impacts of climate change on California's coast and ocean which provide a good understanding of potential effects of climate changes across the U.S. west coast including areas where IPHC research occurs. Sea-level rise, warming ocean temperatures, fluctuations in ocean chemistry changes, and other greenhouse gas-driven changes to the U.S. west coast and oceans are occurring and are projected to have significant consequences for the coastal economy, communities, ecosystems, culture, and heritage. These consequences have the potential to extend into the U.S. economy (Sievanen *et al.* 2018).

In recent decades the Arctic has seen accelerated warming, a phenomenon known as Arctic amplification. Numerous studies report that the Arctic is warming either twice, more than twice, or even three times as fast as the globe on average. Rantanen *et al.* (2022) used several observational datasets that cover the Arctic region to show that over the last 43 years, the Arctic has been warming nearly four times faster than the globe, which is a higher ratio than generally reported in literature. The authors compared the observed Arctic amplification ratio with the ratio simulated by state-of-the-art climate models, and found that the observed four-fold warming ratio occurred over the period 1979–2021 and was determined to be an extremely rare occasion in the climate model simulations (Rantanen *et al.* 2022).

5.3.2 Marine Mammals

As described in Moore and Huntington (2008), certain marine mammal species may have greater ability than others to adapt to major climate shifts and ecosystem disturbances. It is difficult to predict how cumulative effects may impact specific marine mammal species in any given location however, the contribution of climate change to cumulative effects could range from minor to major depending on the specific species and the context of their exposure to other stressors. The most likely impact of climate

change on cetaceans could be changes in the area these species currently occupy due to changes in distribution of prey species with particular thermal requirements (81 FR 62260). According to McLeod (2009), ranges of approximately 88 percent of cetaceans may be affected by changes in water temperature resulting from global climate change. This phenomenon has been noted in AFSC research areas in the BSAIRA and CSBSRA where incidences of encounters with marine mammals such as sperm and humpback whales not typically found in large numbers in those regions have occurred (see Section 4.3.2.1.1).

Lettrich *et al.* (2019) published a method for assessing the vulnerability of marine mammals to climate change. Their method follows the model of the NOAA Fisheries Marine Fish and Shellfish Climate Vulnerability Assessment (Hare *et al.* 2016). The method developed by Lettrich *et al.* (2019) uses existing information and expert knowledge to assess marine mammal stocks' exposure, sensitivity, and capacity to adapt to climate change and variability. The method assesses exposure to climate change by scoring the projected change in climate conditions within a stock's current distribution. Sensitivity and capacity to adapt to climate change are then assessed based on the understanding of a stock's life history traits. This method lays the framework for understanding how marine mammals may be affected by climate change in areas where AFSC and IPHC operate. A climate variability assessment is currently underway to assess the potential impacts of climate change on marine mammal populations in the Pacific[16].

5.3.3 Fish

A publication by Crowder *et al.* (2008), presented information on the global impacts of fisheries (i.e., commercial recreational and artisanal) on marine ecosystems. Researchers have attributed fishing as one of the oldest and most significant factors modifying marine ecosystems (Jackson *et al*. 2001 as cited in Crowder *et al*. 2008). Fishing, combined with other anthropogenic stressors such as warming ocean temperatures, has resulted in a loss of biodiversity (Worm *et al*. 2006 as cited in Crowder *et al*. 2008). Bycatch of sharks and rays in commercial fisheries generally occurs outside of the AFSC research areas or are from non-listed populations. Free *et al.* (2019) reviewed historical abundance data for 124 species in 38 regions worldwide compared to ocean temperature; the report stated that eight percent of these populations were adversely impacted by warming while four percent experienced beneficial effects. Significant discrepancies exist among regions with regard to the magnitude of these effects, with East Asia seeing the largest declines (15 to 35 percent) in fisheries productivity (Free *et al.* 2019).

Recent changes in ocean temperature and related ecological shifts are driving commercially viable catch locations (NMFS 2020) as many target species move further north. The shift in viable catch to the north has resulted in corresponding northward shifts in commercial vessel activity. For example, harvest of Pacific cod in regulatory zones 514 and 524, which had been occurring south of spectacled eider critical wintering habitat, shifted progressively further north in 2017, 2018, and 2019 (USFWS 2021b) .

A recent assessment of climate impacts on Pacific salmon was completed by (Crozier *et al.* 2019). This assessment highlighted high-risks due to climate change for several endangered and threatened ESUs of salmon, some that may be taken by AFSC fisheries research. Changes in water temperatures, and distinct flow conditions or water pathways are the characteristics that contribute to high vulnerability for these types of species (i.e., anadromous like salmon) and make them particularly sensitive to climate change

[16] https://www.fisheries.noaa.gov/national/climate/climate-vulnerability-assessments, Accessed October 20, 2023

(Crozier *et al.* 2019). These include more extreme high and low flows and hotter oceans and rivers. Certain Chinook, coho, and sockeye salmon population groups are the most vulnerable to expected environmental shifts with climate change. For example, both the late-fall and winter-run Chinook ESUs face extinction without continued intensive management/propagation. Similarly, for chum salmon, the summer-run faces relatively greater vulnerability than the more common fall or winter-run life history types in northern regions (Crozier et al. 2019). Steelhead, pink and chum salmon face less risk, either because they are more adaptable to varying conditions (steelhead) or spend less time in freshwater (pink and chum). Generally, populations within distinct ESUs are at most risk along the periphery of the ESU range, especially in interior and southern regions, exactly where climate is expected to change the most (Crozier et al. 2019).

Spencer et al. (2019) applied a trait-based vulnerability assessment to 36 fish and invertebrate stocks in the EBS. The vulnerability assessment considered projections (to 2039) from three downscaled climate models, and graphically characterized the variation in climate projections between climate models and between seasons. The sensitivity of EBS stocks to climate change ranged from "low" to "high," but vulnerability ranged between "low" and "moderate". The study found that the most vulnerable EBS stocks to climate change were: Pacific Ocean perch; rougheye rockfish; shortraker rockfish; shortspine thornyhead; flathead sole; and tanner crab. Kamchatka flounder, sablefish, giant grenadier and salmon shark had moderate exposure to climate change. The authors note that the models projected more variability in salinity and water temperatures in the offshore ocean habitats where all of these species tend to be found, making them more vulnerable than other species which inhabit different areas. Salmon also ranked high due to their limited spawning cycle, complex reproductive strategy, and limited dispersal of early life stages but sharks were determined to be the least sensitive to climate change (Spencer *et al.* 2019). Sharks are highly vulnerable to overfishing because they produce low numbers of offspring. However, their unique life history of not having a larval stage and being actively swimming opportunistic feeders may provide an advantage to coping with climate change. Another factor may be the prehistoric nature of shark species, which have survived historic climate shifts (Spencer *et al.* 2019).

Fully understanding how climate change will continue to affect fisheries research and/or commercial fisheries in the future will require additional research such as that conducted by AFSC. The potential far-reaching impacts of climate change on fish habitat due to warming ocean temperatures, decreased habitat for selected species, changing distributions and abundance, changes in productivity and subsequent production, far exceed the minor impacts of fish removal and other effects as a result of AFSC and IPHC fisheries research.

5.3.4 Seabirds

Considering recent interactions between commercial fishing vessels and eiders and the role of climate change on the distribution of eiders, research vessel collisions (takes) with listed eiders may require further consideration (USFWS 2021b). Recent seabird distributions may overlap with fishing or research vessels to a greater extent than in previous years due to climate change. The 2017 BA (ECO49 Consulting 2017) concluded that sea ice retreat in the Arctic may potentially open new foraging habitat or provide a new migration corridor between the Pacific and Atlantic Oceans. For example, a juvenile short-tailed albatross was sighted in the Chukchi Sea and evidence indicates that other species such as the northern

gannet (*Morus bassanus*) and the ancient murrelet (*Synthliboramphus antiquus*) use ice-free portions of the Arctic as migration or population dispersal routes (USFWS 2015, 2021b).

Data also suggest that the timing of winter distribution of spectacled eiders is changing, likely due to the decreased extent of sea ice in the Bering Sea in late winter (USFWS 2021b). For example, satellite telemetry studies of marked birds show spectacled eiders using a core wintering area located 70 km southwest of St. Lawrence Island as early as December, when sea ice had not yet fully developed, through April during the period from 2008 to 2010 (USFWS 2021b).

In May 2018, 39 spectacled eiders from the Y-K Delta were tagged with satellite transmitters. The study documented three patterns of bird distribution over the winter of 2018-2019. Five tagged birds remained in the core wintering area south of St. Lawrence Island, moving less than 75 km once settled, while twelve birds moved closer to St. Lawrence Island until spring. Based on USFWS unpublished data reported in (USFWS 2021b), seven of the tagged birds moved north of St. Lawrence Island as far northwest as the Chukotka coast. During the winter of 2018-2019, northward movements of the birds coincided with the northward retreat of sea ice, which occurred earlier compared to winters from 1996 to 1999 and 2008 to 2011 (USFWS unpublished data reported in USFWS (2021b). However, during winter 2019-2020, ice was more consistent in the traditional eider core wintering area south of St. Lawrence Island and spectacled eiders remained south of St. Lawrence Island until March during that year. During that winter of 2019-2020, minimal north-south variation in spectacled eider locations occurred, which is consistent with the hypothesis that changes in winter distribution are related to sea ice concentration and extent (unpublished data cited in USFWS (2021b)). Given the changes in commercially viable catch locations, fishing vessel (and therefore fishery research vessel) activity may overlap to a greater extent with seabird distributions moving forward.

5.3.5 Sea Turtles

Sea turtles are also threatened by global climate change (Hawkes *et al.* 2007, Fuentes *et al.* 2011). Sea turtles with high fecundity and low juvenile survival are the most vulnerable to climate change and elevated levels of environmental variability (Cavallo *et al.* 2015). Temperature changes and sea level rise may change ocean currents and the movements of hatchlings, surface-pelagic juveniles, and adults (Hawkes *et al.* 2009, Poloczanska *et al.* 2009, Cavallo *et al.* 2015).

Climate change and sea level rise may have moderate to major impacts on sea turtles depending upon future trophic changes, including changes in the distribution, amount, and types of seagrasses and macroalgal species (Harley *et al.* 2006), thus altering green turtle foraging habitat (Hawkes *et al.* 2009). Sea level rise is likely to reduce the availability and increase the erosion rates of nesting beaches, particularly on low-lying, narrow coastal and island beaches (Fuentes *et al.* 2009, Hawkes *et al.* 2009, Anastacio *et al.* 2014, Pike *et al.* 2015).

5.3.6 Invertebrates

As discussed in Section 5.3.3, Spencer et al. (2019) noted that tanner crab were among the most vulnerable EBS stocks to climate change. As described in Section 3.2.5.2, stocks of king, tanner and in particular snow crabs have seen drastic reductions in Bering Sea waters over the past few years, resulting numerous crab fishery closures. Since 2018, more than 10 billion snow crab have disappeared from the

EBS, and the population collapsed to historical lows in 2021 after the observed historical abundance reached historical highs in 2018 (Szuwalski *et al.* 2023). Szuwalski *et al.* (2023) link this collapse to a marine heatwave in the eastern Bering Sea during 2018 and 2019. Starvation is believed to have played a role in the collapses based on reduced spatial distribution and observed body conditions. The mortality event appears to be one of the largest global reported losses of motile marine macrofauna attributable a marine heatwave (Szuwalski *et al.* 2023).

5.4 Cumulative Effects Conclusion

The 2019 BiOp (NMFS 2019a) concluded that AFSC and IPHC research occurs across a vast action area encompassing the GOA, Bering Sea, Aleutian Islands, Chukchi Sea, and Beaufort Sea and that the activities external to AFSC and IPHC research that can affect ESA-listed species will likely continue into the foreseeable future. Similarly, the 2019 PEA (NMFS 2019c) concluded that in addition to AFSC research efforts, there are many current and reasonably foreseeable activities, and that these actions can produce both adverse and beneficial impacts that directly and indirectly affect ocean resources managed by NMFS and the social and economic environment of fishing communities that rely on them. Based on the analysis in this SPEA these conclusions remain valid.

6 REFERENCES

ADF&G (2017). Subsistence in Alaska: A Year 2017 Update**:** 4 pp.

ADF&G (2023). Bering Sea Snow Crab Season Closed 23/24. Advisory announcement. Dutch Harbor and Juneau AK, Alaska Department of Fish and Game**:** 1 pp.

AFSC (2020a). 2020 Operational Mitigation Measures and Handling Procedures for Fisheries Research Conducted and Funded by the Alaska Fisheries Science Center and the International Pacific Halibut Commission, National Marine Fisheries Service**:** 46 pp.

AFSC (2020b). Annual Report for Fisheries and Ecosystem Research Activities Conducted by Alaska Fisheries Science Center January 1 – December 31, 2019, National Marine Fisheries Service, Alaska Fisheries Science Center**:** 16 pp.

AFSC (2021a). Annual Report for Fisheries and Ecosystem Research Activities Conducted by Alaska Fisheries Science Center January 1 – December 31, 2020, National Marine Fisheries Service, Alaska Fisheries Science Center**:** 19 pp.

AFSC (2021b). Humpback Whale Direct Interaction, Report, Analyis and Effects Determination. Seattle, WA, Alaska Fisheries Science Center**:** 7 pp.

AFSC (2022a). Annual Report for Fisheries and Ecosystem Research Activities Conducted by Alaska Fisheries Science Center January 1 – December 31, 2021, National Marine Fisheries Service, Alaska Fisheries Science Center**:** 25 pp.

AFSC (2022b). Draft Report and Determiniations Sperm Whale Entangelement during AFSC Research, Alaska Fisheries Science Center**:** 5 pp.

AFSC (2023). Annual Report for Fisheries and Ecosystem Research Activities Conducted by Alaska Fisheries Science Center January 1 – December 31, 2022, National Marine Fisheries Service, Alaska Fisheries Science Center**:** 19 pp.

Anastacio, R., C. Santos, C. Lopes, H. Moreira, L. Souto, J. Ferrao, J. Garnier and M. J. Pereira (2014). "Reproductive biology and genetic diversity of the green turtle (*Chelonia mydas*) in Vamizi island, Mozambique." Springerplus **3**: 540.

Andersen, M. S., K. A. Forney, T. V. Cole, T. Eagle, R. Angliss, K. Long, L. Barre, L. Van Atta, D. Borggaard and T. Rowles (2008). "Differentiating serious and non-serious injury of marine mammals: Report of the serious injury technical workshop." NOAA Tech. Memo. NMFS-OPR **39**: 94.

Bailey, H., S. R. Benson, G. L. Shillinger, S. J. Bograd, P. H. Dutton, S. A. Eckert, S. J. Morreale, F. V. Paladino, T. Eguchi and D. G. Foley (2012). "Identification of distinct movement patterns in Pacific leatherback turtle populations influenced by ocean conditions." Ecological Applications **22**(3): 735-747.

Barlow, J. (2016). Cetacean abundance in the California current estimated from ship-based line-transect surveys in 1991-2014. Southwest Fisheries Science Center, Administrative Report, LJ-2016-01.

Beatty, W. S., P. R. Lemons, J. P. Everett, C. J. Lewis, R. L. Taylor, R. J. Lynn, S. A. Sethi, L. Quakenbush, J. J. Citta, M. L. Kissling, N. Kryukova and J. K. Wenburg (2022). "Estimating Pacific walrus abundance and survival with multievent mark-recapture models." Marine Ecology Progress Series **697**: 167-182.

Brase, A. L. J. and D. R. Sarafin (2004). Recovery of Copper River Basin coded wire tagged Chinook salmon, 2001-2002, Alaska Department of Fish and Game**:** 24 pp.

Brewer, S., J. Watson, D. Christensen and R. Brocksmith (2005). Hood Canal & Eastern Strait of Juan de Fuca Summer Chum Salmon Recovery Plan, Hood Canal Coordinating Council**:** 339 pp.

Carretta, J., E. Oleson, K. A. Forney, D. W. Weller, A. Lang, J. Baker, A. J. Orr, B. Hanson, J. Barlow, J. Moore, M. Wallen and R. L. Brownell Jr (2023). Final U.S. Pacific Marine Mammal Stock Assessments: 2022. LaJolla, CA, National Marine Fisheries Service**:** 409 pp.

Carretta, J., E. M. Oleson, K. A. Forney, M. Muto, D. W. Weller, A. Lang, J. Baker, B. Hanson, A. J. Orr, J. Barlow, J. Moore and R. L. Brownell Jr. (2021). Final U.S. Pacific Marine Mammals Stock Assssments: 2020. NOAA Technical Memorandum, National Marine Fisheries Service**:** 394 pp.

Carretta, J. V., E. M. Oleson, K. A. Forney, M. M. Muto, D. W. Weller, A. R. Lang, J. Baker, B. Hanson, A. J. Orr, J. Barlow, J. E. Moore and R. L. Brownell, Jr. (2022). Final U.S. Pacific Marine Mammal Stock Assessments: 2021. C. Southwest Fisheries Science**:** 395 pp.

Cavallo, C., T. Dempster, M.R. Kearney, E. Kelly, D. Booth, K. M. Hadden and T. S. Jessop (2015). "Predicting climate warming effects on green turtle hatchling viability and dispersal performance." Functional Ecology **29**(6): 768-778.

Crocker, S. and F. D. Fratantonio (2016). Characteristics of Sounds Emitted During High-Resolution Marine Geophysical Surveys. Sensors and Sonar Systems DepartmentNaval Undersea Warfare Center Division, Newport, Rhode Island**:** 266 pp.

Crowder, L. B., E. L. Hazen, N. Avissar, R. Bjorkland, C. Latanich and M. B. Ogburn (2008). "The Impacts of Fisheries on Marine Ecosystems and the Transition to Ecosystem-Based Management." Annual Review of Ecology Systems **39**: 259-278.

Crozier, L. G., M. M. McClure, T. Beechie, S. J. Bograd, D. A. Boughton, M. Carr, T. D. Cooney, J. B. Dunham, C. M. Greene, M. A. Haltuch, E. L. Hazen, D. M. Holzer, D. D. Huff, R. C. Johnson, C. E. Jordan, I. C. Kaplan, S. T. Lindley, N. J. Mantua, P. B. Moyle, J. M. Myers, M. W. Nelson, B. C. Spence, L. A. Weitkamp, T. H. Williams and E. Willis-Norton (2019). "Climate vulnerability assessment for Pacific salmon and steelhead in the California Current Large Marine Ecosystem." PLOS ONE **14**(7): e0217711.

Dehnhard, N., J. Skei, S. Christensen-Dalsgaard, R. May, D. Halley, T. H. Ringsby and S.-H. Lorentsen (2020). "Boat disturbance effects on moulting common eiders Somateria mollissima." Marine Biology **167**: 1-11.

Desimone, S. M. (2016). Periodic Status Review for the Marbled Murrelet. Olympia, WA, Washington Depatment of Fish and Wildlife**:** 28 pp.

Donney, S. C., M. Ruckelhshaus, J. E. Duffy, B. F. Chan, C. A. English, H. M. Galindo, W. J. Snyderman, J. M. Grebneier, A. B. Hallowed, N. Knowlton, J. Povolina, N. N. Rabalais and L. d. Talley (2012). "Climate change impacts on marine ecosystems." Annual Review of Marine Science **4**(11): 11-37.

Dow Piniak, W. E., S. A. Eckert, C. A. Harms and E. M. Stringer (2012). Underwater hearing sensitivity of the leatherback sea turtle (*Dermochelys coriacea*): Assessing the potential effect of anthropogenic noise. Herndon, VA, Bureau of Ocean Energy Management**:** 35 pp.

Duarte, C. M., L. Chapuis, S. P. Collin, D. P. Costa, R. P. Devassy, V. M. Eguiluz, C. Erbe, T. A. C. Gordon, B. S. Halpern, H. R. Harding, M. N. Havlik, M. Meekan, N. D. Merchant, J. L. Miksis-Olds, M. Parsons, M. Predragovic, A. N. Radford, C. A. Radford, S. D. Simpson, H. Slabbekoorn, E. Staaterman, I. C. Van Opzeeland, J. Winderen, X. Zhang and F. Juanes (2021). "The Soundscape of the Anthropocene Ocean." Science **371**(6529).

Dunham, K. D., E. E. Osnas, C. J. Frost, J. B. Fischer and J. B. Grand (2021). "Assessing recovery of spectacled eiders using a Bayesian decision analysis." PLOS ONE **16**(7): e0253895.

ECO49 Consulting (2017). Biological Assessment for the Fisheries and Ecosystem Research Conducted and Funded by the Alaska Fisheries Science Center. Seattle, WA, National Marine Fisheries Service**:** 225 pp.

Eguchi, T., T. Gerrodette, R. L. Pitman, J. A. Seminoff and P. H. Dutton (2007). "At-sea density and abundance estimates of the olive ridley turtle *Lepidochelys olivacea* in the eastern tropical Pacific." Endangered Species Research **3**(2): 191-203.

Fedewa, E., B. Garber-Yonts, K. Shotwell and A. Tyrell (2022). Ecosystem and Socioeconomic Profile of the Snow Crab Stock in the Eastern Bering Sea, North Paciic Fisheries Management Council**:** 30 pp.

Felis, J. J., J. Adams, C. A. Horton, E. C. Kelsey and L. M. White (2022). Abundance and productivity of Marbled Murrelets (*Brachyramphus marmoratus*) off central California during the 2020 and 2021 breeding seasons, U.S. Geological Survey**:** 12 pp.

Finneran, J. J., D. A. Carder, C. E. Schlundt and S. H. Ridgway (2005). "Temporary threshold shift in bottlenose dolphins (*Tursiops truncatus*) exposed to mid-frequency tones." Journal of the Acoustic Society of America **118**(4): 2696-2705.

Finneran, J. J., C. E. Schlundt, R. Dear, D. A. Carder and S. H. Ridgway (2002). "Temporary shift in masked hearing thresholds in odontocetes after exposure to single underwater impulses from a seismic watergun." Journal of the Acoustic Society of America **111**(6): 2929-2940.

Free, C. M., J. T. Thorson, M. L. Pinsky, K. L. Oken, J. Wiedenmann and O. P. Jensen (2019). "Impacts of historical warming on marine fisheries production." Science **363**(6430): 979-983.

Fuentes, M., J. A. Maynard, M. Guinea, I. P. Bell, P. J. Werdell and M. Hamann (2009). "Proxy indicators of sand temperature help project impacts of global warming on sea turtles in northern Australia." Endangered Species Research **9**: 33-40.

Fuentes, M. M. P. B., C. J. Limpus and M. Hamann (2011). "Vulnerability of sea turtle nesting grounds to climate change." Climate Change Biology **17**(1): 140-153.

Garber-Yonts, B., J. Lee and A. Abelman (2023). Stock Assessment and Fishery Evaluation Report for the King and Tanner Crab Fisheries of The Gulf of Alaska and Bering Sea/Aleutian Islands Area: Economic Status of The BSAI King And Tanner Crab Fisheries Off Alaska, 2022. Seattle, WA, National Marine Fisheries Service Alaska Fisheries Science Center**:** 227 pp.

García-Aguilar, M. C., F. R. Elorriaga-Verplancken, H. Rosales-Nanduca and Y. Schramm (2018). "Population status of the Guadalupe fur seal (*Arctocephalus townsendi*)." Journal of Mammalogy **99**(6): 1522-1528.

Goetz, K. T., K. E. Shelden, W., C. L. Sims, J. M. Waite and P. R. Wade (2023). Abundance of belugas (*Delphinapterus leucas)* in Cook Inlet, Alaska, June 2021 and June 2022. Seattle, WA, Alaska Fisheries Science Center**:** 47 pp.

Guan, S. (2020). Interim Recommendation for Sound Source Level and Propagation Ananlysis for High Resolution Geophysical (HRG) Sources**:** 4 pp.

Guy, T. J., S. Jennings, R. Suryan, E. Melvin, M. A. Bellman, L. Ballance, B. Blackie, D. Croll, T. Deguchi and T. Geernaert (2013). "Overlap of North Pacific albatrosses with the US west coast groundfish and shrimp fisheries." Fisheries Research **147**: 222-234.

Hare, J. A., W. E. Morrison, M. W. Nelson, M. M. Stachura, E. J. Teeters, R. B. Griffis, M. A. Alexander, J. D. Scott, R. J. Alade, A. S. Chute, K. L. Curtis, D. Kircheis, J. F. Kocik, S. M. Lucey, C. T. MCCandless, L. Mikle, M,, D. E. Richardson, E. Robilliard, H. J. Walsh, M. C. McManus, K. E. Maramick and C. A. Griswold (2016). "A Vulnerability Assessment of Fish and Invertebrates to Climate Change on the Northeast U.S. Continental Shelf." PLoS ONE **11**(2).

Harley, C. D. G., A. R. Hughes, K. M. Hultgren, B. G. Miner, C. J. B. Sorte, C. S. Thornber, L. F. Rodriguez, L. Tomanek and S. L. Williams (2006). "The impacts of climate change in coastal marine ecosystems." Ecology Letters **9**: 228-241.

Hawkes, L. A., A.C. Broderick, M. H. Godfrey and B. J. Godley (2007). "Investigating the potential impacts of climate change on a marine turtle population." Global Change Biology **13**(5): 923-932.

Hawkes, L. A., A. C. Broderick, M. H. Godfrey and B. J. Godley (2009). "Climate change and marine turtles." Endangered Species Research **7**: 137-154.

Himes-Cornell, A., K. Hoelting, C. Maguire, L. Munger-Little, J. Lee, J. Fisk, R. Felthoven and C. Geller (2013). Community Profiles for North Pacific fisheries - Alaska. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-259, Volume 1**:** 70 pp.

Himes-Cornell, A. and S. Kasperski (2016). "Using Socioeconomic and Fisheries Involvement Indices to Understand Alaska Fishing Community Well-Being." Coastal Management **44**(1): 36-70.

Hodge, R. P. and B. L. Wing (2000). "Occurrences of marine turtles in Alaska waters: 1960-1998." Herpetological Review **31**(3): 148.

Hoegh-Guldberg, O. V. E. and J. F. Bruno (2010). "The impact of climate change on the world's marine ecosystems." Science **328**(5985): 1523-1528.

Hofmeyr, G., M. M. De, M. Beste, S. Kirkman, P. Pistorius and A. Makhado (2002). "Entanglement Of Pinnipeds At Marion Island, Southern Ocean: 1991-2001." Australian Mammalogy **24**(1): 141-146.

