Saltonstall-Kennedy Research and Development Program Programmatic Environmental Impact Statement

September 2022

Lead Agency:	National Oceanic and Atmospheric Administration
Jurisdiction in which actions take place:	All U.S. fisheries geographic areas
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Cost estimate:	$723,674.36

Abstract: This draft Programmatic EIS is prepared pursuant to the National Environmental Policy Act (NEPA) to assess the environmental impacts of NOAA's implementation of the Saltonstall-Kennedy (S-K) Research and Development Program (S-K Program). The S-K Program implements projects that foster the promotion, marketing, research, and development of U.S. fisheries and their associated fishing sectors. The S-K Program funds projects that address the needs of fishing communities, optimize economic benefits by building and maintaining sustainable fisheries, and increase other opportunities to keep working waterfronts viable. S-K Program projects implemented by NOAA vary in size, complexity, geographic location, and NOAA involvement, and they often benefit a wide range of habitat types and affect a number of different species. Seafood Promotion and Marketing, Research and Monitoring, Gear Testing, Bycatch Reduction, and Processing Studies, Aquaculture, Socioeconomic Research, and Outreach, Education, and Planning are among the project types implemented by NOAA through the S-K Program. The Proposed Action is a promotion, marketing, research, and development alternative that proposes to continue funding projects that are consistent with the scope of the S-K Program. Under the No Action Alternative, the S-K Program would not fund projects that address the needs of fishing communities, optimize economic benefits by building and maintaining sustainable fisheries, and increase other opportunities to keep working waterfronts viable.

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List of Acronyms and Abbreviations

Acronym or Abbreviation	Meaning
ACHP	Advisory Council on Historic Preservation
APHIS	Animal and Plant Health