IPCC (2014). Climate Change 2014 Synthesis Report. R. K. Pachauri and L. A. Meyer. Geneva, Switzerland, Intergovernmental Panel on Climate Change**:** 151 pp.

IPCC (2022). Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. D. C. R. H.-O. Pörtner, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.) Cambridge, UK and New York, NY, USA,, Intergovernmental Panel on Climate Change**:** 3056 pp.

Kastak, D., R. J. Schusterman, B. L. Southall and C. J. Reichmuth (1999). "Underwater temporary threshold shift induced by octave-band noise in three species of pinniped." Journal of the Acoustic Society of America **106**(2): 1142-1148.

Ketten, D. and S. M. Bartol (2006). Functional Measures of Sea Turtle Hearing, Final Report, Office of Naval Research**:** 4 pp.

Koetse, M. J. and P. Rietveld (2009). "The impact of climate change and weather on transport: An overview of empirical findings." Transportation Research Part D: Transport and Environment **14.3**: 205-221.

Larned, W., K. Bollinger and R. Stehn (2012). Late winter population and distribution of spectacled eiders (*Somateria fischeri*) in the Bering Sea 2009 & 2010. Unpublished report, US Fish and Wildlife Service, Migratory Bird Management Office, Anchorage, AK.

Lauth, P. G. and C. Armistead (2014). Results of the 2012 Chukchi Sea Bottom Trawl Survey of Bottomfishes, Crabs, and Other Demersal Macrofauna, National Marine Fisheries Service**:** 123 pp.

Lettrich, M. D., M. J. Asaro, D. L. Borggard, D. M. Dick, R. B. Griffis, J. A. Litz, C. D. Orphanides, D. Palka, D. E. Pendleton and M. S. Soldevilla (2019). A Method for Assessing the Vulnerability of Marine Mammals to a Changing Climate. NOAA Technical Memorandum, U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service**:** 73 pp.

Lewis, T. L., M. A. Swaim, J. A. Schmutz and J. B. Fischer (2019). "Improving population estimates of threatened spectacled eiders: correcting aerial counts for visibility bias." Endangered Species Research **39**: 191-206.

Løkkeborg, S. (2011). "Best practices to mitigate seabird bycatch in longline, trawl and gillnet fisheries—efficiency and practical applicability." Marine Ecology Progress Series **435**: 285-303.

Lowry, D., S. Wright, M. Neuman, D. Stevenson, J. Hyde, M. Lindeberg, N. Tolimieri, S. Lonhart, S. Traiger and R. Gustafson (2022). Endangered Species Act Status Review Report: Sunflower Sea

Star (*Pycnopodia helianthoides*). Review Draft, National Marine Fisheries Service Office of Protected Resources**:** 89 pp + appendices.

Martin, S. B., Z. Siders, T. Eguchi, B. Langseth, A. Yau, J. Baker, R. Ahrens and T. T. Jones (2020). Update to Assessing the Population-level Impacts of North Pacific Loggerhead and Western Pacific Leatherback Turtle Interactions: Inclusion of the Hawaii-based Deep-set and American Samoa-based Longline Fisheries. NOAA Technical Memorandum**:** 67 pp.

McCracken, J. and S. Rheinsmith (2022). Draft Environmental Assessment for the Proposed Amendment to the Fishery Management Plan for the Bering Sea and Aleutian Islands King and Tanner Crabs, Rebuilding Plan for Eastern Bering Sea Snow Crab Initial Review Analysis. Anchorage, AK, North Pacific Fisheries Management Council**:** 119 pp.

McLeod, C. (2009). "Global climate change, range changes and potential implications for the conservation of marine cetaceans: a review and synthesis." Endangered Species Research **7**: 125-136.

Melvin, E. F., K. S. Dietrich, R. M. Suryan and S. M. Fitzgerald (2019). "Lessons from seabird conservation in Alaskan longline fisheries." Conserv Biol **33**(4): 842-852.

Moore, J. E. and J. P. Barlow (2014). "Improved abundance and trend estimates for sperm whales in the eastern North Pacific from Bayesian hierarchical modeling." Endangered Species Research **25**(2): 141-150.

Moore, S. E. and H. P. Huntington (2008). "Arctic marine mammals and climate change: Impacts and resilience." Ecological Applications **18**(2): 157-165.

Mora, E. A., R. D. Battleson, S. T. Lindley, M. J. Thomas, R. Bellmer, L. J. Zarri and A. P. Klimley (2018). "Estimating the annual spawning run size and population size of the southern distinct population segment of green sturgeon." Transactions of the American Fisheries Society **147**(1): 195-203.

Murray, C. C., M. E. Mach and R. G. Martone (2014). Cumulative effects in marine ecosystems: scientific perspectives on its challenges and solutions, WWF-Canada and Center For Ocean Solutions**:** 60 pp.

Muto, M., V. Helker, B. J. Delean, C. N. Young, J. C. Freed, R. Angliss, N. A. Friday, P. Boveng, J. M. Breiwick, B. Brost, M. F. Cameron, P. J. Clapham, J. L. Crance, M. Dahle, M. E. Dahlheim, B. S. Fadely, M. Ferguson, L. Fritz, T. Goetz, R. C. Hobbs, Y. V. Ivashchenko, A. Kennedy, J. M. London, S. Mizroch, R. Ream, E. L. Richmond, K. Shelden, K. Sweeney, R. G. Towell, P. R. Wade, J. M. Waite and A. Zerbini (2022). Final Alaska Marine Mammal Stock Assessments, 2021. NOAA Technical Memorandum, National Marine Fisheries Service**:** 304 pp.

Muto, M., V. Helker, B. J. Delean, N. C. Young, J. C. Freed, R. Angliss, N. A. Friday, P. Boveng, J. M. Breiwick, B. Brost, M. F. Cameron, P. Clapham, J. Crance, S. P. Dahle, M. E. Dahlheim, B. S. Fadely, M. Ferguson, L. Fritz, K. T. Goetz, R. C. Hobbs, Y. V. Ivashchenko, A. Kennedy, J. M. London, S. A. Mizroch, R. Ream, E. L. Richmond, K. E. W. Shelden, K. Sweeney, R. G. Towell, P. R. Wade, J. M. Waite and A. N. Zerbini (2021). Final Alaska Marine Mammal Stock Assessments, 2020. NOAA Technical Memorandum. Seattle, WA, National Marine Fisheries Service**:** 398 pp.

NMFS (1998). Recovery Plan for the Blue Whale (*Balaenoptera musculus*). Silver Spring, MD, National Marine Fisheries Service**:** 48.

NMFS (2007a). Guidance for Social Impact Assessment, U.S. Department of Commerce National Oceanic and Atmospheric Administration, National Marine Fisheries Service**:** 39 pp.

NMFS (2007b). Puget Sound Salmon Recovery Plan, National Marine Fisheries Service**:** 550 pp.

NMFS (2008a). Conservation Plan for the Cook Inlet Beluga Whale (*Delphinapterus leucas*). Juneau, AK, National Marine Fisheries Service**:** 128.

NMFS (2008b). Recovery Plan for the Steller Sea Lion (*Eumetopias jubatus*) Revision. Silver Spring, MD, National Marine Fisheries Service**:** 325 pp.

NMFS (2009a). Middle Columbia River Steelhead Distinct Population Segment ESA Recovery Plan, National Marine Fisheries Service**:** 2626 pp.

NMFS (2009b). Recovery Plan for Lake Ozette Sockeye Salmon (*Oncorhynchus nerka*). Portland, OR, National Marine Fisheries Service**:** 394 pp.

NMFS (2011). "76 FR 20180 Final Rule Endangered and Threatened Species: Designation of Critical Habitat for Cook Inlet Beluga Whale." Federal Register **76**(69): 20180-20214.

NMFS (2013). ESA Recovery Plan for Lower Columbia River Coho Salmon, Lower Columbia River Chinook Salmon, Columbia River Chum Salmon, and Lower Columbia River Steelhead, National Marine Fisheries Service**:** 1051 pp.

NMFS (2015). ESA Recovery Plan for Snake River Sockeye Salmon (*Oncorhynchus nerka*). Portland, OR, National Marine Fisheries Service**:** 431 pp.

NMFS (2016a). 5-Year Review: Summary & Evaluation of Lower Columbia River Chinook Salmon Columbia River Chum Salmon Lower Columbia River Coho Salmon Lower Columbia River Steelhead. Portland, OR, National Marine Fisheries Service**:** 87 pp.

NMFS (2016b). 5-Year Review: Summary & Evaluation of Middle Columbia River Steelhead. Portland, OR, National Marine Fisherise Service**:** 73 pp.

NMFS (2016c). 5-Year Review: Summary & Evaluation of Ozette Lake Sockeye. Portland, OR, National Marine Fisheries Service**:** 47 pp.

NMFS (2016d). 5-Year Review: Summary & Evaluation of Puget Sound Chinook Salmon, Hood Canal Summer-run Chum Salmon, Puget Sound Steelhead. Portland, OR, National Marine Fisheries Service**:** 98 pp.

NMFS (2016e). 5-Year Review: Summary & Evaluation of Snake River Sockeye Snake River Spring-Summer Chinook Snake River Fall-Run Chinook Snake River Basin Steelhead. Portland, OR, National Marine Fisheries Service**:** 127 pp.

NMFS (2016f). 5-Year Review: Summary & Evaluation of Upper Columbia River Steelhead Upper Columbia River Spring-run Chinook Salmon. Portland, OR, National Marine Fisheries Service**:** 74 pp.

NMFS (2016g). 5-Year Review: Summary & Evaluation of Upper Willamette River Steelhead Upper Willamette River Chinook. Portland, OR, National Marine Fisheries Service**:** 71 pp.

NMFS (2016h). Biological Opinion and Letter of Concurrence for the Fisheries Research Conducted and Funded by the Northwest Fisheries Science Center. Seattle, WA, National Marine Fisheries Service**:** 326 pp.

NMFS (2016i). Recovery Plan for the Cook Inlet Beluga Whale (*Delphinapterus leucas*). Juneau, AK, National Marine Fisheries Service**:** 284 pp.

NMFS (2017a). ESA Recovery Plan for Snake River Fall Chinook Salmon (*Oncorhynchus tshawytscha*). Portland, OR, National Marine Fisheries Service**:** 366 pp.

NMFS (2017b). ESA Recovery Plan for Snake River Spring/Summer Chinook Salmon (*Oncorhynchus tshawytscha*) & Snake River Basin Steelhead (*Oncorhynchus mykiss*). Portland, OR, National Marine Fisheries Service**:** 284 pp.

NMFS (2018a). Recovery Plan for the Southern Distinct Population Segment of North American Green Sturgeon (*Acipenser medirostris*). Sacramento, CA, National Marine Fisheries Service**:** 120 pp.

NMFS (2018b). Revision To: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0), Underwater Thresholds for Onset of Permanent and

Temporary Threshold Shifts. NOAA Technical Memorandum, U.S. Department of Commerce National Oceanic and Atmospheric Administration, National Marine Fisheries Service**:** 167 pp.

NMFS (2019a). Biological Opinion Alaska Fisheries Science Center Surveys in the Gulf of Alaska, Bering Sea/Aleutian Islands, and Chukchi Sea/Beaufort Sea Research Areas, 2019 - 2022 and the International Halibut Commission Surveys in the Gulf of Alaska and Bering Sea, 2019 - 2022**:** 390 pp.

NMFS (2019b). Fin Whale (*Balaenoptera physalus*) 5-Year Review: Summary and Evaluation. Silver Spring, MD, National Marine Fisheries Service**:** 40 pp.

NMFS (2019c). Final Programmatic Environmental Assessment for Fisheries and Ecosystem Research Conducted and Funded by the Alaska Fisheries Science Center. Anchorage, AK, National Marine Fisheries Service**:** 502 pp.

NMFS (2019d). Final Rule 84 FR 46788 for Taking and Importing Marine Mammals; Taking Marine Mammals Incidental to Alaska Fisheries Science Center Fisheries Research**:** 40 pp.

NMFS (2020). "Fisheries of the Exclusive Economic Zone off Alaska: Authorize the Retention of Halibut in Pot Gear in the BSAI; Amendment 118." Federal Register **85**(5): 840-850.

NMFS (2021a). 5-year Review: Summary and Evaluation of North American Green Sturgeon (*Acipenser medirostris*). Sacraento. CA, Naitonal marine Fisheries Service**:** 63 pp.

NMFS (2021b). Occurrence of Humpback Whales in Alaska, National Marine Fisheries Service, Alaska Region**:** 4 pp.

NMFS (2021c). Sei Whale (*Balaenoptera borealis*) 5-Year Review: Summary and Evaluation. Silver Spring, MD, National Marine Fisheries Service**:** 57 pp.

NMFS (2022a). 2022 5-Year Review: Summary & Evaluation of Snake River Basin Steelhead, National Marine Fisheries Service.**:** 105 pp.

NMFS (2022b). 2022 5-Year Review: Summary & Evaluation of Snake River Fall-Run Chinook Salmon, National Marine Fisheries Service**:** 98 pp.

NMFS (2022c). 2022 5-Year Review: Summary and Evaluation of Snake River Sockeye Salmon, National Marine Fisheries Service**:** 95 pp.

NMFS (2022d). 2022 5-Year Review: Summary and Evaluation of Lower Columbia River Chinook Salmon, Columbia River Chum Salmon, Lower Columbia River Coho Salmon, Lower Columbia River Steelhead, National Marine Fisheries Service**:** 137 pp.

NMFS (2022e). 2022 5-Year Review: Summary and Evaluation of Middle Columbia River Steelhead, National Marine Fisheries Service**:** 97 pp.

NMFS (2022f). 2022 5-Year Review: Summary and Evaluation of Ozette Lake Sockeye Salmon, National Marine Fisheries Service**:** 73 pp.

NMFS (2022g). 2022 5-Year Review: Summary and Evaluation of Snake River Spring/Summer Chinook Salmon, National Marine Fisheries Service**:** 111 pp.

NMFS (2022h). 2022 5-Year Review: Summary and Evaluation of Upper Columbia River Spring-run Chinook Salmon and Upper Columbia River Steelhead, National Marine Fisheries Service**:** 105 pp.

NMFS (2022i). National Marine Fisheries Service: Summary of Marine Mammal Protection Act Acoustic Thresholds**:** 7 pp.

NMFS (2022j). Process for Distinguishing Serious from Non-Serious Injury of Marine Mammals**:** 5 pp.

NMFS (2023a). 2023 Stock Assessment- Quarter 1 Update Through March 31, 2023, NOAA Fisheries Sustainable Fisheries**:** 46 pp.

NMFS (2023b). Fisheries Economics of the United States, 2020. U.S. Dept. of Commerce, NOAA Tech. Memo. NMFS-F/SPO-236**:** 231 pp.

NMFS (2023c). Guidelines for Distinguishing Serious from Non-Serious Injury**:** 55 pp.

NMFS and USFWS (1998). Recovery Plan for U.S. Pacific Populations of the Olive Ridley Turtle (*Lepidochelys olivacea*). Silver Spring, MD, National Marine Fisheries Service and U.S. Fish and Wildlife Service**:** 62 pp.

NMFS and USFWS (2014). Olive Ridley Sea Turtle (*Lepidochelys olivacea*) 5-year Review: Summary and Evaluation. Silver Spring, MD, National Marine Fisheries Service and U.S. Fish and Wildlife Service**:** 87 pp.

NMFS and USFWS (2020a). Endangered Species Act Status Review of the Leatherback Turtle (*Dermochelys coriacea).* Silver Spring, MD, National Marine Fisheries Service and U.S. Fish and Wildlife Service**:** 396 pp.

NMFS and USFWS (2020b). Loggerhead Sea Turtle (*Caretta caretta*) North Pacific Ocean DPS 5-Year Review: Summary and Evaluation. Silver Spring, MD, National Marine Fisheries Service and U.S. Fish and Wildlife Servce**:** 84 pp.

NOAA (2019). Unmanned Aircraft Systems (UAS) Operations Policy 220-1-5, Version 7.0, Department of Commerce, National Oceanic and Atmospheric Adminstration.

NOAA (2021). List of Fisheries for 2021. Federal Register, National)ceanic and Atmospheric Administration. **85:** 3028-3053.

NPFMC and NMFS (2023). Draft Essential Fish Habitat (EFH) 5- Year Review Summary Report, North Pacific Fisheries Management Council and National Marine Fisheries Service**:** 135 pp.

NRC (2005). Marine Mammal Populations and Ocean Noise: Determining When Noise Causes Biologically Significant Effects. Washington DC, National Research Council**:** 142 pp.

O'Connor, A. J. (2013). "Distributions and fishery associations of immature short-tailed albatrosses (*Phoebastria albatrus*) in the North Pacific."

ODFW (2018). Status Review of the Marbled Murrelet (*Brachyramphus marmoratus*) in Oregon and Evaluation of Criteria to Reclassify the Species from Threatened to Endangered under the Oregon Endangered Species Act. Report prepared for the Oregon Fish and Wildlife Commission, January 2018. Oregon Department of Fish and Wildlife, Salem, Oregon.**:** 134 pp.

ODFW (2021). Biological Assessment of the Marbled Murrelet (*Brachyramphus marmoratus*) in Oregon and Evaluation of Criteria to Reclassify the Species from Threatened to Endangered under the Oregon Endangered Species Act. Salem, Oregon, Oregon Fish and Wildlife Commission**:** 128 pp.

ODFW and NMFS (2011). Upper Willamette River Conservation and Recovery Plan for Chinook Salmon and Steelhead, Oregon Department of Fish and Wildlife and National Marine Fisheries Service**:** 722 pp.

PFMC (2023). Fishery Management Plan for U.S. West Coast Fisheries for Highly Migratory Species - Amended through Amendment 7. Portland, OR, Pacific Fishery Management Council**:** 100 pp.

Pike, D. A., E. A. Roznik and I. Bell (2015). "Nest inundation from sea-level rise threatens sea turtle population viability." R Soc Open Sci **2**(7): 150127.

Poloczanska, E. S., C. J. Limpus and G. C. Hays (2009). Vulnerability of Marine Turtles to Climate Change. Advances in Marine Biology. D. W. Sims, Academic Press. **56:** 151-211.

Quakenbush, L., A. L. Bryan and J. Crawford (2022). Winter Ringed Seal Density within Beaufort Sea Oil and Gas Project Areas, BOEM**:** 36 pp.

Quakenbush, L., A. L. Bryan and J. Crawford (2023). Winter Ringed Seal Density in Beaufort Sea Oil and Gas Project Areas. Quarterly Report for April - June 2023**:** 18 pp.

Rantanen, M., A. Y. Karpechko, A. Lipponen, K. Nordling, O. Hyvärinen, K. Ruosteenoja, T. Vihma and A. Laaksonen (2022). "The Arctic has warmed nearly four times faster than the globe since 1979." Communications Earth & Environment **3**(1): 168.

Raphael, M. G., J. Baldwin, G. A. Falaxa, M. H. Huff, M. Lance, S. L. Miller, S. F. Pearson, C. J. Ralph, C. Strong and C. Thompson (2007). Regional population monitoring of t murrelet: field and analytical methods. Portland, Oregon, U.S. Department of Agriculture, Forest Service Pacific Northwest Research Station.**:** 70 pp.

Richardson, W. J., C. R. Greene Jr., C. I. Malme and D. H. Thomson (1995). Marine Mammals and Noise. San Diego, Academic Press.

Sakashita, M. (2021). Petition to List Sunflower Sea Star as Threatened or Endangered Under the U.S. Endangered Species Act. Oakland, cA, Cnter for Biological diversity**:** 23 pp.

Sato, C. and J. Wiles (2021). Periodic Status Review for the Humpback Whale in Washington. Olympia, WA, Washington Deptarment of Fish and Wildlife**:** 36 pp.

Schlundt, C. E., J. J. Finneran, D. A. Carder and S. H. Ridgway (2000). "Temporary shift in masked hearing thresholds of bottlenose dolphins, *Tursiops truncatus*, and white whales, *Delphinapterus leucas*, after exposure to intense tones." Journal of the Acoustic Society of America **107**(6): 3496-3508.

Seminoff, J. A., C. D. Allen, G. H. Balazs, P. H. Dutton, T. Eguchi, H. L. Haas, S. A. Hargrove, M. P. Jensen, D. L. Klemm, A. M. Lauritsen, S. L. MacPherson, P. Opay, E. E. Possardt, S. L. Pultz, E. E. Seney, K. S. Van Houtan and R. S. Waples (2015). Status Review of the Green Turtle (*Chelonia mydas*) Under the U.S. Endangered Species Act. NOAA Technical Memorandum**:** 571 pp.

Sievanen, L., J. Phillips, C. Colgan, G. Griggs, J. Finzi Hart, E. Hartge, T. Hill, R. Kudela, N. Mantua and K. Nielsen (2018). "California's coast and ocean summary report." California's Fourth Climate Change Assessment. Publication number: SUMCCC4A-2018-011.

Southall, B., A. E. Bowles, W. T. Ellison, J. J. Finneran, R. L. Gentry, C. R. G. Jr., D. Kastak, D. R. Ketten, J. H. Miller, P. E. Nachtigall, W. J. Richardson, J. A. Thomas and P. L. Tyack (2007). "Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations." Aquatic Mammals **33**(4): 411-509.

Southall, B. L., J. J. Finneran, C. Reichmuth, P. E. Nachtigall, D. R. Ketten, A. E. Bowles, W. T. Ellison, D. P. Nowacek and P. L. Tyack (2019). "Marine Mammal Noise Exposure Criteria: Updated Scientific Recommendations for Residual Hearing Effects." Aquatic Mammals **45**(2): 125-232.

Spencer, P. D., A. B. Hollowed, M. F. Sigler, A. J. Hermann and M. W. Nelson (2019). "Trait-based climate vulnerability assessments in data-rich systems: An application to eastern Bering Sea fish and invertebrate stocks." Global Change Biology **25**(11): 3954-3971.

Stewart, I. and A. Hicks (2022). Assessment of the Pacific halibut (*Hippoglossus stenolepis*) stock at the end of 2021, International Pacific Halibut Commission**:** 36 pp.

Suryan, R. M., M. L. Arimitsu, H. A. Coletti, R. R. Hopcroft, M. R. Lindeberg, S. J. Barbeaux, S. D. Batten, W. J. Burt, M. A. Bishop, J. L. Bodkin, R. Brenner, R. W. Campbell, D. A. Cushing, S. L. Danielson, M. W. Dorn, B. Drummond, D. Esler, T. Gelatt, D. H. Hanselman, S. A. Hatch, S. Haught, K. Holderied, K. Iken, D. B. Irons, A. B. Kettle, D. G. Kimmel, B. Konar, K. J. Kuletz, B. J. Laurel, J. M. Maniscalco, C. Matkin, C. A. E. McKinstry, D. H. Monson, J. R. Moran, D. Olsen, W. A. Palsson, W. S. Pegau, J. F. Piatt, L. A. Rogers, N. A. Rojek, A. Schaefer, I. B. Spies, J. M. Straley, S. L. Strom, K. L. Sweeney, M. Szymkowiak, B. P. Weitzman, E. M. Yasumiishi and S. G. Zador (2021). "Ecosystem response persists after a prolonged marine heatwave." Sci Rep **11**(1): 6235.

Szuwalski, C. S., K. Aydin, E. J. Fedewa, B. Garber-Yonts and M. A. Litzow (2023). "The collapse of eastern Bering Sea snow crab." Science **382**(6668): 306-310.

UCSRB (2007). Upper Columbia Spring Chinook Salmon and Steelhead Recovery Plan, Upper Columbia Salmon Recovery Board, National Marine Fisheries Service, and U.S. Fish and Wildlife Service**:** 362 pp.

USFWS (1997). Recovery Plan for the Threatened Marbled Murrlet (*Brachyramphus marmoratus*) in Washington, Oregon, and California. U.S. Fish and Wildlife Service, Portland, OR**:** 203 pp.

USFWS (2008). Short-Tailed Albatross Recovery Plan. U.S. Fish and Wildlife Service, Anchorage Fish and Wildlife Field Office. Anchorage, AK**:** 105 pp.

USFWS (2010). 75 FR 76086 Final Rule Designation of Critical Habitat for the Polar Bear (*Ursus maritimus*) in the United States. Federal Register. **75:** 76086-76137.

USFWS (2014a). 5-Year Review: Summary and Evaluation Short-tailed Albatross (*Phoebastria albatrus)* U.S. Fish and Wildlife Service, Anchorage Fish and Wildlife Field Office. Anchorage, Alaska**:** 43 pp.

USFWS (2014b). Revised Pacific Walrus Stock Assessment Report, U.S. Dept. of the Interior, U.S. Fish and Wildlife Service**:** 30 pp.

USFWS (2014c). Revised Stock Assessment Report Northern Sea Otter (*Enhydra lutris kenyoni)* Southwest Alaska Stock, U.S. Dept. of the Interior, U.S. Fish and Wildlife Service**:** 23 pp.

USFWS (2015). Biological Opinion for the Effects of the Fishery Management Plans for the Gulf of Alaska and Bering Sea/Aleutian Islands Groundfish Fisheries and the State of Alaska Parallel Groundfish Fisheries. Anchorage, AK, U.S. Fish and Wildlife Service**:** 54 pp.

USFWS (2017a). Biological Opinion: Proposed Oil and Gas Lease Sale 244 in Cook Inlet, Alaska. Anchorage, AK, U.S. Dept. of the Interior, U.S. Fish and Wildlife Service**:** 168 pp.

USFWS (2017b). Programmatic Biological Opinion on the Fisheries and Ecosystem Research Program Proposed by NOAA-Fisheries' Southwest Fisheries Science Center (SWFSC) and Northwest Fisheries Science Center (NWFSC). Portland, OR, U.S. Fish and Wildlife Service**:** 244 pp.

USFWS (2018a). Biological Opinion on the Effects of Groundfish Research Surveys by the Alaska Fisheries Science Center in Alaska, U.S. Fish and Wildlife Service**:** 30 pp.

USFWS (2018b). Final Stock Assessment Report Northern Sea Otter (*Enhydra lutris kenyon)* Washington Stock, U.S. Fish and Wildlife Service**:** 7 pp.

USFWS (2019a). Marbled Murrelet (*Brachyramphus marmoratus*) 5-Year Status Review. Lacy, Washington, U.S. Fish and Wildlife Service Washington Fish and Wildlife Office**:** 118 pp.

USFWS (2019b). Status Assessment of The Alaska-breeding Population of Steller's Eiders. Fairbanks, AK, U.S. Fish and Wildlife Service, Fairbanks Fish and Wildlife Field Office**:** 149 pp.

USFWS (2020a). Short-tailed Albatross (*Phoebastria albatrus*) 5-Year Review: Summary and Evaluation. Anchorage, AK, U.S. Fish and Wildlife Service**:** 47 pp.

USFWS (2020b). Species status assessment report for the Southwest Distinct Population Segment of the Northern Sea Otter (*Enhydra lutris kenyoni*), Version 2.0.**:** 183 pp.

USFWS (2021a). Biological Opinion on the NOAA-funded Distributed Biological Observatory Time-Series Cruises, Alaska. Anchorage, AK, U.S. Fish and Wildlife Service**:** 42 pp.

USFWS (2021b). Biological Opinion on the Proposed Modification of the EPA General Permit AKG524000 for Offshore Seafood Processors in Alaska and on the NMFS Groundfish Fishery for the Gulf of Alaska, Bering Sea, and Aleutians Islands. Anchorage, AK, U.S. Fish and Wildlife Service**:** 82 pp.

USFWS (2021c). Birds of Conservation Concern 2021 Migratory Bird Program, U.S. Fish an Wildlife Service**:** 48 pp.

USFWS (2021d). Chukchi-Bering Sea Polar Bear Stock Assessment Report, U.S. Fish and Wildlife Service**:** 41 pp.

USFWS (2021e). Southern Beaufort Sea Polar Bear SAR, U.S. Fish and Wildlife Service**:** 36 pp.

USFWS (2022). Biological Opinion on the Fisheries Research Conducted and Funded by the Alaska Fisheries Science Center and the International Pacific Halibut Commission in Waters of Alaska (Consultation 2022-0026619-S7). Seattle, WA, U.S. Fish and Wildlife Service**:** 62 pp.

USFWS (2023a). Northern Sea Otter (Enhydra lutris kenyoni) Stock Assessment Report: Southcentral Alaska Sock, U.S. Fish and Wildlife Service**:** 18 pp.

USFWS (2023b). Northern Sea Otter (*Enhydra lutris kenyoni*) Stock Assessment Report: Southeast Alaska Sock, U.S. Fish and Wildlife Service**:** 17 pp.

USFWS (2023c). Northern Sea Otter (*Enhydra lutris kenyoni*) Stock Assessment Report: Southwest Alaska Stock, U.S. Fish and Wildlife Service**:** 21 pp.

USFWS (2023d). Pacific Walrus (*Odobenus rosmarus divergens*) Stock Assessment Report: Alaska Stock, U.S. Fish and Wildlife Service**:** 14 pp.

Wilson, J., T. Buehrens, D. Rawding and E. Olk (2020). Estimates of Adult Fall Chinook Salmon Spawner Abundance and Viable Salmonid Population Parameters in the Washington Portion of the Lower Columbia River ESU 2013-2017. Ridgefield, WA, Washington Department of Fish and Wildlife**:** 2.2 pp.

Young, N. C., A. Brower, M. Muto, J. C. Freed, R. Angliss, N. A. Friday, P. Boveng, B. Brost, M. F. Cameron, J. L. Crance, M. Dahle, B. S. Fadely, M. Ferguson, F. Goetz, J. M. London, E. Oleson, R. Ream, E. L. Richmond, K. Shelden, K. Sweeney, R. G. Towell, P. R. Wade, J. M. Waite and A. Zerbini (2023). Final Alaska Marine Mammal Stock Assessments, 2022. Seattle, WA, National Marine Fisheries Service**:** 316 pp.

Zacher, L. S., J. I. Richar, E. Fedewa, R. Ryznar and M. A. Litzow (2022). The 2022 Eastern Bering Sea Continental Shelf Trawl Survey: Results for Commercial Crab Species DRAFT. NOAA Technical Memorandum NMFS-AFSC. Kodiak, AK, National Marine Fisheries Service**:** 196 pp.

APPENDIX A
GEAR AND VESSEL DESCRIPTIONS

APPENDIX B
AFSC GEOGRAPHIC AREAS OF RESEARCH

APPENDIX C
PROTECTED SPECIES HANDLING PROCEDURES

Appendix A

Descriptions of AFSC Gear and Vessels

Table of Contents

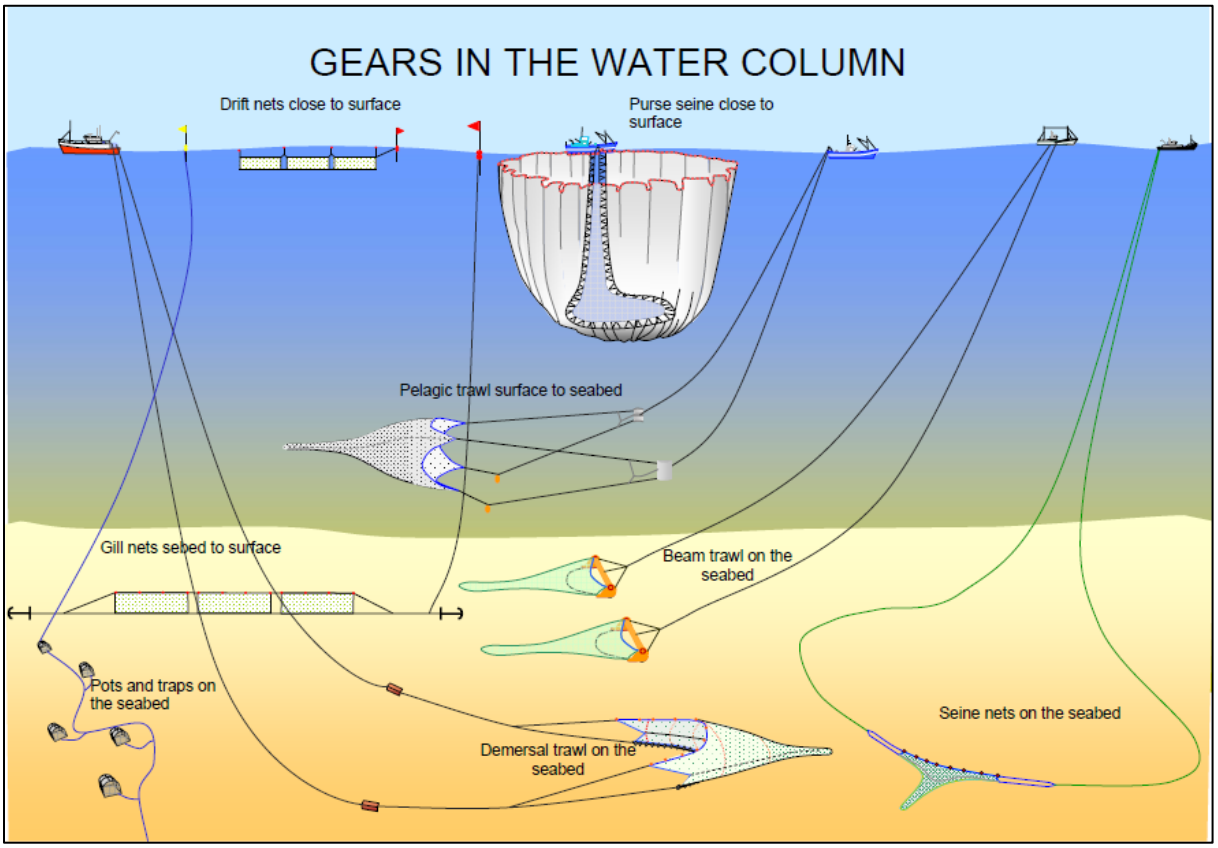
List of Figures

List of Tables

This page intentionally left blank.

1. Net-Based Gear

Various types of sampling gear composed of or containing nets are used by the AFSC in order to catch or trap marine organisms for study. Figure A-1 depicts several types of commercial fishing net gear.



Credit: Seafish 2005. Note: not all depicted gear types are used in AFSC research.

Figure A-1 Fishing gears in the water column

Trawl Nets

A trawl net is a funnel-shaped net towed behind a boat to capture organisms. Trawl nets are made of four basic parts – the opening (or, 'mouth') of the net, the spreading mechanism, the body of the net, and the codend (or, 'bag') (Figure A-2). The mouth is held open vertically using floatation on the upper edge, or 'headrope,' and weights on the lower edge, or 'footrope.' In most trawls used in AFSC research, the mouth is spread open horizontally during fishing using steel trawl doors. In some types of trawl nets, such as beam trawls, the mouth is spread open by a rigid bar called a 'beam'. Large panels of wide mesh at the horizontal reaches of the mouth, called 'wings', are connected to the trawl doors. The mouth of the net is held open (horizontally and vertically) by the hydrodynamic force exerted on the trawl doors attached to the wings of the net, floats placed on the headrope, and the net itself as the vessel moves forward.

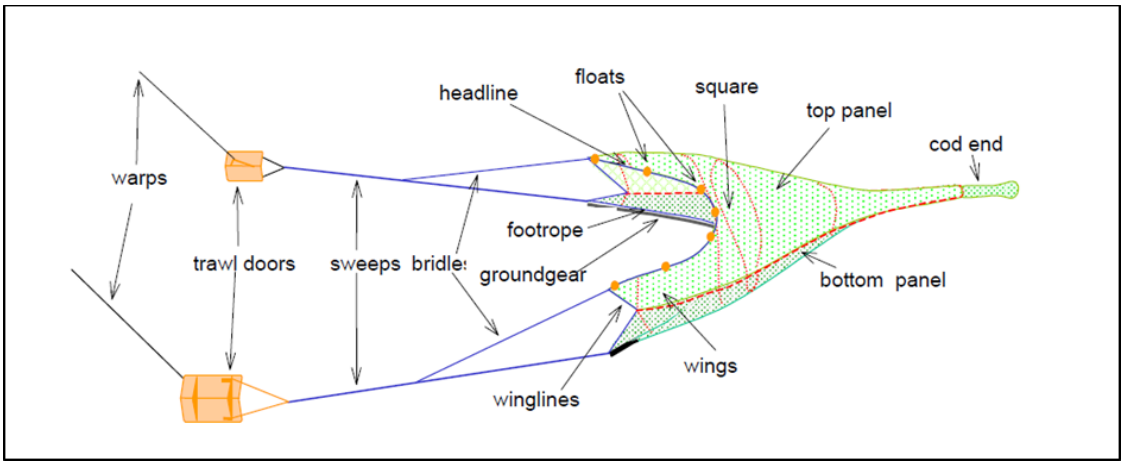


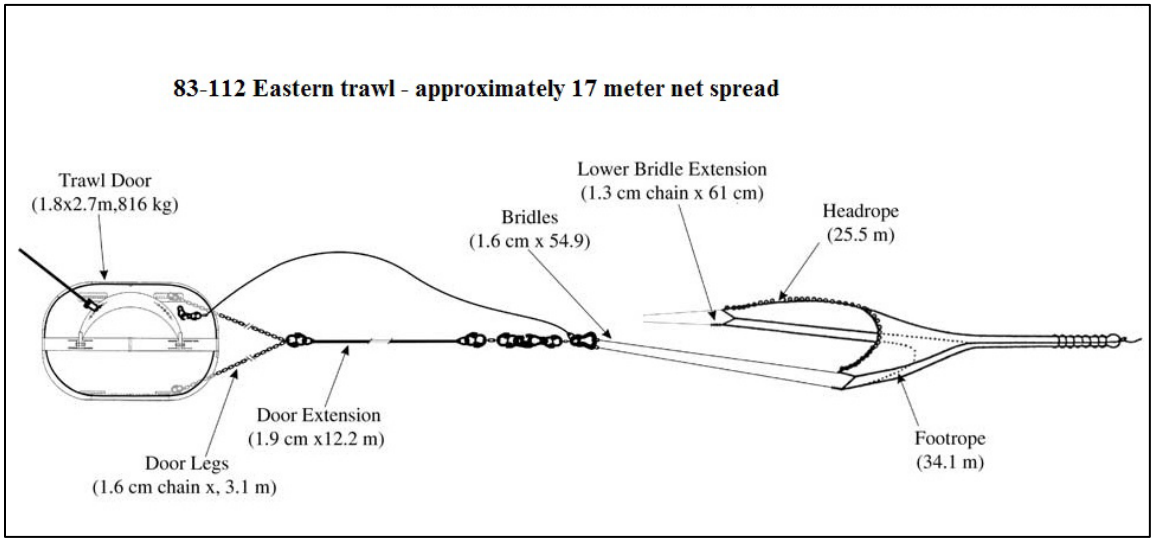
Figure A-2 Otter bottom trawl illustration

The body of the trawl net is made of panels of different sized mesh (Figure A-5). Mesh size is largest at the wings and near the mouth and, depending on construction of the net and target species, mesh size gets progressively smaller towards the codend portion of the net. The codend has the finest mesh of the net and is where fish and other organisms larger than the mesh size are retained. In contrast to commercial fishery operations, which generally use larger mesh to capture marketable fish, research trawls often use smaller mesh throughout the net to catch fish of many sizes. This helps to make estimates of the size and age distributions of fish in a particular area. Research trawls typically have much smaller openings, from 10 to 17 m compared to commercial trawls that can have openings over 90 m.

The trawl net is usually deployed over the stern of the vessel, and attached with two cables, or 'warps,' to winches on the deck of the vessel. The cables are paid out until the net reaches the fishing depth. The duration of the tow depends on the purpose of the trawl, the catch rate, and the target species. AFSC trawl surveys typically involve tow speeds from two to four knots and tow durations from 10 to 45 minutes. At the end of the tow, the net is retrieved and the contents of the cod end are emptied onto the deck or sorting table. For research purposes, the speed and duration of the tow and the characteristics of the net must be standardized to allow for meaningful comparisons of data collected at different times and locations. Active acoustic devices incorporated into some research vessels and trawl gear may be used to monitor the position and status of the net, speed of the tow, and other variables important to the research design.

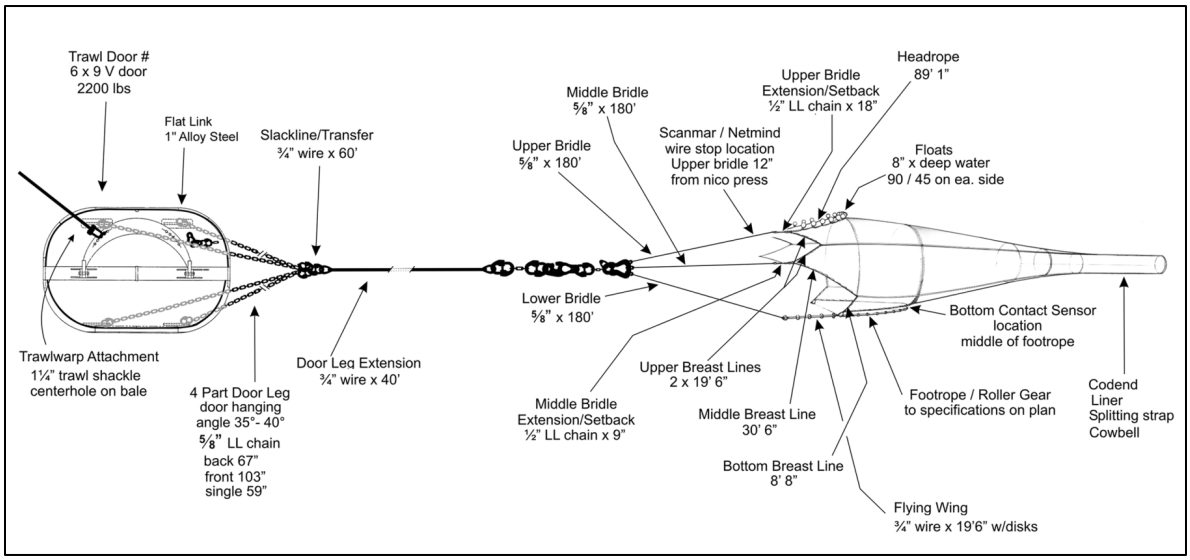
AFSC research trawling activities use both 'pelagic' (surface or mid-water) trawls, which are designed to operate at various depths within the water column, as well as 'bottom' trawls, which are designed to capture target species at or near the seafloor. Bottom trawls often have bobbins or roller gear to protect the footrope as the net is dragged along the seabed. Within these two basic deployment methodologies, there are many different designs used by the AFSC oriented to the basic needs of each survey or target species. Common bottom trawls include the 83-112 Eastern Trawl (Figure A-3) used in the Bering Sea

Bottom Trawl Survey and the more fortified Poly Nor'eastern (PNE) bottom trawl (Figure A-4) used in the Aleutian Islands, Bering Sea Slope, and Gulf of Alaska Bottom Biennial Bottom Trawl Surveys. AFSC also uses push trawls (Figure A-5) during the Yukon Delta Nearshore Surveys. Push trawls differ from most other trawls in that vessels push nets in shallow, nearshore waters.



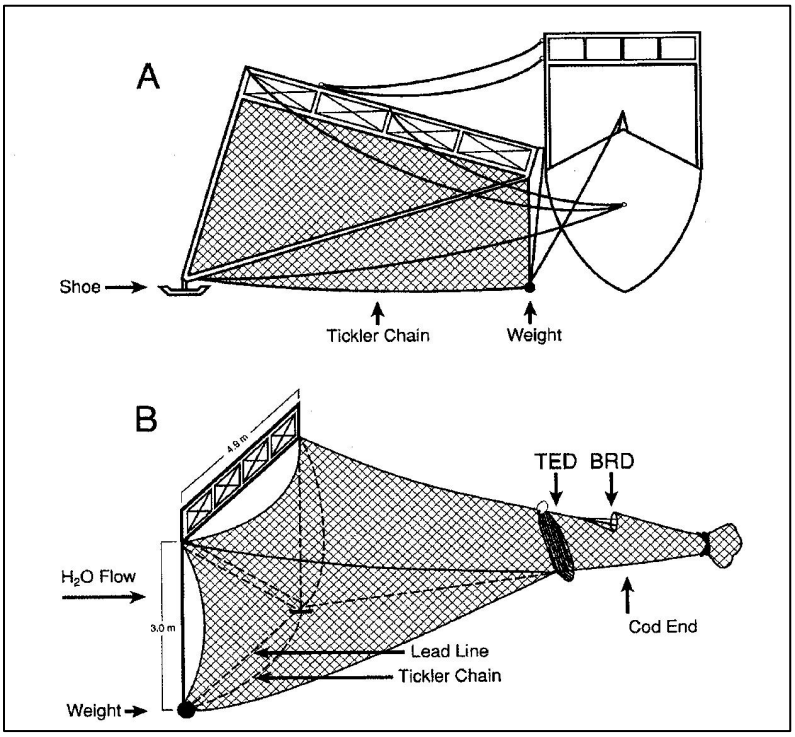
Credit: SFOS 2015

Figure A-3 83-112 Eastern trawl illustration



Credit: Stauffer 2004

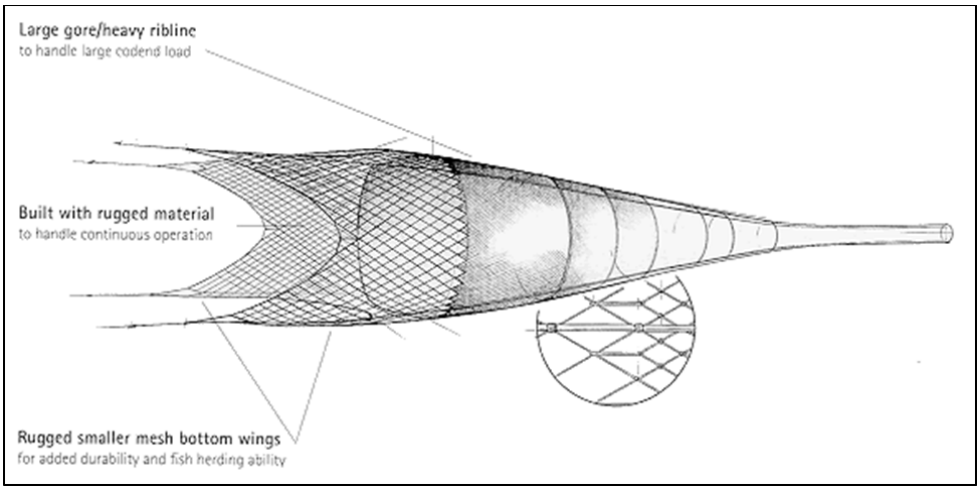
Figure A-4 Poly Nor'eastern bottom trawl illustration



Credit: NOAA 2014; Push trawls used by the AFSC do not include a Turtle Excluder Device (TED) or Bycatch Reduction Device (BRD)

Figure A-5 Push trawl illustration

Midwater trawls include the Nordic 264 trawl, anchovy trawl, Cantrawl, Marinovich trawl, and Aleutian wing trawl (Figure A-6) used on the Acoustic Trawl Surveys, and the Kodiak trawl (Figure A-7) used in the Yukon Delta Nearshore Surveys. AFSC construction, repair, and use of the bottom trawl survey trawls adhere to national standards (Stauffer 2004).



Credit: Net Systems Inc. 2016

Figure A-6 Aleutian wing pelagic trawl illustration

Credit: California Department of Fish and Wildlife 2015

Figure A-7 Kodiak trawl

A beam trawl (Figure A-8) is a type of bottom trawl that uses a wood or metal beam to hold the net open as it is towed along the sea floor. The beam holds open the mouth of the net and trawl doors are not needed. Beam trawls are generally smaller than other types of bottom trawls. Beam trawls used by the AFSC typically use beams less than or equal to 3 m in length for post-larval, juvenile fish and invertebrate surveys.

Credit: SFOS 2015

Figure A-8 Plumb staff beam trawl

A nephrops trawl is designed to be towed over rough seabeds where nephrops may be found. The mouth of the net is held open by a pair of otter boards (trawl doors) and the net is fitted with a rock hopper footrope to tow over such 'patchy' areas. Generally, nephrops trawl nets are towed in areas of low concentrations of other fish but are fitted with legislation square mesh panels. The gear that contacts the seabed is made up of large rubber discs spaced out using smaller rubber discs between them, all of which is threaded onto either wire or chain. While the gear may appear heavy, it is quite light and is designed to 'bounce' easily over the rough bottom that may be interspersed with muddy seabeds[1].

Plankton Nets

AFSC research activities include the use of several plankton sampling nets which employ very fine mesh to sample plankton and fish eggs from various parts of the water column. Plankton sampling nets usually consist of fine mesh attached to a rigid frame. The frame spreads the mouth of the net to cover a known surface area. Many plankton nets have a removable collection container at the codend where the sample is concentrated. When the net is retrieved, the catch is washed to the cod end with a saltwater hose and then the collecting bucket can be detached and easily transported to a laboratory. Plankton nets may be towed through the water horizontally, vertically, or at an oblique angle. Often, plankton nets are equipped with instruments such as flow meters or pitch sensors to provide researchers with additional information about the tow or to ensure plankton nets are deployed consistently. Plankton nets are generally used to

[1] https://www.seafi sh.org/responsible-sourcing/fi shing-gear-database/gear/demersal-trawl-nephrops-hopper-trawl; Accessed August 8, 2023.

collect marine organisms for research purposes, and are not used for commercial harvest. AFSC plankton nets employ mesh sizes from 63 to 500 micrometers (µm).

To capture plankton with vertical tows, the AFSC uses ring nets or CalVET nets. A ring net consists of a circular frame and a cone-shaped net with a collection jar at the codend. The net, attached to a labeled dropline, is lowered into the water while maintaining the net's vertical position. When the desired depth is reached, the net is pulled straight up through the water column to collect the sample (Dougherty 2010).

Bongo nets consist of two cylindrical nets whose frames are yoked together and allows replicate samples to be collected concurrently (Figure A-8). The bongo nets are of various diameters and fine mesh sizes and are towed through the water at various depths to sample plankton in different parts of the water column. During each plankton tow, the bongo net is deployed to the desired depth and is then retrieved at a controlled rate so that the volume of water sampled is uniform across the range of depths. In shallow areas, sampling protocol is adjusted to prevent contact between the bongo nets and the seafloor. A collecting bucket, attached to the codend of the net, is used to contain the plankton sample.

Credit: Morgan Busby, Alaska Fisheries Science Center

Figure A-9 Bongo net

The Tucker net (Figure A-10) is a medium-sized single-warp trawl net used to capture plankton at different depths. The Tucker trawl usually consists of a series of nets that can be opened and closed sequentially without retrieving the net from the fishing depth.

Credit: AFSC 2015a

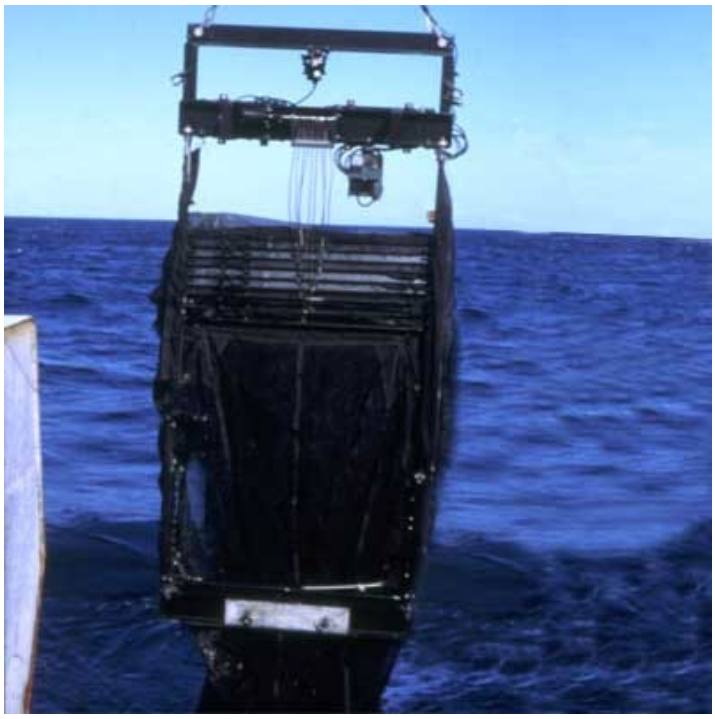
Figure A-10 Tucker trawl

Neuston nets (Figure A-11) are designed to capture members of the neuston, the collective term for the organisms that inhabit the water's surface. Neuston nets have a rectangular frame and are towed horizontally at the top of the water column, half submerged at 1-2 knots from the side of the vessel on a boom to avoid the ship's wake.

Figure A-11 Neuston net

The Multiple Opening/Closing Net and Environmental Sensing System (MOCNESS) is based on the Tucker trawl principle where a stepping motor is used to sequentially control the opening and closing of the nets

using underwater and shipboard electronics (Figure A-12). The electronics system continuously monitors the functioning of the nets, frame angle, horizontal velocity, vertical velocity, volume filtered, and selected environmental parameters, such as salinity and temperature. The AFSC utilizes the MOCNESS and the Multinet to determine the vertical distribution of larval fishes and crabs for use in transport models. Data is also used to investigate the effects of climate variability on recruitment.



Credit: AFSC 2015a

Figure A-12 MOCNESS

Seine Nets

A seine is a fishing net that generally hangs vertically in the water with its bottom edge held down by weights and its top edge buoyed by floats. AFSC uses two types of seines for research - beach seines and pole seines.

Beach seines are deployed from shore to surround all fish in a nearshore area. When setting the net, one end is fastened to the shore while the other end is set out in a wide arc and brought back to the beach. A beach seine can be deployed by hand or with the help of a small boat. When the net is set, each side is pulled in simultaneously, herding the fish toward the beach (Figure A-13). During the entire operation, the headrope with floats stays on the surface and the weighted footrope remains in contact with the bottom to prevent fish from escaping the area enclosed by the net. The beach seines used in AFSC research are 15 to 30 feet in depth and 75 to 150 feet in length, with mesh sizes of less than 1 inch.

A pole seine is a rectangular net that has a pole on either end to keep the net rigid and act as a handle for pulling the net in (Figure A-14). The net is pulled along the bottom by hand as two or more people hold the poles and walk through the water. Fish and other organisms are captured by walking the net towards shore or tilting the poles backwards and lifting the net out of the water.

Credit: Paul Olsen, NOAA Fisheries

Figure A-13 A beach seine being pulled in

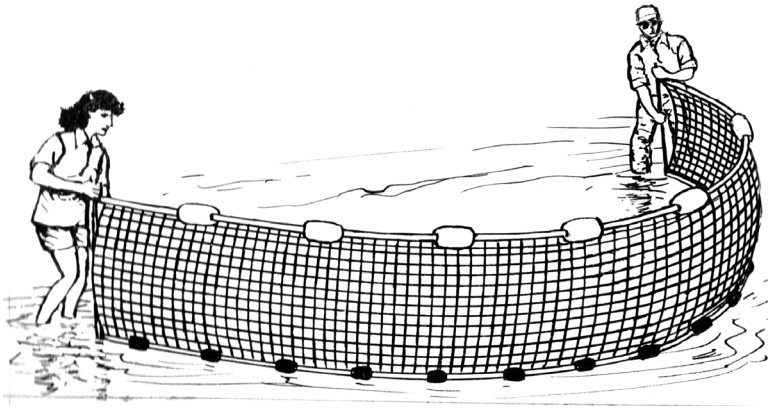


Figure A-14 Pole seine

Cast Nets

Cast nets are a light weight circular net with weights around the perimeter. The net is thrown from shore or from a vessel and falls towards the bottom, trapping any fish that are caught (FAO 2015a). The AFSC uses cast nets to survey forage fish and in educational programs.

Gillnets

Gillnets (Figure A-15) consist of vertical netting held in place by floats and weights to selectively target fish of uniform size depending on the netting size (Walden 1996). Gillnets are either anchored to the bottom ('set gillnet') or are deployed with one end attached to a vessel and is allowed to drift with the current or tides ('drift gillnet'). Gillnets are made of monofilament, multi-monofilament, or multifilament nylon constructed of single, double, or triple netting/paneling of varying mesh sizes, depending on their use and target species (Hovgård and Lassen 2000). A specific mesh size will catch a target species of a limited size range, allowing this gear type to be very selective. The AFSC uses gillnets of various mesh sizes and 35 to 150 ft in length in forage fish and salmon studies.

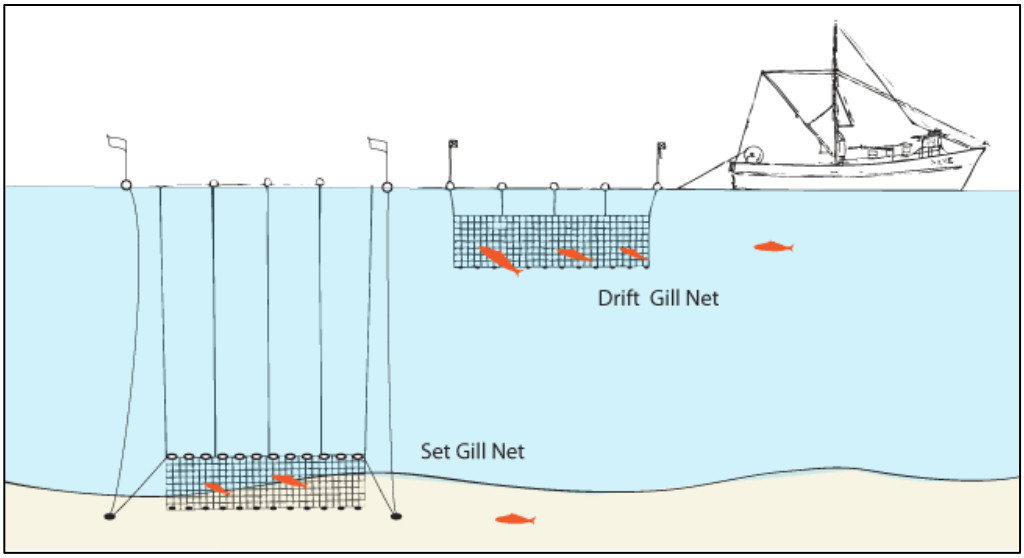


Figure A-15 Diagram of a drift and set gillnet deployment

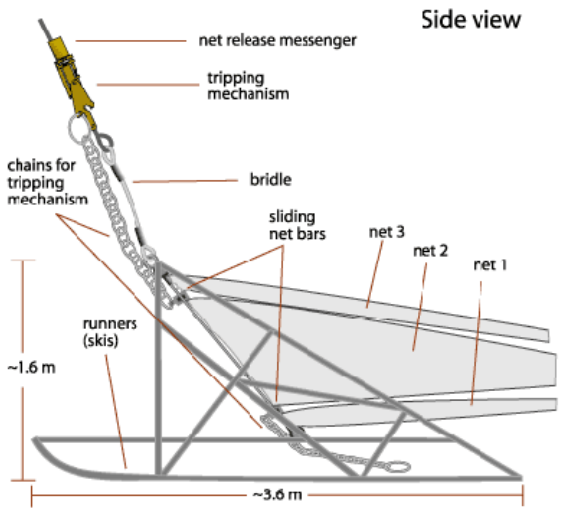
Dip Nets

A dip net (Figure A-16) is a bag net attached to a long rod that is used by hand to scoop fish or other organisms of interest from the water. Dip nets come in various sizes, the AFSC uses dip nets with a diameter range of 0.25m to 0.5m and a mesh size from 505 µm to 6300 µm.

Figure A-16 Dip net

Epibenthic tow sled

An epibenthic tow sled (Figure A-17) is an instrument that is designed to collect organisms that live on or just above bottom sediments. It consists of a fine mesh net attached to a rigid frame with runners to help it move along the substrate (it resembles a Tucker Trawl on skis). The sled is towed along the bottom at the sediment-water interface, scooping up small fish, shrimp, plankton and other organisms as it goes. The AFSC uses an epi-benthic tow sled with a 0.68 m^2 net to collect age-0 flatfish and tanner crabs in nursery areas off Kodiak Island and a 1 m^2 mouth area sled with 0.500 mm mesh in the Arctic to capture near bottom invertebrates and larval fish.



Credit: AFSC 2015a

Figure A-17 Diagram of an epibenthic tow sled

Rock Dredges

The AFSC uses a six foot wide Virginia crab style dredge fitted with a half inch nylon mesh liner (Figure A-18). This dredge type consists of a heavy metal rectangular form bearing a toothed drag bar and a mesh bag to collect specimens.

Credit: Maryland Department of Natural Resources 2016

Figure A-18 Virginia crab style dredge

Pots and Traps

Fishing pots and traps are three-dimensional structures that permit fish and other organisms to enter the enclosure but make it difficult for them to escape. Traps and pots allow commercial fishers and researchers to capture live fish and can allow them to return bycatch to the water unharmed. Traps and pots also allow some control over species and sizes of fish that are caught. The trap entrance can be regulated to control the maximum size of fish that enter. The size of the mesh in the body of the trap can regulate the minimum size that is retained. In general, the fish species caught depend on the type and characteristics of the pot or trap used. Fishing traps and pots used by AFSC include fyke nets, net pens, weirs, and pots.

A fyke net (Figure A-19) is a fish trap that consists of cylindrical or cone-shaped netting bags that are mounted on rings or other rigid structures and fixed on the bottom by anchors, ballast or stakes. Fyke traps are often outfitted with wings and/or leaders to guide fish towards the entrance of the bags. The Fyke net used by the AFSC is constructed with a length of 40 ft and a mesh size of ½ inch and is only deployed in freshwater to capture juvenile salmon.

Figure A-19 Fyke net diagram

A net pen is a three sided net with no top that is designed to hold fish alive. The net pen used by AFSC is 20 ft deep by 20 ft wide by 20 ft long.

A hoop net is a long conical trap made of multiple successive hoops, typically six or seven, and multiple nested funnels. Fish swim into each successive funnel and become trapped (FAO 2015b). The hoop net used by the AFSC is 3 ft in diameter and 8 ft in length with a mesh size of ¼ inch.

A weir is a barrier across a river that is designed to alter the movements of fish so they can be either caught more easily or counted. There are many types of designs and constructions of weirs, from temporary wood weirs to permanent concrete and metal weirs. The type of weir utilized for a particular area is dependent on the tides, bathymetry, and species being targeted. The AFSC operates the Auke Creek Weir in the Juneau area of Alaska. This weir is used for tracking salmonid migration patterns in Auke Creek.

Pots generally consist of a rigid square, circular or conical frame made of steel, wood, or plastic. Stretched between the framing members is nylon netting with one or more funnel-shaped entrance tunnels. Pots are often baited with squid and herring and thrown overboard to rest on the seafloor and are often attached by a rope to a buoy at the water's surface. If a series of pots is set, a groundline may be used to

connect the pots to each other to aid in pot deployment and retrieval. Groundlines and vertical buoy lines can pose an entanglement hazard for marine mammals (NOAA Fisheries 2014). Various pot designs set in a longline fashion are used by the AFSC for the Octopus Gear Trial and Maturity Study in order to determine a configuration that is most effective at collecting octopus and other organisms for biological collection.

A “slinky pot” is a tunnel shaped pot that may be used as long as the pot is equipped with an 18 inch biodegradable panel following regulations for authorized fishing gear specified in 50 CFR 679.2. A slink pot is described as a more efficient and sustainable way to harvest certain species such as Sablefish as compared to the traditional baited hook. Slinky pots are collapsible and lightweight mesh filled with bait, attached to a long line, and set at the bottom of the ocean to await the fish.

2. Hook-and-Line Gear

Numerous variations of fishing gear use hooks in order to catch marine organisms. Two types used by the AFSC for research are bottom longline gear and rod-and-reel gear.

Bottom Longline

Longline fishing is a technique for catching fish in which baited hooks attached to a mainline or 'groundline' are deployed from a vessel. The hooks are attached to the longline by thinner lines called 'gangions.' Longlines can be deployed on the bottom ('bottom longline', Figure A-20), or suspended in midwater ('pelagic longline'). Bottom longlines have a weighted groundline anchored on the seafloor with long buoy lines at either end to allow it to rest on the seafloor while the attached buoys float on the surface. Each end buoy has an attached mast with radar reflector and lights which help crew find the line for retrieval.

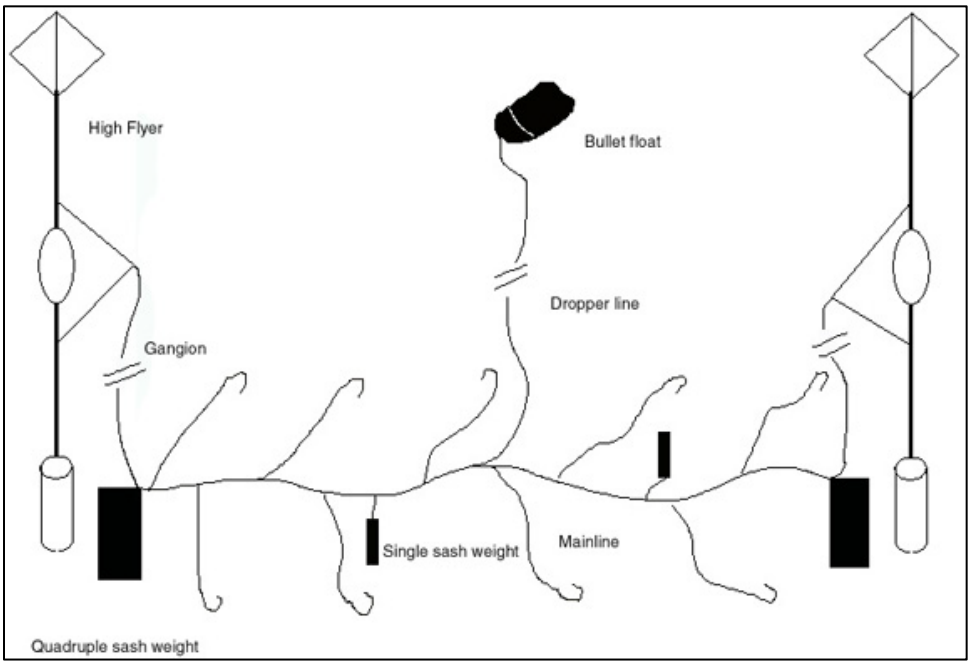


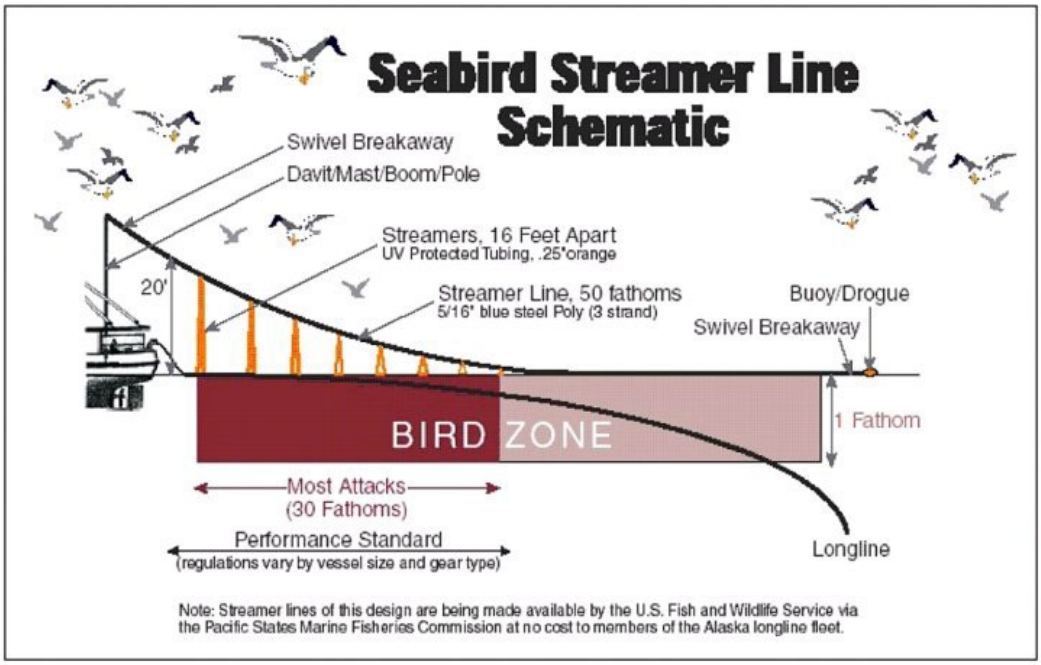
Figure A-20 General bottom longline diagram

The depth and length of the longline, the number of hooks, the length of the gangions, the duration of the set, and the distance between each gangion depend on the species targeted, the size of the vessel used, and the purpose of the fishing activity. A commercial longline set can be well over 10 miles long, have up to 20,000 baited hooks and once deployed can soak anywhere from hours to days ('soak time').

Longlines used for AFSC research purposes are 16 km in length, have 7,200 hooks, and soak for three hours, although haulback operations can take up to eight hours to complete.

Soak time is an important parameter for calculating fishing effort. For commercial fisheries, the optimal soak time maximizes the catch of target species while minimizing bycatch and minimizing damage to hooked target fish that may result from sharks or other predators. Haulback operations and soak time can be an important factor for controlling longline interactions with protected species. Marine mammals may be attracted to bait during haulback, or to fish caught on the longline hooks, and may become caught on longline hooks or entangled in the longline while attempting to feed on the catch before the longline is retrieved.

Birds may be attracted to the baited longline hooks, particularly while the longline gear is being deployed from the vessel. Birds may get caught on the hooks, or entangled in the gangions while trying to feed on the bait. Birds may also interact with longline gear as the gear is retrieved. Tori lines, consisting of paired streamers, are deployed prior to every longline set to mitigate entanglement of seabirds diving on baited hooks. The tori line gear and deployment protocols are consistent with the bird-avoidance requirements imposed on the commercial longline fleet under Magnuson-Stevens Act regulations in Alaska (Figure A-21).



Credit: Washington Sea Grant, Seattle WA

Figure A-21 Tori lines deployed for longline sets to deter seabirds

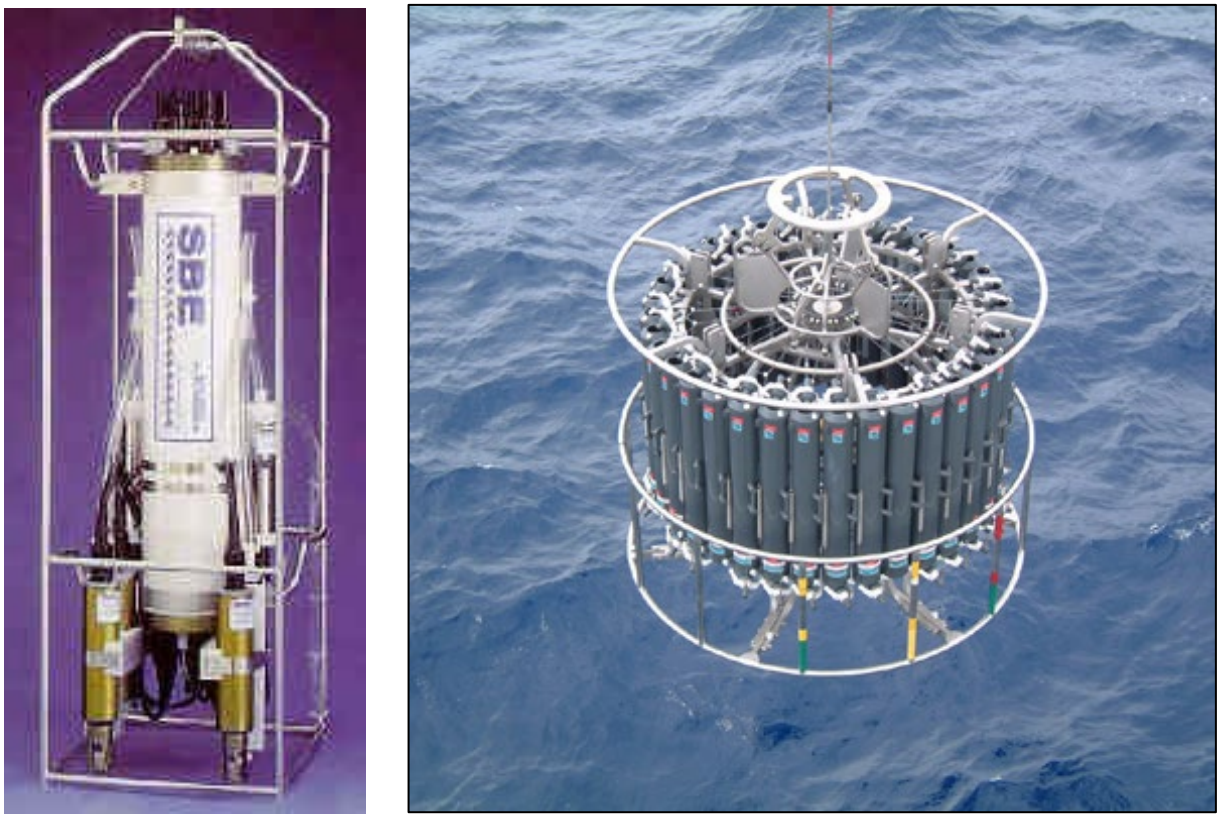
Rod and Reel

A standard fishing pole with a reel attached near the base can be used to catch fish in areas where longline, trawl or other gears are not feasible, such as complex bottom substrates, or where the survivability of the fish after capture is important. The AFSC utilizes rod and reel gear for their Juvenile Sablefish Tagging Survey. In this survey, baited jigging rigs are used in order to catch sablefish for mark and recapture analysis.

3. Oceanographic Instruments

Conductivity, Temperature, and Depth (CTD) and Water Samples

A CTD profiler measures these parameters and is the primary research tool for determining chemical and physical properties of seawater. A CTD profiler may be a fairly small device (Figure A-8 immediately above the Bongo net) or it may be deployed with a variety of other oceanographic sensors and water sampling devices (e.g., Niskin or go-flo bottles) in a large (1 to 2 meter diameter) metal rosette wheel (Figure A-22). The CTD profiler is lowered through the water column on a cable, and CTD data are collected either within the device or via a cable connecting to the ship. Water sampling devices range from a bucket dropped over the side of a small boat to Niskin bottles that are triggered at discrete depths to collect a suite of water samples throughout the water column. A CTD cast takes from minutes to hours to complete depending on water depth (WHOI 2011). The data from a suite of samples collected at different depths are often called a depth profile, and are plotted with the value of the variable of interest on the x-axis and the water depth on the y-axis. Depth profiles for different variables can be compared in order to glean information about physical, chemical, and biological processes occurring in the water column.



Credit: Sea-Bird Electronics, Bellevue WA

Figure A-22 Sea-Bird 911 and CTD deployment on a sampling rosette with Niskin bottles

Free Fall Cone Penetrometer

The Free Fall Cone Penetrometer (FFCPT) is a 52 kg probe designed to free fall through the water and penetrate 3 meters into the seabed (Figure A-23). Sound velocity is measured during deployment, and deceleration and pore pressure are measured at the end of free fall, allowing a profile of sediment types to be inferred. The FFCPT can be deployed at vessel speeds of up to 6 knots, allowing sediment sampling and sound velocity data to be collected without stopping the vessel.

Figure A-23 Free Fall Cone Penetrometer

4. Submersible Delta

The Delta (Figure A-24) is a battery powered two-person submersible with sonar, data loggers, manipulating arms, and other equipment for oceanographic and biological sample collection. The Delta is 15 1/2 feet long, weighs 4,800 lbs, and can dive to a maximum depth of 1,200 feet with a maximum speed of 1.5 knots (Delta Oceanographics 2015).

Credit: AFSC 2015b

Figure A-24 Delta submersible photo

5. Active Acoustic Sources

A wide range of active acoustic sources are used in AFSC fisheries and ecosystem research for remotely sensing bathymetric, oceanographic, and biological features of the environment. Most of these sources involve relatively high frequency, directional, and brief repeated signals tuned to provide sufficient focus on and resolution of specific objects. Table A-1 shows important characteristics of the primary acoustic devices used on NOAA research vessels and NOAA-chartered vessels conducting AFSC fisheries surveys, followed by descriptions of some of the primary general categories of sources, including all those for which acoustic takes of marine mammals are calculated in the LOA application.

Table A-1 Output characteristics for predominant AFSC acoustic sources

Abbreviations: kHz = kilohertz; dB re 1 µPa at 1 m = decibels referenced at one micro Pascal at one meter; ms = millisecond; Hz = hertz

Acoustic system	Operating frequencies	Maximum source level (dB re 1 µPa at 1 m)	Single ping duration (ms) and repetition rate (Hz)	Orientation/ Directionality	Nominal beam width (degrees)
Simrad EK60 narrow beam echosounder	18, 38, 70, 120, 200 kHz	226.7	1 ms @ 1 Hz	Downward looking	11°
Simrad ME70 narrow beam echosounder	70 kHz	226.7	1 ms @ 1 Hz	Downward looking	11°
Simrad ES60 multibeam echosounder	38 and 120 kHz	226.6	1 ms @ 1 Hz	Downward looking	7°
Reson 7111 multibeam echosounder	38, 50, 100, 180, 300 kHz	230		Downward looking	150°

Single Frequency Sonars

The Dual Frequency Identification Sonar (DIDSON) operates on a high frequency of 12 MHz that allows for high resolution for up to 30 m even in dark turbid waters. This type of sonar is used for monitoring net shapes under different fishing conditions and for fish imaging and identification.

Multibeam Echosounder and Sonar

Multibeam echosounders (Figure A-25) and sonars work by transmitting acoustic pulses into the water then measuring the time required for the pulses to reflect and return to the receiver and the angle of the reflected signal. The depth and position of the reflecting surface can be determined from this information, provided that the speed of sound in water can be accurately calculated for the entire signal path. The use of multiple acoustic 'beams' allows coverage of a greater area compared to single beam sonar. The sensor arrays for multibeam echosounders and sonars are usually mounted on the keel of the vessel and have the ability to look horizontally in the water column as well as straight down. Multibeam echosounders and sonars are used for mapping seafloor bathymetry, estimating fish biomass, characterizing fish schools, and studying fish behavior. The AFSC uses the Simrad ES60 operating at 38 and 120 kHz.

Side scan sonars (Figure A-25) are designed to produce imagery of the seafloor. Each side scan sonar consists of three parts: the towfish, the transmission cable, and the topside processing unit. The towfish is deployed near the seafloor and collects echo data for transmission to the topside processing unit which

uses the information to develop imagery of the seabed. Images contain information regarding sediment type and general roughness, and tend to show an improved view of the seafloor over hull-mounted systems due to a lower angle of incidence with the seafloor. In addition to creating higher resolution imagery, side scan sonars are used to collect data on fluorescence of colored dissolved organic matter (CDOM), chlorophyll-a and turbidity.

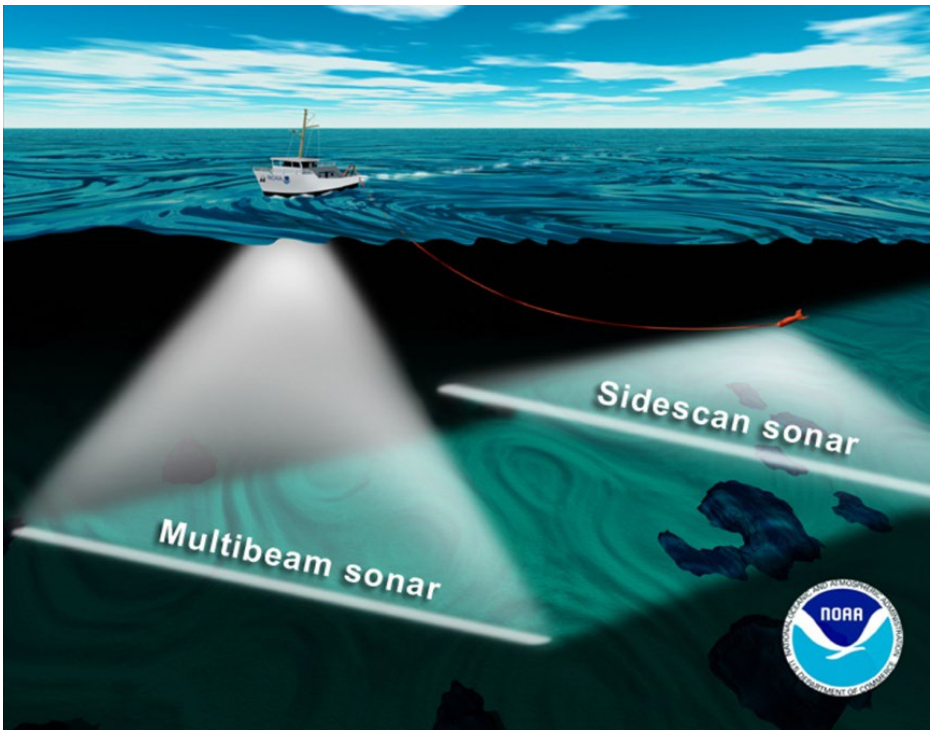


Figure A-25 Conceptual image of a multibeam echosounder and side scan sonar

Multi-Frequency Sensors

Similar to multibeam echosounders, multi-frequency split-beam sensors are deployed from NOAA survey vessels to acoustically map the distributions and estimate the abundances and biomasses of many types of fish; characterize their biotic and abiotic environments; investigate ecological linkages; and gather information about their schooling behavior, migration patterns, and avoidance reactions to the survey vessel. The use of multiple frequencies allows coverage of a broad range of marine acoustic survey activity, ranging from studies of small plankton to large fish schools in a variety of environments from shallow coastal waters to deep ocean basins. Simultaneous use of several discrete echosounder frequencies facilitates accurate estimates of the size of individual fish, and can also be used for species identification based on differences in frequency-dependent acoustic backscattering between species. The AFSC uses primarily the Simrad EK60, which is a split-beam echosounder with built-in calibration. It is specifically suited for permanent installation onboard a research vessel. The Simrad EK60s used in AFSC surveys operate in multiple frequencies simultaneously; 18, 38, 70, 120, and 200 kHz.

6. Underwater Cameras

The AFSC uses a diverse array of underwater camera housing designs in order to capture still and video footage of study areas. Some of these are attached to nets, and some have stand-alone housings that allow the camera to be deployed independently of survey fishing gear.

Underwater Cameras Attached to Fishing Gear

The Conservation Engineering surveys utilize a 20 x 9 x 4.5 inch camera and housing unit that is attached to the headrope of a research trawl. It is a complete integrated unit with internal LED light and battery. It is typically deployed on fishing gear by clipping it to the gear.

The FISHPAC survey utilizes a camera and sample collection device known as the Seabed Observation and Sampling System (SEABOSS, Figure A-26). The SEABOSS is designed to observe and collect data on sediment and physical seabed characteristics. The samples and video collected are used to groundtruth acoustic backscatter.

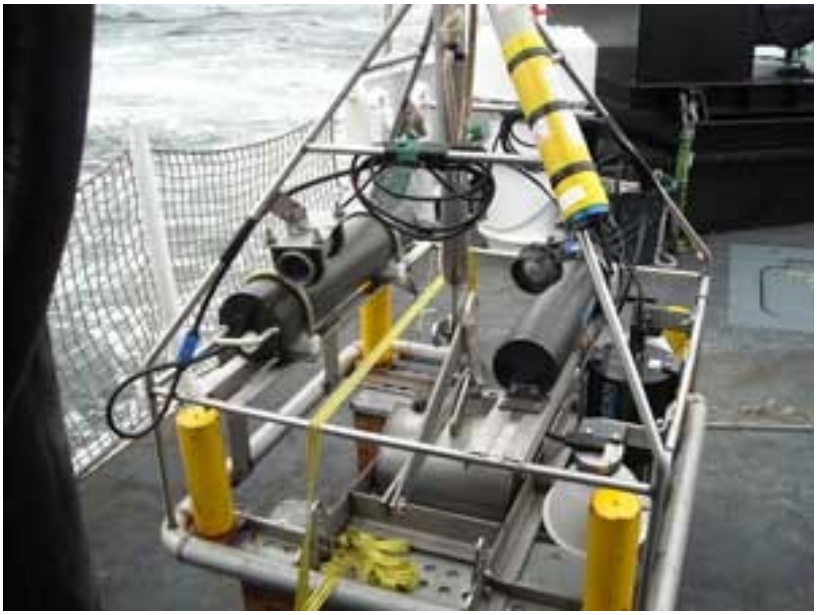


Figure A-26 SEABOSS

Underwater Cameras Deployed Independently of Fishing Gear

The Acoustic Assessment of Snakehead Bank survey used drop cameras housed in a 1 x 0.75 x 0.5 meter cage constructed from aluminum tubing. Two machine-vision cameras spaced approximately 3 cm apart in underwater housings are connected via ethernet cables to a computer also in an underwater housing within the cage.

The Rockfish Habitat Studies survey uses paired video cameras housed and mounted in a metal frame. They are deployed for approximately ~45 minutes at a depth of 45-100 m.

The Deep Sea Coral and Sponge Distribution surveys utilize a stereo camera sled with two cameras four strobe lights contained in an aluminum frame. It is designed to be drifted or towed along the seafloor at a distance of ~1 m off the seafloor. Other towed cameras include the Towed Auto-Compensating Optical System (TACOS, Figure A-27), which utilizes four to six underwater lights and a down-weight up to 25 m in front of the camera sled to stabilize sled motion (Figure A-28). The TACOS is used in the FISHPAC survey to groundtruth acoustic data.

Remotely Operated Vehicles (ROVs) and Autonomous Underwater Vehicles (AUVs) are either owned by AFSC or other NOAA entities and have the potential to be used in new techniques to survey fishes and quantify habitat.

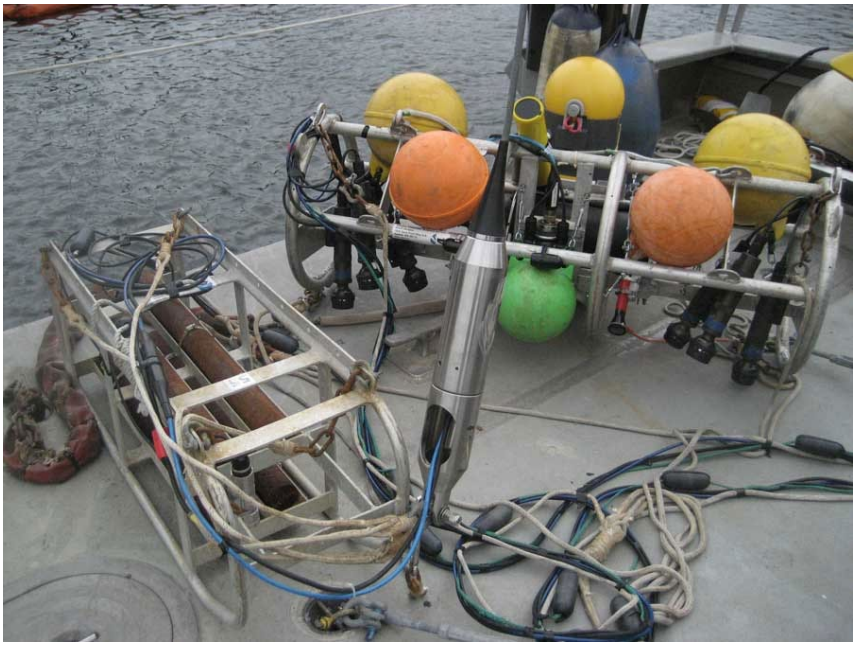


Figure A-27 TACOS video system with weighted sled

Figure A-28 TACOS video system during deployment

7. Vessels used for AFSC Survey Activities

The AFSC primarily employs one NOAA- owned and operated fisheries research vessel, the NOAA Ship *Oscar Dyson* (Figure A-29), and the Alaska Department of Fish and Game (ADFG) uses the R/V *Resolution* to conduct fisheries research on behalf of the AFSC. It also uses the NOAA Ship *Fairweather* (Figure A-30), as well as research vessels in the University National Oceanographic Laboratory (UNOLS) fleet. However, most of the vessels used for AFSC fisheries research are chartered fishing vessels. A wide range of commercial fishing vessels participate in such research, ranging from small open boats to modern trawlers and longliners measuring up to 57 m in length. The sizes of the vessels used, engine types, cruising speeds, etc. vary depending upon the location and requirements of the research for which the vessel is used. Although some vessels are chartered on a regular basis, the particular vessels used year to year depend on availability, research needs, and competition for contract services.

NOAA Ship *Oscar Dyson*

Figure A-29 NOAA Ship *Oscar Dyson*

The *Oscar Dyson* supports NOAA's mission to protect, restore and manage the use of living marine, coastal, and ocean resources through ecosystem-based management. Its primary objective is as a support platform to study and monitor Alaskan pollock and other fisheries, as well as oceanography in the Bering Sea and Gulf of Alaska. The ship also observes weather, sea state, and other environmental conditions, conducts habitat assessments, and surveys marine mammal and marine bird populations. Ship specifications are available at: http://www.moc.noaa.gov/od/

Figure A-30 NOAA Ship *Fairweather*

The *Fairweather* is a hydrographic survey ship that was originally commissioned with NOAA in 1968. The ship was deactivated in 1989 but a critical backlog of surveys for nautical charts in Alaska was a motivating factor to reactivate the ship in 2004. The ship is equipped with the latest in hydrographic survey technology – multi-beam survey systems; high-speed, high-resolution side-scan sonar; position and orientation systems, hydrographic survey launches, and an on-board data-processing server. Increased mission space and deck machinery enable *Fairweather* to be tasked with anything from buoy operations to fisheries research cruises. Ship specifications are available at: http://www.moc.noaa.gov/fa/index.html

R/V *Resolution*

Source: http://www.adfg.alaska.gov/cfregion4/dynamic/research/view/NPRB:1107_Objectives

Figure A-31 R/V *Resolution*

One of many research vessels administered by ADFG, the 27.7m R/V *Resolution* (Figure A-30) was used in the ADFG Large-mesh Trawl Survey and the ADFG Small-mesh Shrimp and Forage Fish Survey.

8. References

Alaska Fisheries Science Center (AFSC). 2015a. Ichthyoplankton Cruise Database gear dictionary. Available online at: http://access.afsc.noaa.gov/icc/gearframe.php

AFSC. 2015b. MESA archives: effects of bottom trawling on soft-bottom sea whip and other habitat in the central Gulf of Alaska. Available online at: http://www.afsc.noaa.gov/ABL/MESA/archives/effects%20of%20trawl%20on%20seawhips.htm

California Department of Fish and Wildlife. 2015. Delta Smelt Populations Plummet 2nd Year in a Row. Available online at: http://www.capradio.org/articles/2016/03/07/delta-smelt-populations-plummet-2nd-year-in-a-row/

Dougherty, A., C. Harpold, and J. Clark. 2010. Ecosystems and Fisheries-Oceanography Coordinated Investigations (EcoFOCI) field manual. AFSC Processed Rep. 2010-02, 213 p. Alaska Fish. Sci. Cent., NOAA, Natl. Mar. Fish. Serv., 7600 Sand Point Way NE, Seattle WA 98115.

Delta Oceanographics. 2015. Available online at: http://www.deltaoceanographics.com/sub.html

Food and Agriculture Organization of the United Nations (FAO). 2015a. Fishing gear types: cast nets. Available online at: http://www.fao.org/fishery/geartype/217/en

FAO. 2015b. Guidelines for sampling fish in inland waters: sampling with traps. Available online at: http://www.fao.org/docrep/003/aa044e/aa044e05.htm

Hovgård, H. and Lassen, H. 2008. Manual on estimation of selectivity for gillnet and longline gears in abundance surveys. FAO Fisheries Technical Paper. No. 397. Rome, FAO. 84 pp. Available online at: http://www.fao.org/docrep/005/X7788E/X7788E00.HTM

Maryland Department of Natural Resources. 2016. 2016 Blue Crab Winter Dredge Survey. Available online at: http://dnr2.maryland.gov/fisheries/Pages/blue-crab/dredge.aspx.

Net Systems Inc. 2016. Available online at: http://www.net-sys.com/96-2/

NOAA Fisheries. 2014. Fishing Gear and Risks to Protected Species. Last updated: January 30, 2014. Available online at: http://www.nmfs.noaa.gov/pr/interactions/gear/

Sea Fish Industry Authority (Seafish). 2005. Basic Fishing Methods. Manchester Street, Hull, UK, APRIL 2005.

Stauffer, G. (Compiler). 2004. NOAA protocols for groundfish bottom trawl surveys of the nation's fishery resources. U.S. Dept. Commerce, NOAA Tech. Memo. NMFS-F/SPO-65, 205 p.

University of Alaska Fairbanks (SFOS) Coastal Marine Institute. Available online at: https://www.sfos.uaf.edu/research/seaicebiota/CMI_crab/images.html

WHOI (2011). Woods Hole Oceanographic Institution, Ships and Technology. Available online at: http://www.whoi.edu/ships_technology/

Walden, J.B. 1996. The New England gillnet effort study. Northeast Fisheries Science Center. Reference Document 96-10; 38p. Available from: National Marine Fisheries Service, 166 Water St., Woods Hole, MA 02543-1026.

Appendix B

Distribution of Research

This page intentionally left blank.

Table of Contents

List of Figures

1. Spatial and Temporal Distribution of AFSC and IPHC Fisheries and Ecosystem Research Effort by Gear Type, Season, and Research Area

This appendix provides a synopsis of AFSC and IPHC fisheries research effort by gear type and by season in the Gulf of Alaska Research Area (GOARA), Bering Sea/Aleutian Islands Research Area (BSAIRA), and Chukchi Sea/Beaufort Sea Research Area (CSBSRA) as well as IPHC research areas offshore of Washington and Oregon. This appendix provides information about the spatial and temporal distribution of research effort in the three research areas to complement the information provided in Table 2-1 of the SPEA.

The data presented in the figures below are sample points or transect lines for recent years when each survey was conducted. Note that all surveys are not conducted annually so the total amount of research represented on the figures would not occur in any given year. These figures are meant to give a visual representation of the spatial and seasonal distribution of AFSC and IPHC fisheries and ecosystem research efforts using some of the most common gear types for each research area.

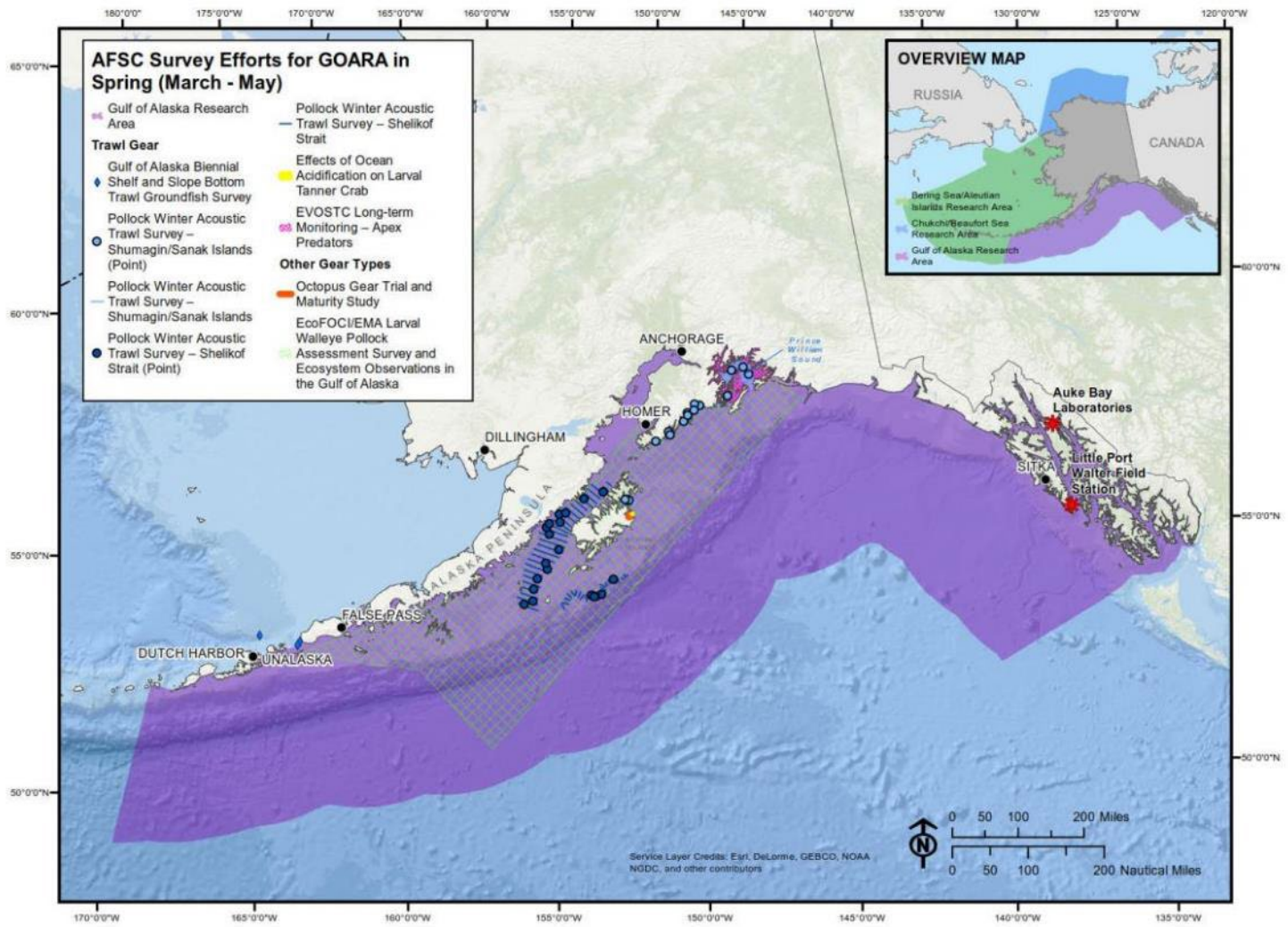


Figure B-1 Distribution of AFSC research effort in the GOARA in spring.

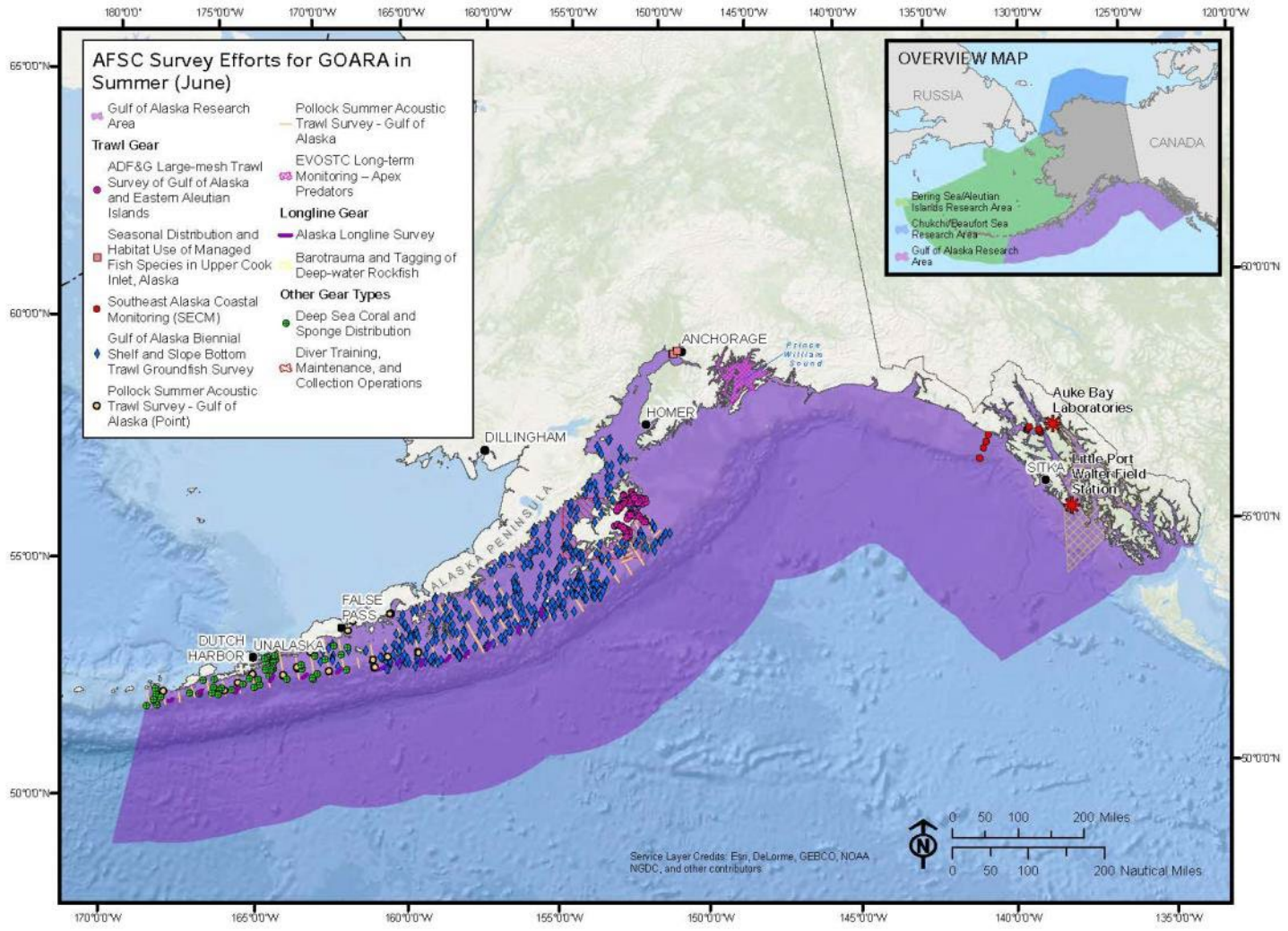


Figure B-2 Distribution of AFSC research effort in the GOARA in June

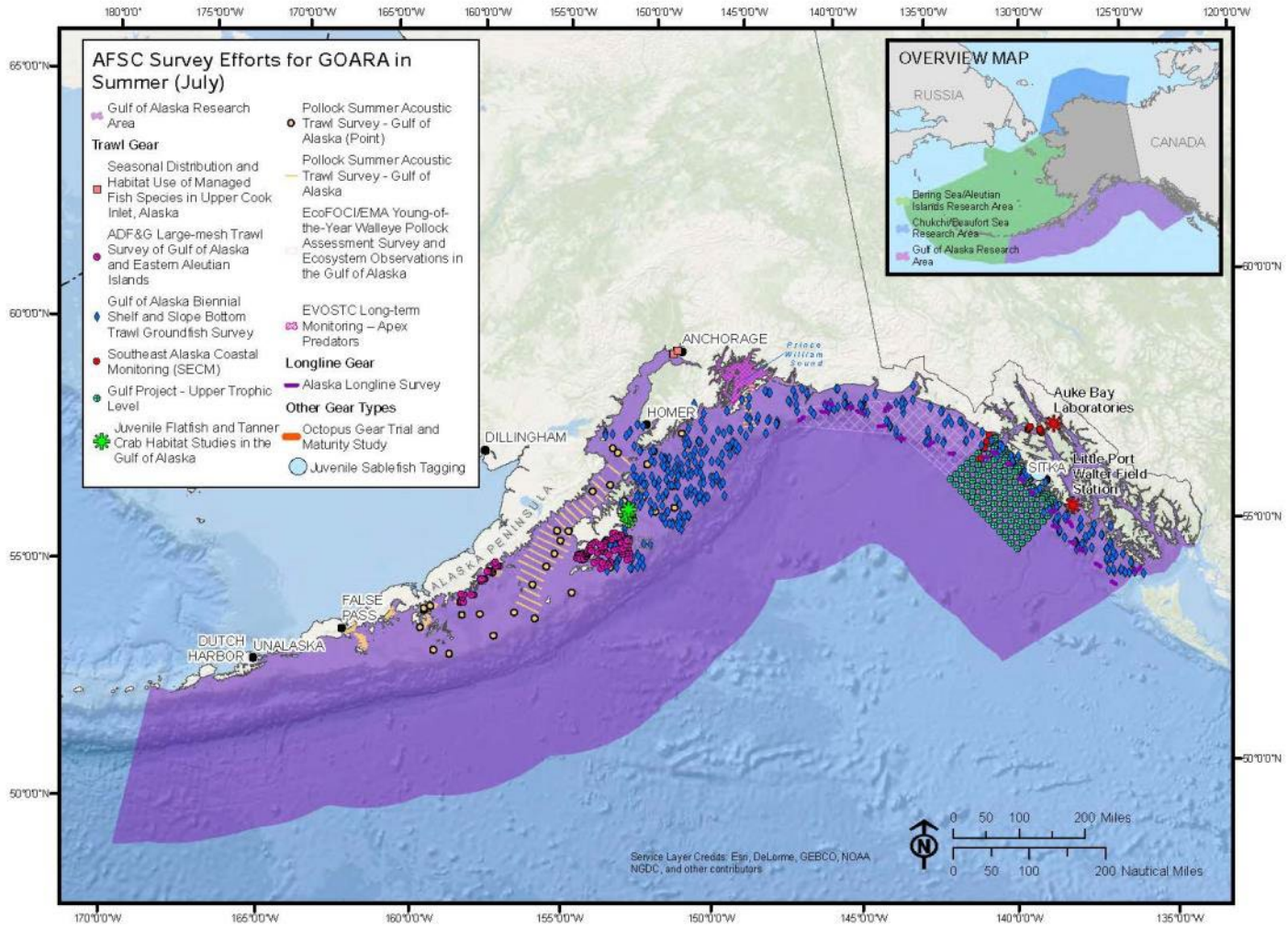


Figure B-3 Distribution of AFSC research effort in the GOARA in July

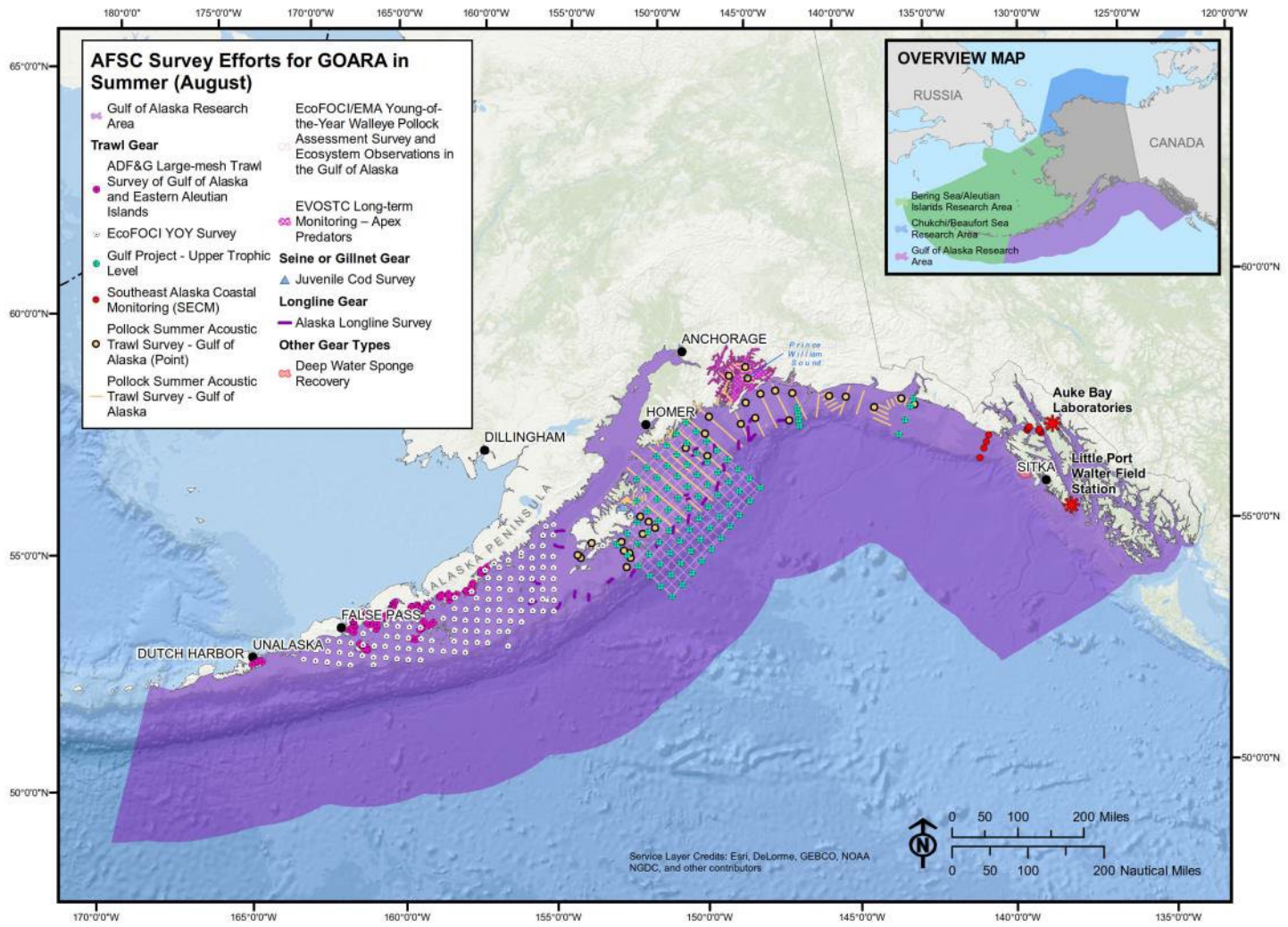


Figure B-4 Distribution of AFSC research effort in the GOARA in August

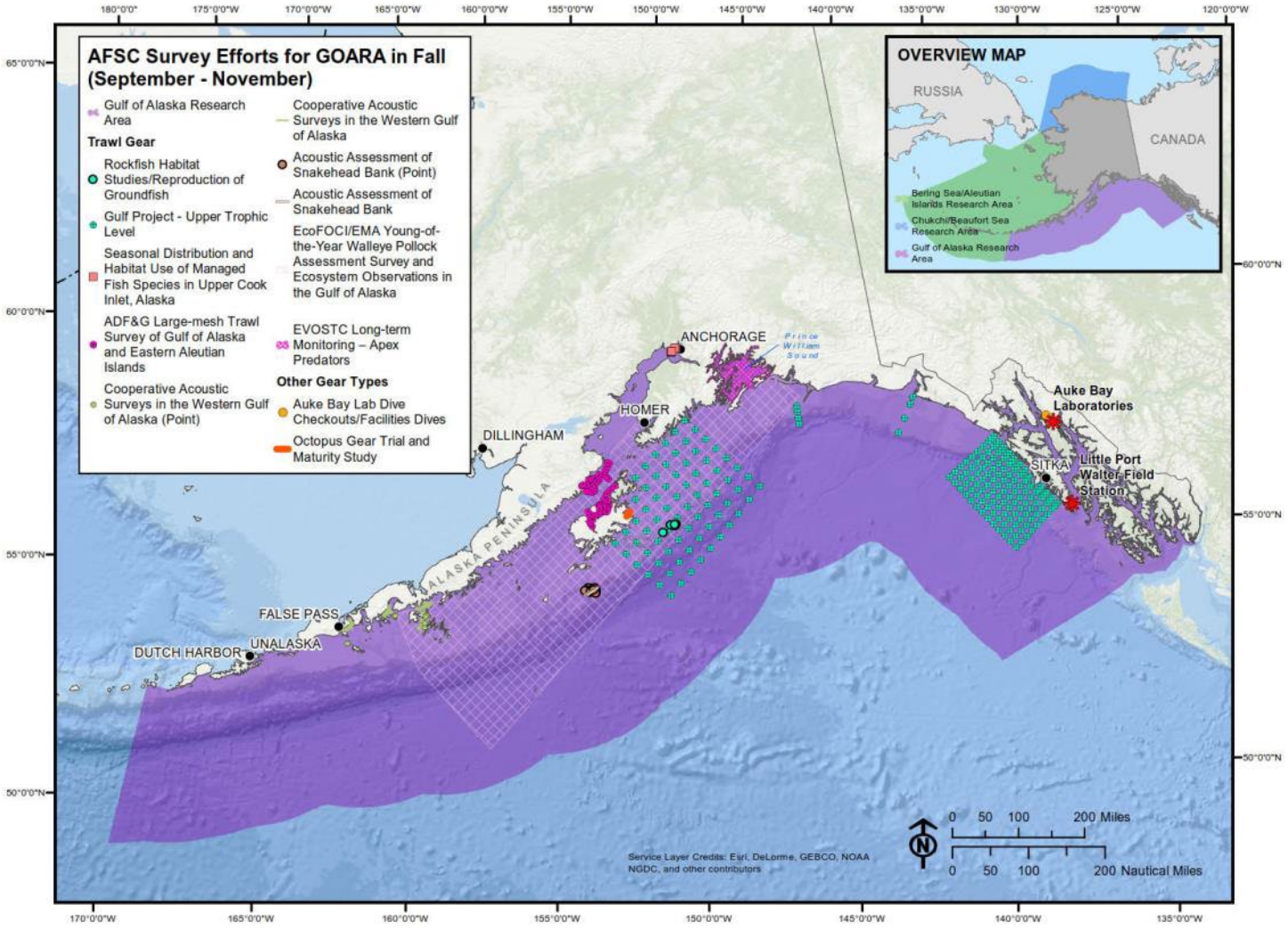


Figure B-5 Distribution of AFSC research effort in the GOARA in fall

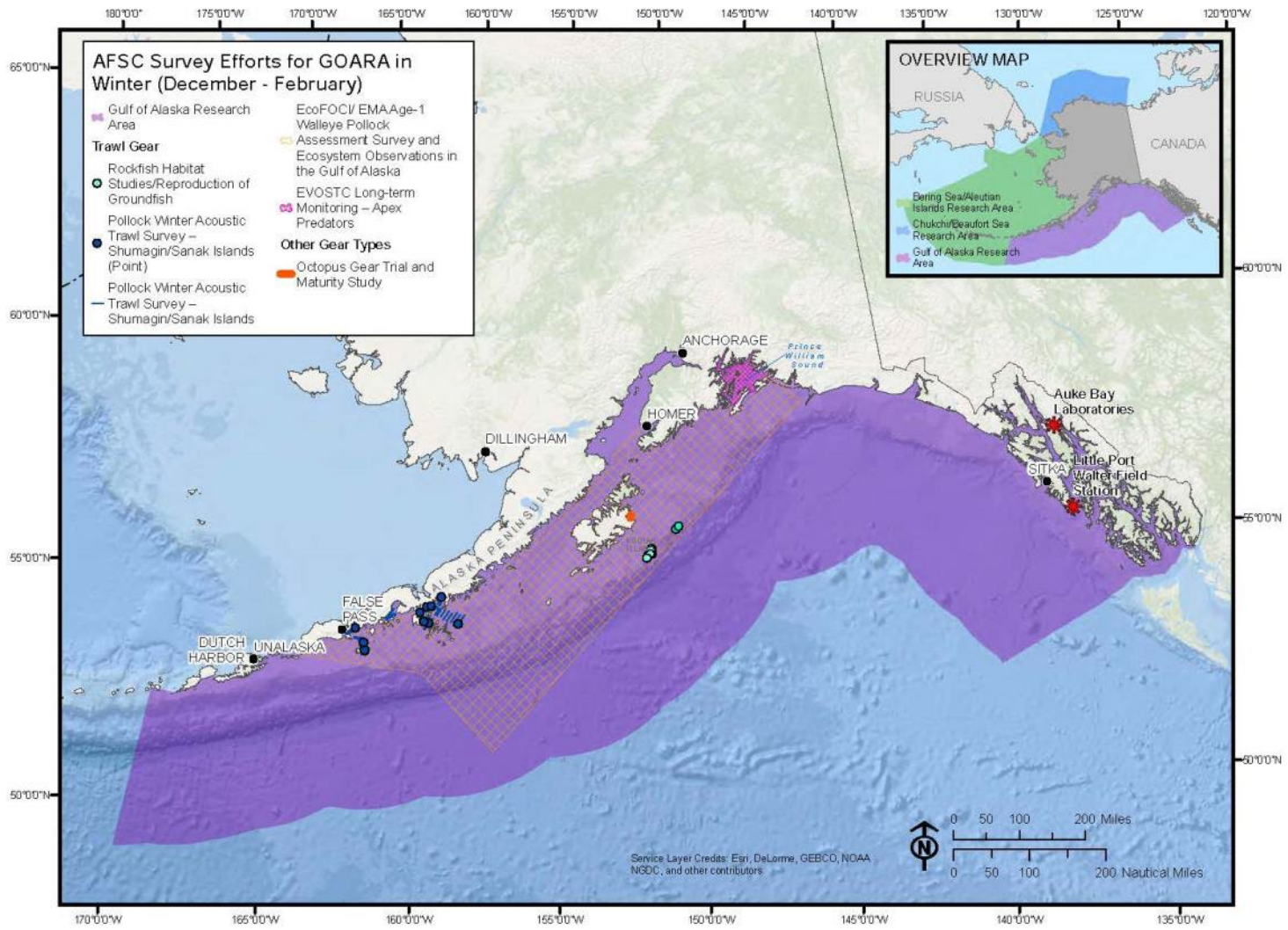


Figure B-6 Distribution of AFSC research effort in the GOARA in winter

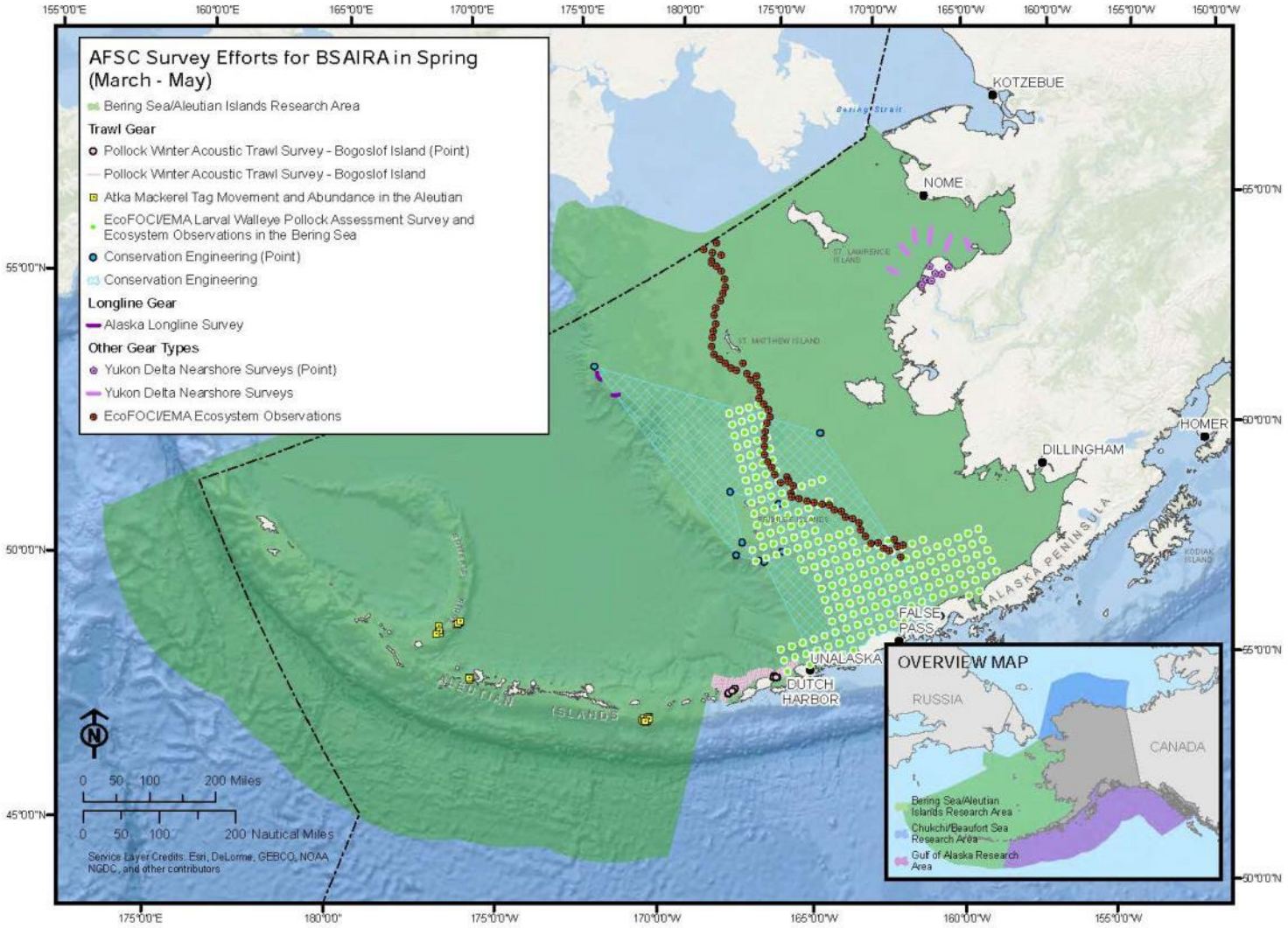


Figure B-7 Distribution of AFSC research effort in the BSAIRA in spring.

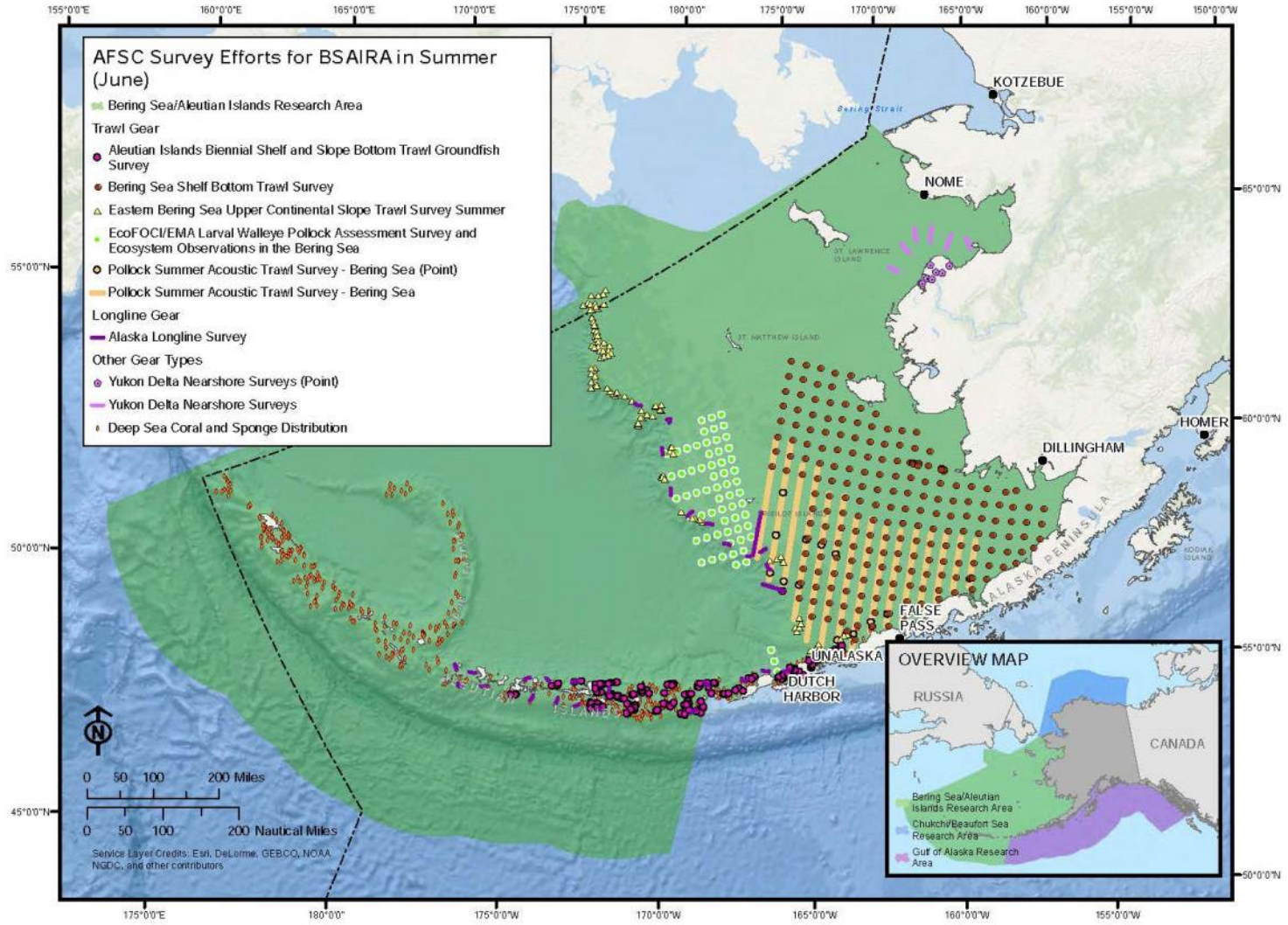


Figure B-8 Distribution of AFSC research effort in the BSAIRA in June

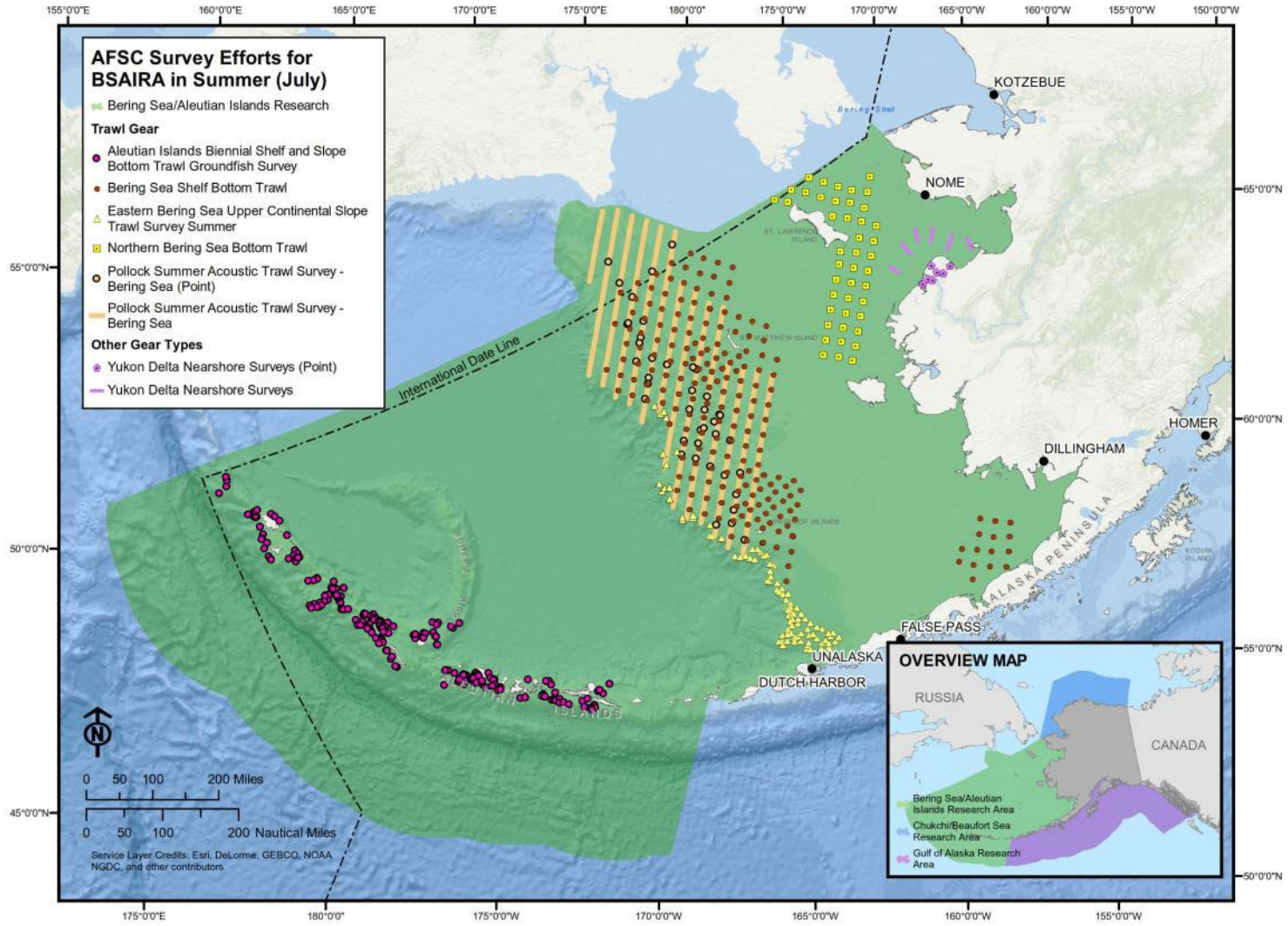


Figure B-9 Distribution of AFSC research effort in the BSAIRA in July

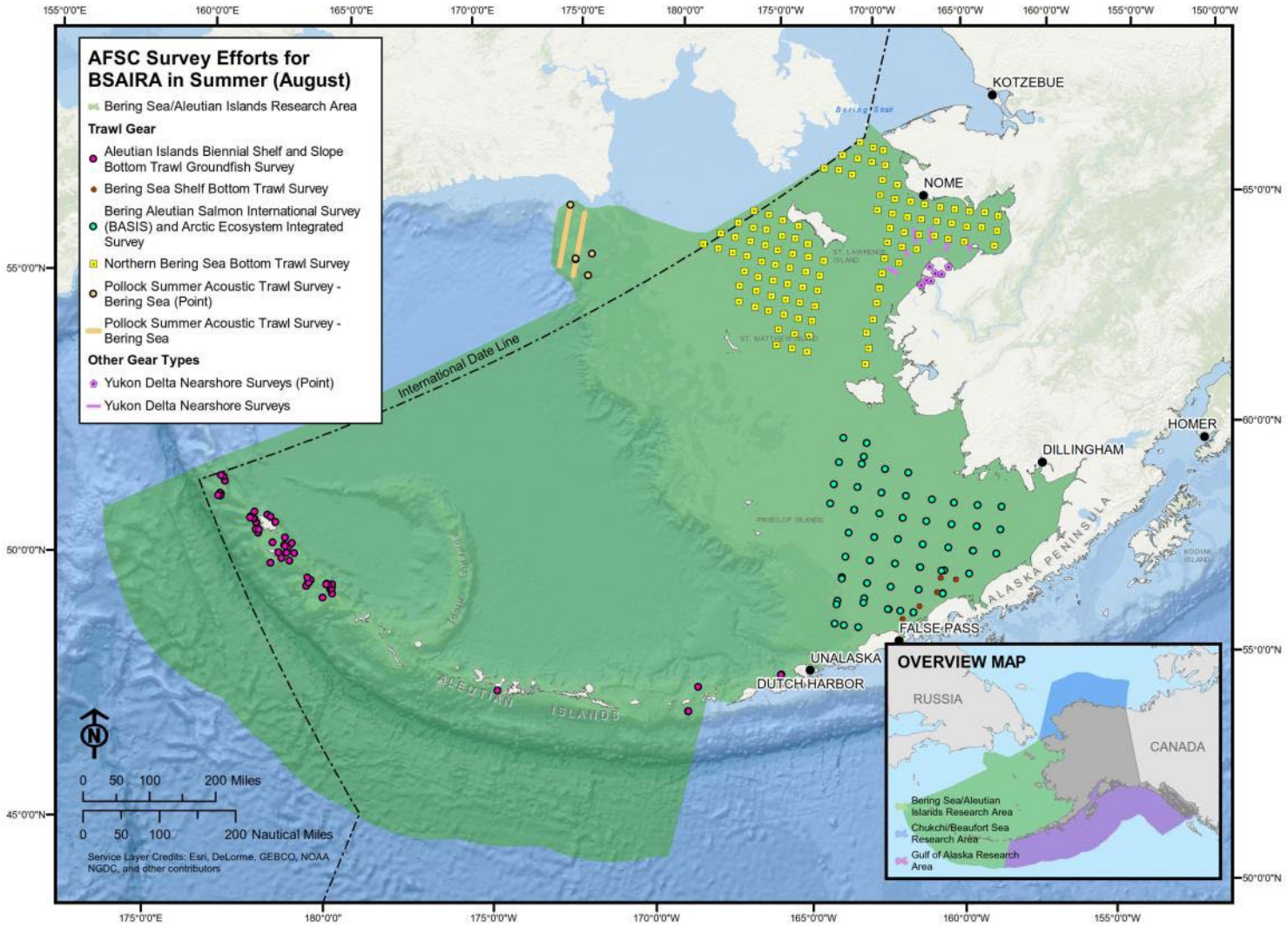


Figure B-10 Distribution of AFSC research effort in the BSAIRA in August

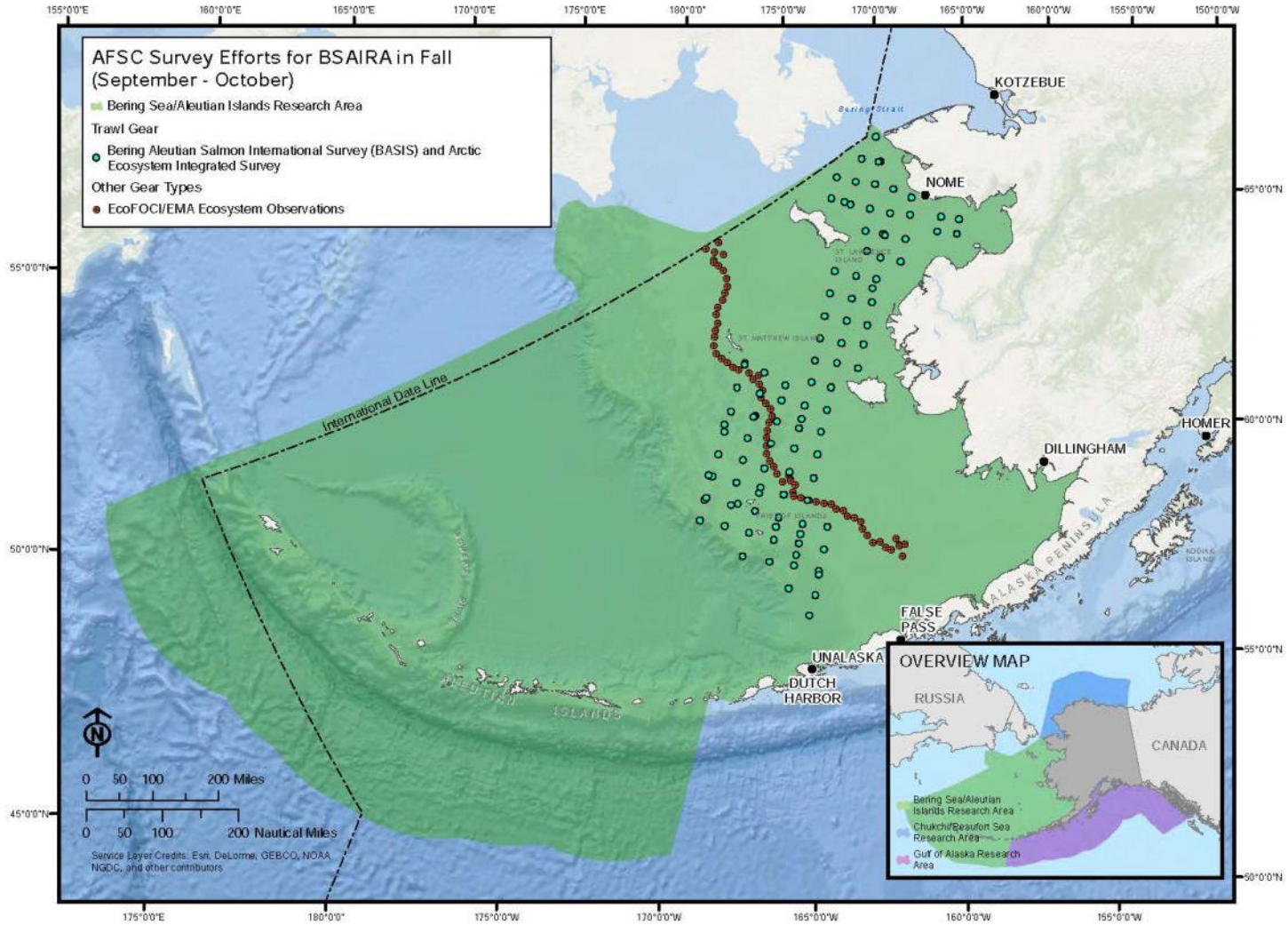


Figure B-11 Distribution of AFSC research effort in the BSAIRA in fall

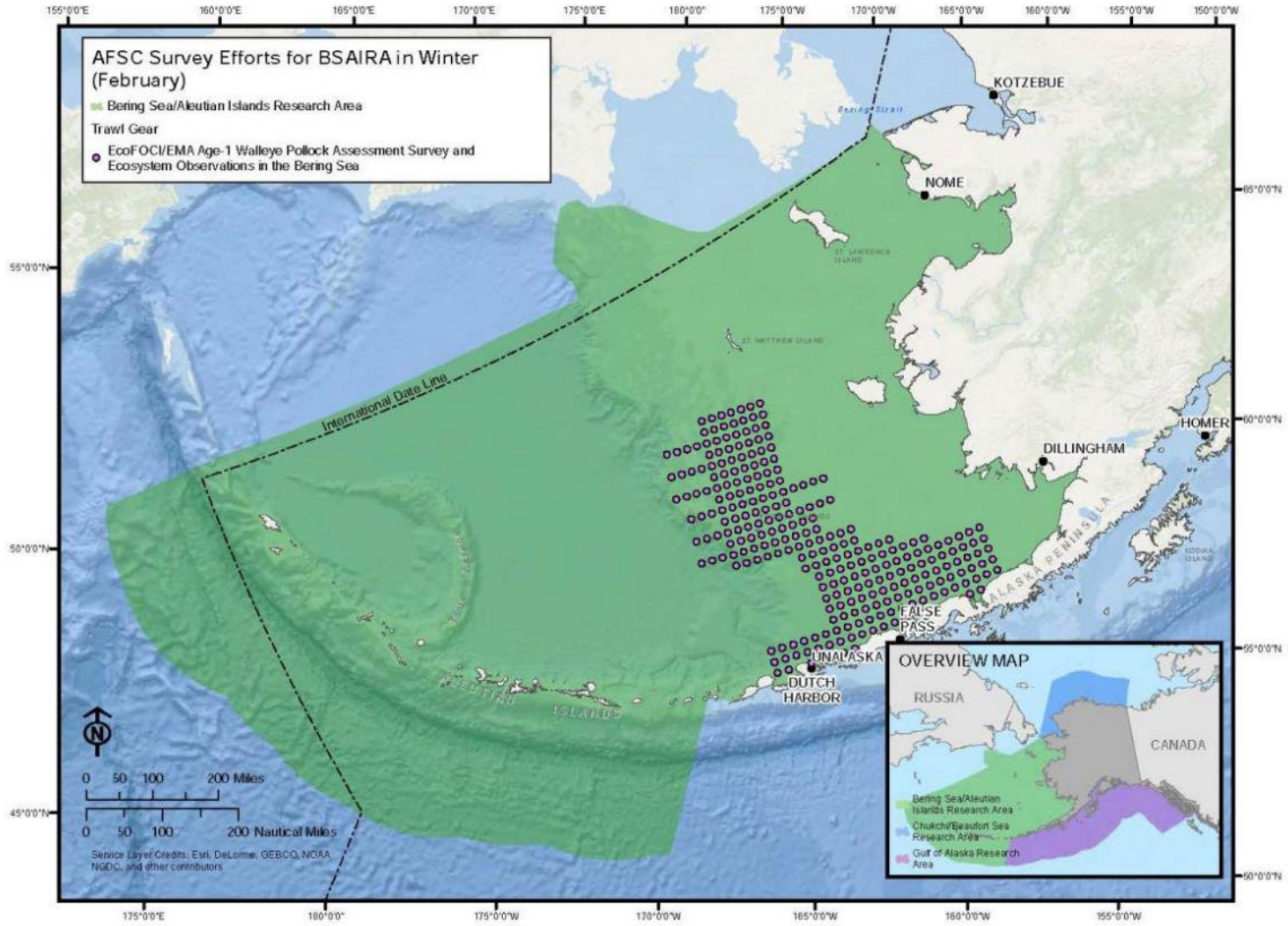


Figure B-12 Distribution of AFSC research effort in the BSAIRA in winter

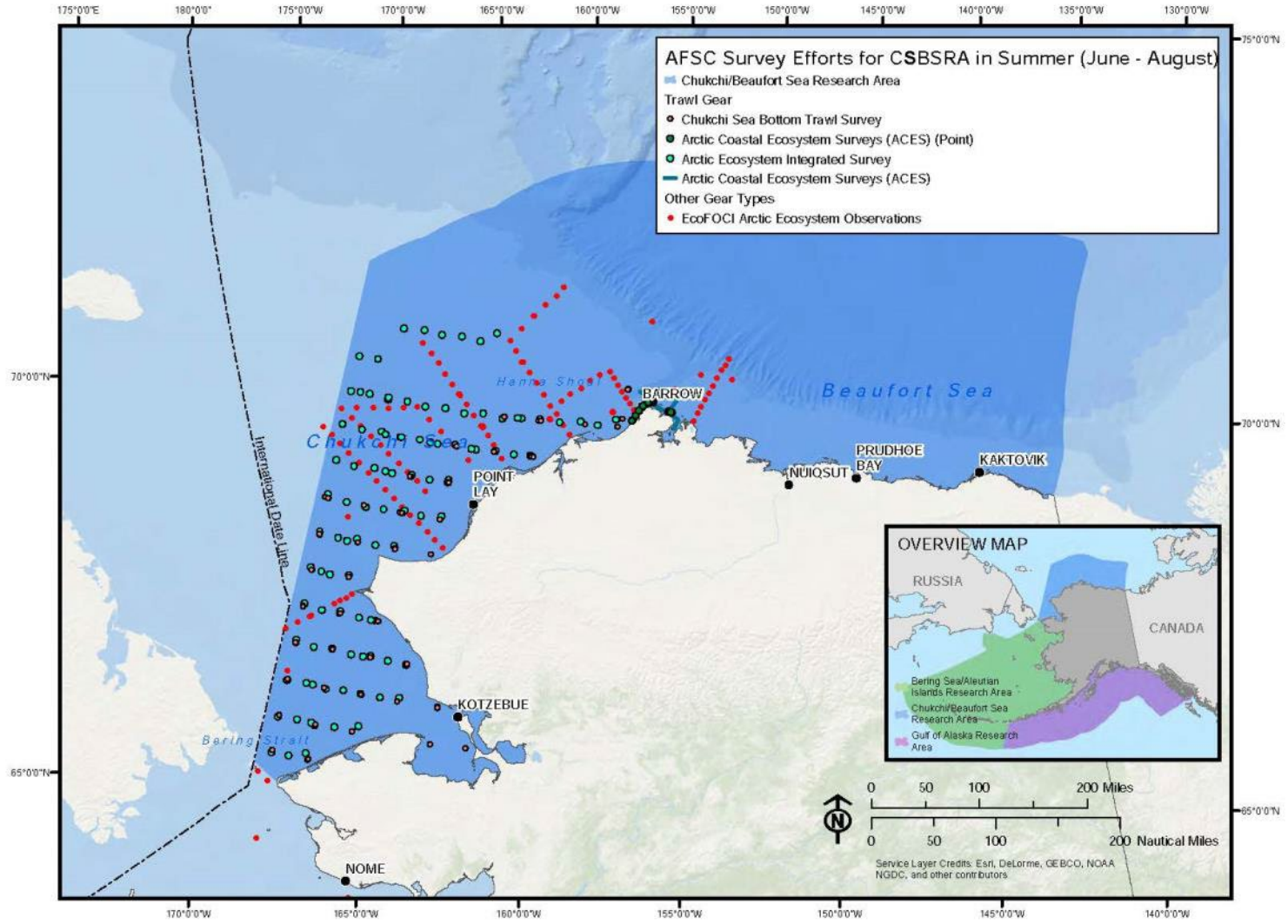


Figure B-13 Distribution of AFSC research effort in the CSBSRA in summer.

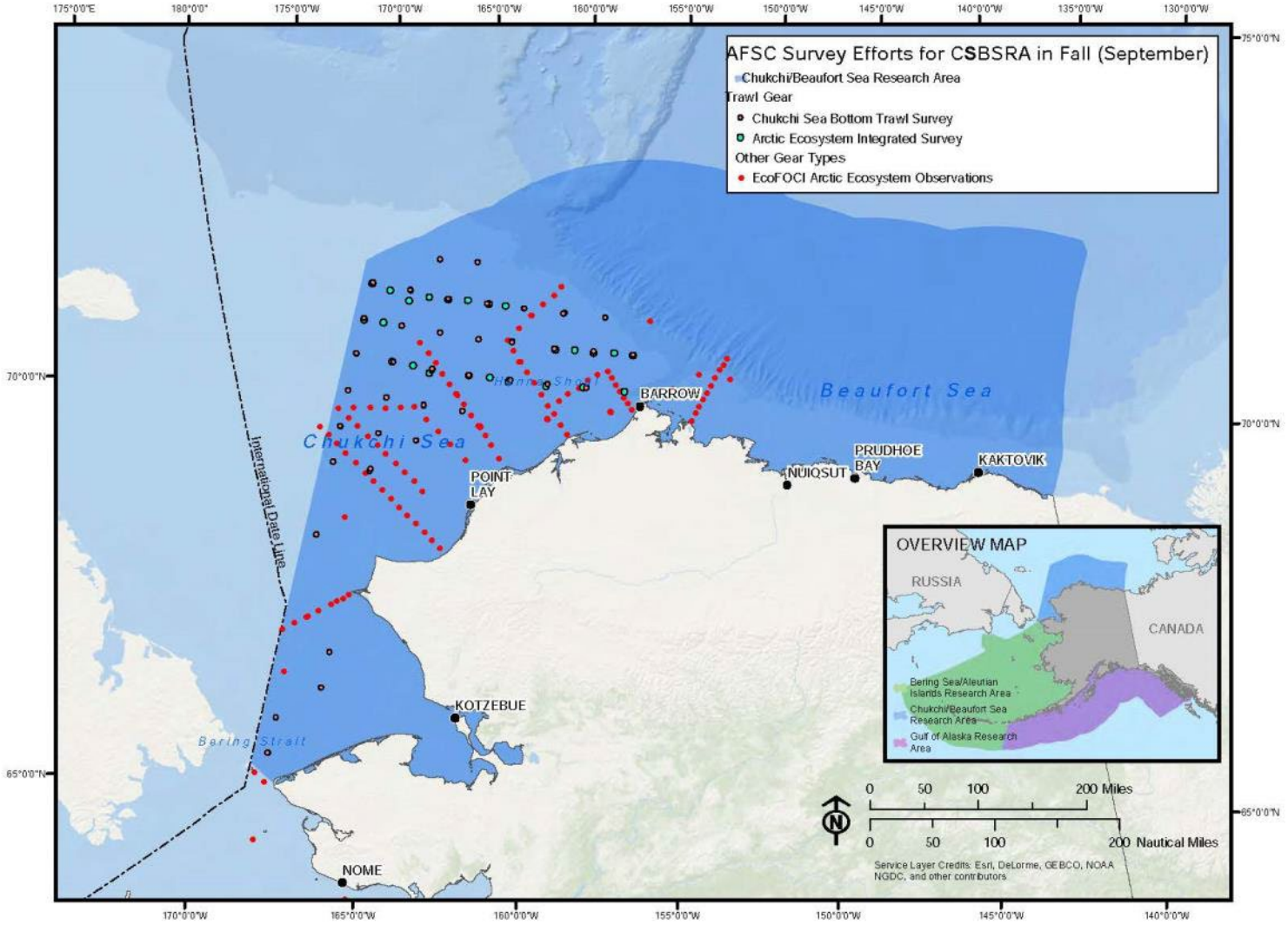


Figure B-14 Distribution of AFSC research effort in the CSBSRA in September

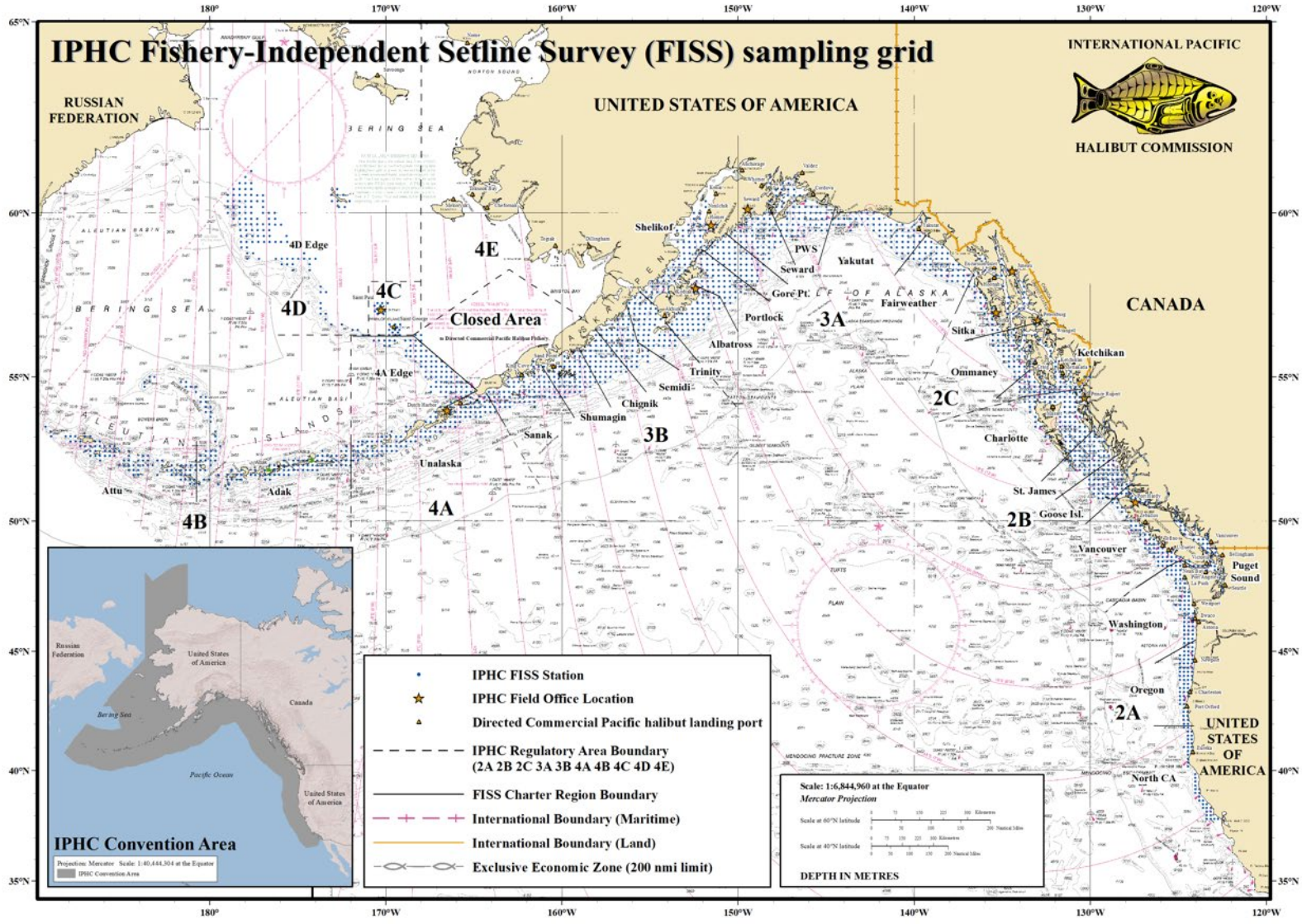


Figure B-15 IPHC Fishery-Independent Setline Survey (FISS) Sampling Grid

This page intentionally left blank.

Appendix C

Protected Species Handling Procedures

This page intentionally left blank.

Table of Contents

1.0 Handling Procedures: Marine Mammals

Marine Mammals including ESA-listed marine mammals that are captured may be alive, seriously injured, or dead. The primary directive for handling incidentally captured marine mammals is to maintain the safety of the crew and vessel. It is up to the professional judgement of the vessel crew to determine the best procedure to safely free a live animal from the gear or return a live animal to the sea. Scientific crew should never be on deck or near a live marine mammal that has been captured. If an animal is one that MML has requested biological samples, it is up to the Chief Scientist and Vessel Operator to determine the safety of taking biological samples of the dead animal. Note: No samples are to be taken from any ESA-listed species (walrus, Stellar Sea Lion, many whale species). AFSC will collect biological samples in accordance with section 109(h) of the MMPA for live/dead marine mammals (non-listed), and via regulations 223.206 and 222. 310 for live/dead threatened and endangered turtles under the ESA, or under a directed scientific research and enhancement permit. Any marine mammal biological samples should be sent to Katie Luxa, Katie.luxa@noaa.gov, 206-526-6316, at AFSC 7600 Sand Point Way NE, Seattle WA 98115.

Before the cruise begins, the Chief Scientist will provide this protocol to the vessel operator, and they will discuss procedures for handling live and dead marine mammals before the cruise begins. Marine mammal biological samples will be used to improve stock assessments, vital rates, and foraging behaviors. Data collection have been developed to be responsive to all relevant permits and legislation (e.g., MMPA, ESA, MSA). Handling procedures and a pathogen exposure control plan have been developed between AFSC fishery research personnel and the AFSC safety and environmental compliance officer. It is the Chief Scientist's responsibility to document these interactions and communicate with appropriate authorities (see Documentation and Reporting).

Pathogen Exposure Control Plan for taking biological samples

Although the risk of transmission of any diseases from marine mammals to humans is low, we recommend the following protocols to further minimize potential exposure. It is up to the Chief Scientist and Vessel Operator to determine the safety of the field conditions for collecting any biological samples. These procedures must be followed during and after any sampling of marine mammals.

In the event of an incidental death of a marine mammal during AFSC research cruise:

- Stop or conclude regular sampling activities until the marine mammal specimens have been collected and the carcass returned to the sea. It may be necessary to jog or run to the next station during this time.
- Only trained and properly equipped personnel shall collect data and specimens from marine mammals.
- Proper personal protective equipment (PPE) should be worn during all sampling AND
- Prior to sampling marine mammals, the following pathogen exposure control plan detailing proper PPE, handling, and clean-up procedures MUST be followed:

Personal Protective Equipment (note this is the same PPE worn to conduct to sample fish with the addition of a face shield in certain circumstances, but it is to be saved for use only when

taking biological samples from a marine mammal. Funding for this will be supplied by Center Director's Office):

- Nitrile gloves (New pair, dispose of after use and decontamination procedures)
- Rubber boots without holes that can be disinfected
- Face shields (for tissue sampling, including snout or head removal)
- A new set of rain bibs and a jacket that does not have any holes or tears

Pregnant or Immunocompromised Personnel

If you are pregnant, possibly pregnant, or immunocompromised you should not volunteer to collect biological samples due to the increased risk of zoonotic diseases. Inform your supervisor of your situation, so that accommodations may be made.

General Protective Guidelines

Follow blood-borne pathogens procedures for humans and treat the sampling area like a spill requiring decontamination and clean-up. However, marine mammal carcasses and cleaning wastes are not considered Hazardous Waste.

Hand Hygiene

Gloves should always be worn while handling a carcass. Wash hands after touching a carcass and after contact with blood, tissue, body fluids, secretions, excretions, or articles contaminated by these fluids. Wash hands before eating, drinking, or smoking; and whenever hands are visibly soiled. Avoid touching your face or other exposed body parts until you have washed thoroughly. Alcohol-based gels may be used if hands are not visibly soiled, but hand washing with soap and running water is preferred.

Use of Gloves

Wear nitrile gloves for sampling. Other gloves can be used when cleaning contaminated environmental surfaces and equipment; when handling dirty laundry; when handling tissues. Gloves should be removed promptly and disposed of after use. Hands should be washed immediately after glove removal. Change torn gloves immediately.

Protective Outerwear

Wear the supplied protective outer garments (boots, bib, and jacket) for taking marine mammal samples, when working with carcasses, tissues, and when conducting cleaning chores. These should be decontaminated and changed whenever soiled and after performing any sampling. Boots must be fully water-resistant and easily cleanable. Impermeable outerwear should be worn during sampling and whenever substantial splashes or large quantities of bodily fluids may be encountered. Place soiled garments in a bag for washing later, see the decontamination section below. Any disposable items in the garbage.

Face Shields

Wear a face shield when a carcass is open, has open wounds/lesions, when removing tissues, or if the placenta/umbilicus is present.

Buddy System

Either the Field Party Chief or Deck Lead who has been trained in safe marine mammal collection procedures shall be the primary individual collecting tissues. However, a fully suited

person shall stand by to assist the collector and aid in specimen bagging, containment, and decontamination.

Other Equipment
In addition to the required PPE identified above, additional sampling equipment shall be prepared for use. This equipment should be suitable for decontamination or direct disposal. This equipment can include:

1. Sampling vials with DMSO, forceps, and scalpels. (supplied by the compliance officer and MML)
2. Serrated knives of various sizes ranging from 3 to 12 inches. (use what's available)
3. Plastic bags that are sufficient for sample size and for bagging in three successively sealed bags. (these are analogous to those used for fish specimens)
4. Freezer box for storing frozen specimens. (If available, freezer storage is dependent on the ship's availability)
5. Detergent Soap and cleaning brushes.
6. Bleach diluted to a 1:10 solution for decontamination. (may need to be supplied)
7. Sea water hose is ready for cleaning.

Shower
After sampling, storing samples, and decontamination, it is recommended that the persons involved in the sampling take a shower before continuing work or eating a meal.

Protective Actions for Sampling Procedures

Sampling

1. Wear PPE: gloves, face shield, and impermeable outerwear (bibs and rubber boots).
2. Chief Scientist and Vessel Operator choose a safe area to work that is away from food handling areas, easy to clean and decontaminate, and that is near a discard chute to the sea.
3. Discard gloves and wash hands before touching clean items.
4. Follow sampling procedures below.
5. Place bagged specimens in a freezer or other heavy box to prevent puncture of the bags and contamination of anything in the freezer.
6. DO NOT USE ANY POWER TOOLS TO REMOVE TISSUES.
7. Eating and drinking are not allowed in the sampling area.

Environmental Infection Control

Cleaning and Disinfection of PPEs, Equipment, and Environmental Surfaces

1. Wear gloves when cleaning and wash hands afterwards.
2. First, using soap and water, clean surfaces (deck, freezer, table) and equipment (scalpel handles, measuring tapes, etc.) to remove organic matter.
3. Next, spray the area with ship-approved disinfectant (e.g., 70% alcohol or a 1:10 chlorine bleach solution) and let sit for 10 minutes. Disinfectant should be used according to manufacturer's instructions.
4. Rinse all PPE, instruments, and surfaces with fresh water after disinfecting.
5. Minimize dust and aerosols when cleaning.

Handling Laundry

Wear gloves when handling soiled laundry. Wash (with standard laundry detergent) and machine dry soiled clothing separately from other items. Use separate storage and transport bins for clean and dirty laundry.

Decontamination and Blood or Body Fluid Spill Response

Don gloves, face shield, and protective clothing (including rubber boots if the spill is on the floor and may be stepped in) before beginning the clean-up. Contain spill with absorbent material (e.g., paper towels or absorbent pads in spill kit). Pick up the absorbent material, then seal it in a series of leak-proof plastic bags and place them in the regular trash for disposal. Clean and disinfect the area as above.

Employee Health

Documenting and Reporting Exposure Incidents

1. Report incidents that result in injury or potential exposure to an infectious agent to your supervisor and Field Party Chief.
2. After the sampling event, monitor personnel for any signs or symptoms of infection or flu-like symptoms.
3. Submit a NOAA incident report online through the emergency contact procedures for the vessel. The RACE Directorate will report the incident to the NOAA Safety Office.
4. If consultation with a health care provider is necessary, be sure to inform them of the exposure to the animal(s).
5. As available, provide health care provider literature materials regarding the treatment of infections with tetracycline.

Handling: Previously Dead or Injured marine mammals or protected species

If a previously dead or injured marine mammals, or animals entangled in gear are encountered and it is certain it was not due to AFSC fishery research activities. A stranded animal is one that is dead on the beach or in the water, one that is alive on land and unable to return to the water and/or in need of medical attention, or a live animal in the water that is unable to return to its natural habitat under its own power or without assistance. Please don't move or touch the animal.

Report sighting as follows:

- Previously dead marine mammal or protected species brought aboard. Record encounter by taking photograph and providing information from the haul: date, location (including latitude and longitude). Report to Division Directorate, Compliance Coordinator, and AFSC Marine Mammal Lab (contact Nancy Friday).

- Previously dead marine mammal or protected species floating by research vessel. Document encounter by recording date, location of stranding (including latitude and longitude), number of animals, and species. Take pictures from different angles if you are able.

- Injured and entangled marine mammals or protected species that are not injured or entangled by AFSC research activities. Document with photos, collect date, time and location. Report to Alaska Marine Mammal Stranding network (24-hour Hotline: (877) 925-7773) and the Alaska SeaLife Center in Seward, (1-888-774-7325, 24-hrs).). In some cases, vessel captains may be required by law to attempt disentanglement; it is the

responsibility of a vessel captain to understand and carry out any legal requirements. If disentanglement is attempted, standard procedures on mitigating the risks to the animal and persons aboard the vessel should be followed.

  - NOAA Fisheries statewide 24-hour Stranding Hotline: (877) 925-7773 or (877) 9-AKR-PRD
  - If a large whale is alive and entangled in fishing gear, the vessel should immediately call the U.S. Coast Guard (USCG) at VHF Ch. 16
  - Protected Resources Office (M-F 8:00-4:00):
  - Juneau: (907) 586-7235
  - Anchorage: (907) 271-5006
  - Alaska SeaLife Center Stranding Hotline: (888) 774-7325

- **NOTE**: If the stranded animal is a walrus, sea otter, or polar bear, call the Marine Mammals Management Office of the US Fish and Wildlife Service in Anchorage (1-800-362-5148 FREE, business hours) or the Alaska SeaLife Center in Seward (1-888-774-7325, 24-hrs).

If you find a sea otter carcass, please contact the Marine Mammals Management office of the Fish and Wildlife Service at 1-800-362-5148 or the Alaska SeaLife Center at 1-888-774-7325. The carcass is less than 24 hours old if:

- There are no maggots or fly eggs on or under the body
- There is no foul odor or dark brown/ black fluid emanating from body
- The eyes are present and not wrinkled or shrunken
- The animal was observed alive within the last 12 hours, i.e., not observed dead for more than 12 hours.
- The body is intact and not scavenged
- The fur does not pull free in clumps when grasped

If you find a dead sea otter that is less than 24 hours old, please call the numbers above and they will arrange for shipment back to our laboratory. Do not disturb the carcass until you have contacted the Fish and Wildlife Service or the Alaska SeaLife Center. However, if the tides, predators or people may disturb the carcass, please secure it. Be prepared to give the exact location and take photographs if possible. Your help in collecting this information is invaluable.

Handling: Returning Live Animals to Sea

If a marine mammal is brought aboard alive (even if injured), the goal should be to release them without removing them from the water or to return the animal to the water as rapidly as possible. If animals come onto the vessel, the crew should attempt to provide an unobstructed pathway for the animal to return to the sea, usually down the trawl ramp or transom opening. Of paramount importance is the safety of the scientists and crew. Unnecessary crew should seek the safety of the boat house. Any actions taken to record data, take pictures, etc., on captured marine mammals should be performed only after an evaluation of the risks involved to personal safety. Unacceptable human risk is not authorized in assisting marine mammals (e.g., scientists and crew are prohibited from entering the water to aid a marine mammal). A marine mammal may come aboard in a shocked state and look dead. Therefore, all animals brought onboard should be treated as if alive, and all safety precautions are taken.

Once the risks and safety issues have been properly assessed and managed, identify the animal to species if possible, assess the condition (noting any injuries), take pictures from different angles, and then release the animal and enter the data into the AFSC Protected Species Handling Form (APSH). Data collection is conducted in such a manner as not to delay the release of the animal(s) and includes species identification, sex identification (if the genital region was visible), estimated length, disposition at release (e.g., live, dead, hooked, entangled, amount of gear remaining on the animal, etc.) and photographs. The Chief Scientist and crew collect as much data as possible from captured animals considering the disposition of the animal; if it is in imminent danger of drowning, it is released as quickly as possible.

Sampling: Dead Marine Mammals

MMPA regulations and Letters of Authorization authorizes NMFS to collect biological samples in accordance with section 109(h) of the MMPA for live/dead marine mammals (non-listed), or under a directed scientific research and enhancement permit. Measuring, collecting data from, and sampling dead, incidentally caught marine mammals is a priority for NMFS and AFSC. These samples would be collected for diagnostic purposes and not solely or specifically collected for research; therefore directed a scientific research and enhancement permit under MMPA section 104 is not required nor is an ESA section 10(a)(1) (A) directed research permit required. The following is a table of ESA-listed marine mammals [DO NOT TAKE BIOLOGICAL SAMPLE], in addition to Walrus.

Cetaceans	Pinnipeds
Blue Whale	Steller Sea Lions W of 144W
Bowhead Whale	Bearded Seals – Beringia DPS
Cook Inlet Beluga	Ringed Seals – Arctic subspecies
Fin Whale	Pacific Walrus [ESA candidate species]
Humpback Whale	
North Pacific Right Whale	
Sei Whale	
Sperm Whale	
Gray Whale	

Photos/Videos

Use NMFS-issued or other cameras to take photos of dead marine mammals and related data points such as carcasses and evidence of fish damaged by depredation from sperm whales, killer whales and/or sea lions. Photos will be used by MML scientists to verify species and sex identifications.

When taking pictures of dead marine mammals, include the following characteristics:

Pinnipeds	Cetaceans
Full body (dorsal, ventral, side views)	Full body (dorsal, ventral, side views)

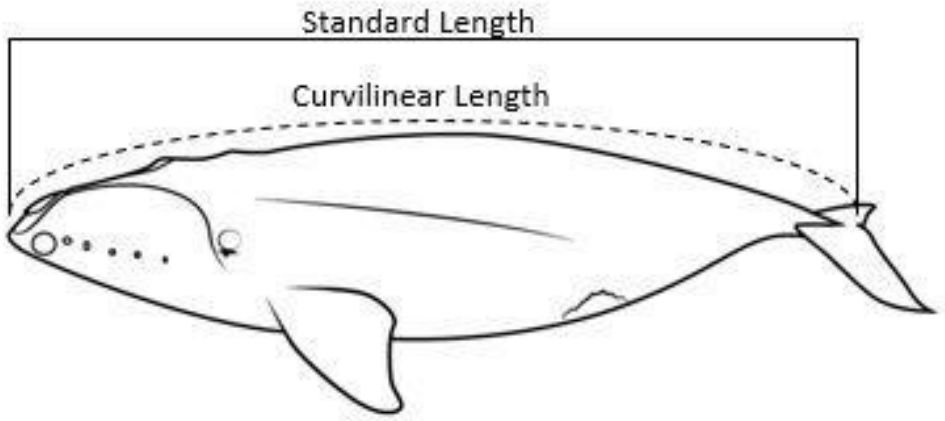
Pinnipeds	Cetaceans
Head straight-on (with vibrissae visible)	Dorsal fin
Head in profile (with ear/ear hole visible)	Saddle patch
Fore flippers	Flukes (underside)
Hind flippers	Sex determination
Sex determination	Other distinguishing marks (scars, scratches, etc.)
Brands and/or flipper tags	
Other distinguishing marks (scars, scratches, etc.)	

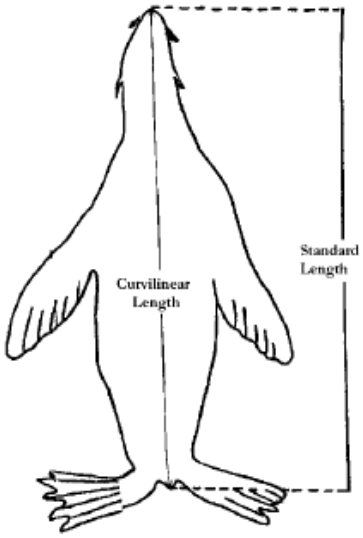
Marine Mammal Measurements

All marine mammals killed by gear must be measured. There are two acceptable methods for measuring marine mammals:

Standard length: This is the preferred method of measurement. Measure the animal in a straight line from the tip of the snout or rostrum to the tip of the tail flesh or tail notch on the unskinned body, belly up, ideally with the head and vertebral column on a straight line. Record your measurement to the nearest centimeter.

Curvilinear length: This is the shortest surface distance from the tip of the snout or rostrum to the tip of the tail or tail notch along the back, belly, or side. This method is used if rigor has set in or the animal is too large or deteriorated to maneuver. Take the measurements with the flexible measuring tape provided by NMFS. Record your measurement to the nearest centimeter.





Determining Marine Mammal Sex

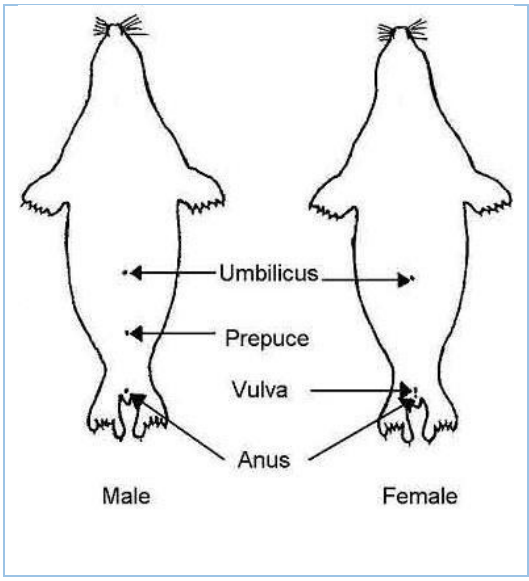
To accurately determine the sex of marine mammals, you will need to examine the ventral body surface and hind flippers (pinnipeds). If necessary, ask for assistance to move the carcass and access the appropriate part of the body.

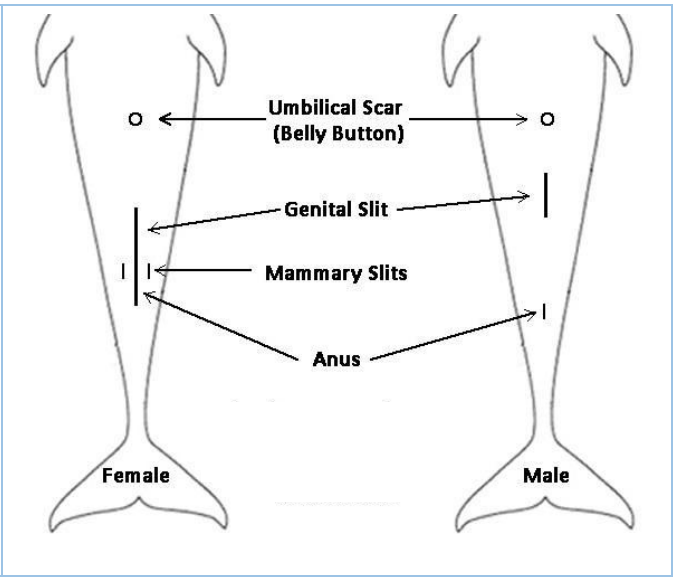
Pinnipeds: spread the hind flippers to expose the perineal area.

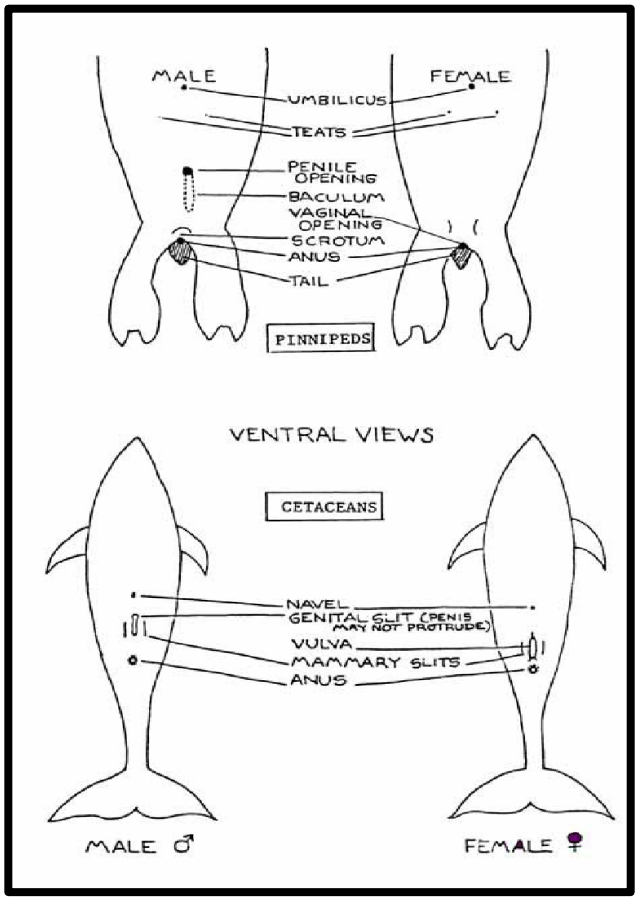
- Males have one opening in the perineal area (anus) and a penile opening (prepuce) mid-way between the navel (umbilicus) and the anus. The penis may also be extended/visible (more common in Steller sea lions).
- Females have two openings in the perineal area: the anus and vulva.

Cetaceans: find the navel, the anus, and the genital slit.

- Males have a genital slit that is located between the navel (umbilical scar) and the anus.
- Females have a single ventral genital slit which contains both the vagina and the anus. Females also have mammary slits which flank each side of the genital slit.


Umbilicus
Prepuce
Vulva
Anus
Male
Female


Umbilical Scar
(Belly Button)
Genital Slit
Mammary Slits
Anus
Female
Male


MALE
FEMALE
UMBILICUS
TEATS
PENILE OPENING
BACULUM
VAGINAL OPENING
SCROTUM
ANUS
TAIL
PINNIPEDS
VENTRAL VIEWS
CETACEANS
NAVEL
GENITAL SLIT (PENIS MAY NOT PROTRUDE)
VULVA
MAMMARY SLITS
ANUS
MALE ♂
FEMALE ♀

Pinniped Samples (Except Walrus and ESA-listed species)

Do not collect parts or specimens from walrus. They are managed by the US Fish and Wildlife Service and are therefore not covered under the AFSC MMPA collection permit.

The Marine Mammal Laboratory has requested the snout of any non-ESA pinnipeds carcasses that were killed by gear**. Only collect specimens from pinnipeds that were killed by gear; do not collect specimens from previously dead pinnipeds.** Snouts provide valuable data: they help MML scientists verify species and sex identifications (e.g., morphology, genetic analysis of tissue), the upper canine teeth can be used to determine the animal's age, and the vibrissae (i.e., whiskers) can be used for stable isotope analysis. These specimens, combined with the other data you collect, help MML scientists assess the general health of pinniped populations.

Snout Specimens

Collect the snout of any seal if found dead in the fishing gear. On AFSC bottom trawl surveys, skulls can be part of the voucher specimen collection system.

To collect a pinniped snout:

1. Using a hack saw or other device, cut across the snout slightly in front of the eyes in a line that connects the corners of the mouth.
2. Do not remove the skin as fur coloration can be used to verify species identification.
3. Do not trim or cut vibrissae.
4. Place the snout in three plastic bags. Place a Bag and Tag label inside the outer bag and another label on the outside. Write the species and length of the pinniped in the Comments sections of the label.
5. Freeze; never store it in a preservative (e.g., formaldehyde).

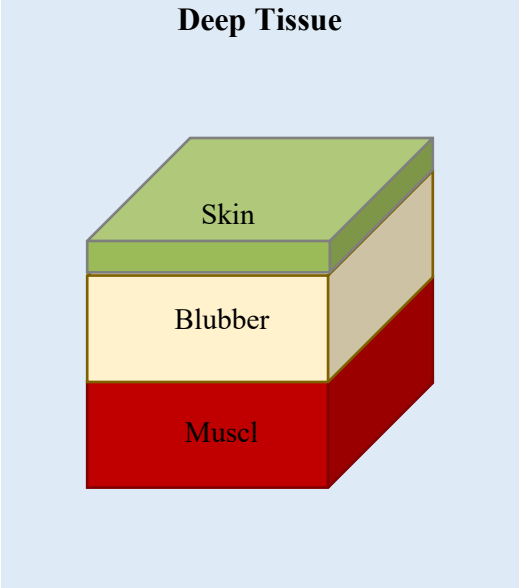
Cetacean Samples (except ESA-listed species)

The Marine Mammal Laboratory has asked that AFSC scientists collect a deep tissue sample from all non-ESA cetaceans that are killed by gear and from previously dead cetaceans that are still in reasonably good condition and the body is largely intact. **Do not collect samples from cetacean carcasses with skin falling off the bone, unrecognizable body, gelatinous tissue, or missing skin.** MML scientists use skin tissue samples to verify species and sex identifications and to identify cetacean stock structure; deep tissue samples are analyzed for contaminant, fatty acid, and stable isotope profiles.

Deep Tissue Sample

To collect a deep tissue sample:

1. Cut a 2 inch square of tissue from the back, posterior to the dorsal fin.
2. The depth of the sample should be from the outer skin layer into the muscle layer, including the entire blubber layer, and include at least 1 inch of red muscle tissue.
3. To store this tissue sample, wrap it in aluminum foil, or seal it in a ziploc bag (aluminum foil is preferred). Place the foil package (or sealed ziploc bag) inside another ziploc bag with a completed Bag and Tag label.
4. This sample should be frozen and kept frozen to the best of your ability during transit.
5. Record specimen information on the AFSC RPSI form. Include in the Comments section how you obtained the specimen.



2.0 Handling Procedures: Seabirds

Seabirds, including ESA-listed seabirds, may be incidentally caught in most gears or may come aboard at night, especially when attracted to lights. While it is highly likely birds will be dead in nets, especially those that are towed, it is possible that living birds may be caught in research gear. As with marine mammals, maintaining personal safety is of the greatest importance when handling a captured seabird. Potential injuries include bites and scratches from a live bird and potential diseases on both living and dead birds. Also be sure to protect your eyes from their sharp bills and potential to reach with their long necks.

The AFSC has a salvage permit from the U.S. Fish and Wildlife Service for birds incidentally caught during AFSC fisheries research activities (Number MB035470-0). Make sure that copies of this permit accompany the survey documents. The Chief Scientist or designee will complete the AFSC Protected Species Encounter form for any interactions with Short-Tailed albatross. This permit covers the collection (salvage) of all seabirds that are not listed under the Endangered Species Act. Generally, due to the collections happening in the Observer Program, we ask only that Laysan and Black-footed albatross are retained on research cruises, unless there is a bird that you need to bring back to verify the identification.

Because short-tailed albatross is an ESA-listed species, our salvage permit does not cover collection of the carcass. However, the Biological Opinion does require that we keep it, and coordinate closely with the USFWS on retention, transportation, and final location. If a short-tailed albatross is caught, regardless of gear type, and regardless of whether the mortality occurs

in a sampled portion of the haul, it must be retained and reported immediately to the Division Directorate and the Environmental compliance coordinator. The AFSC will then notify the USFWS of any mortality within 2-business days of the initial reporting. The AFSC, including the IPHC is allowed a maximum of three (3) short-tailed albatross as incidental take as a result of fisheries research in 5 years 2020-2024. If AFSC, including IPHC, exceeds this amount it represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided.

Dead Seabird Handling

All unidentified albatross taken during research activities must be kept until identified as a listed or non-listed species. In the event the albatross cannot be readily identified, carcasses should be retained for confirmation as non-listed albatross, and pictures documenting the species should be taken for verification. All efforts must be made to recover any dead short-tailed albatross, including gaffing them if they fall off of the hook. Specimens should be frozen immediately with any identification tags attached directly to the carcass, and duplicate identification tag attached to the bag or container. Identification tags should include species, date of mortality, name of vessel, location (latitude and longitude) of mortality, name of Chief Scientist or vessel operator and any legband numbers. Coordinate with Anchorage Fish and Wildlife Ecological Services Branch or Conservation Office prior to shipping.

1. Identify the bird, if possible, to species.
2. Photograph the bird. If possible, take the following pictures- overall dorsal, overall ventral, close up of head/beak, bands or tags, and any wounds, marks, damage.
3. Describe condition of bird including any damage (wounds, scars).
4. Check for presence of legbands or tags and note number and location of any.
5. If the bird is a Short -tailed Albatross, Spectacled Eider, Steller's Eider, or other albatross, retain the bird, assuming it is fresh- (i.e. caught by the survey and not dead for other reasons).
6. Prepare a label with bird species, vessel name, and id number and place bird and label in large bag.
7. If the bird is a Short -tailed Albatross, Spectacled Eider, or Steller's Eider, contact your Divisional Directorate. They will contact Shannon Fitzgerald, the AFSC Seabird Biologist who will contact the USFWS for disposition of the bird.
8. Record the information on the AFSC Protected Species Handling form and forward to the Survey Coordinator and Division Directorate.

Freeing live birds

Consider safety when processing live birds. Live birds can be entangled in gear or land on the boat and are unable to take flight. If a live bird is captured by any research gear, then first disentangle or unhook the bird. At night, especially when anchored near the shore, turn off unnecessary lights. Each morning check for stranded birds on the deck, especially under tables and in dark areas.

If the bird is not listed under the Endangered Species Act, then use the following procedures and complete the AFSC Protected Species Handling form:

- Identify the bird, if possible, to species and sex.
- Photograph the bird. If possible, take the following pictures- overall dorsal, overall ventral, close up of head/beak, bands or tags, and any wounds, marks, damage.
- Describe condition of bird including any damage (wounds, scars).
- Check for presence of bands or tags and note number and location of any.
- Comment on response of bird after release (did it fly immediately, for example).

Protocol for ESA-listed seabirds (e.g., Short -tailed Albatross, Spectacled Eider, or Steller's Eider).

If an injured or sick short-tailed albatross is observed either on the water or entangled in the research gear, then inform USFWS via the Division Directorate. Live birds must be retained in a safe location.

1. If caught in hook and line, stop vessel to reduce tension on the line and bring bird aboard using a dip net.
2. Wrap the bird's wings and feet with a clean towel to protect its feathers from oils or damage.
3. Remove any entangled lines from the bird and determine if the bird is dead or alive. If dead, follow procedure for processing dead birds. If alive, place bird in a safe, enclosed place and immediately contact NMFS, USCG or USFWS. If unable to make contact for 24-48 hours, determine if the bird is lightly, moderately, or deeply hooked (see description below).
4. If bird is deeply hooked, keep bird in a safe, enclosed place until further instructed. Do NOT release the bird.
5. If bird is lightly or moderately hooked, remove hook by cutting the barb and backing hook out.
6. Allow bird to dry for 1/2 hour to 4 hours in a safe, enclosed place. Refer to Release Guidelines.
7. Record information on the AFSC Protected Species Handling Form.

Record Bird Condition:

- Lightly Hooked: Hook is clearly visible on bill, leg or wing.
- Moderately Hooked: Hooked in the mouth or throat with hook visible.
- Deeply Hooked: Hook has been swallowed and is located inside the bird's body below the neck.

3.0 Handling Procedures: ESA-Listed Fish

The AFSC considers the adverse impacts of its various research activities on ESA-listed salmonids to be very small in magnitude, dispersed in time and geographic area, and likely to

have minimal impact on all ESUs. In contrast to these minor adverse effects, AFSC research on Pacific salmon has beneficial impacts on both ESA-listed and non-listed ESUs through its contribution to sustainable fisheries management and monitoring changes in the marine environment important to the recovery of these species.

Handling of Salmonids

Salmonids will be handled with normal catch processing protocols for the various surveys. For most surveys, salmonids will be identified, weighed, sexed, and measured. They will be discarded with normal procedures. For studies and surveys targeting salmonids or salmonids as species of interest, additional sampling may occur for coded wire tags and genetic samples. Data will be recorded as per normal collection protocols.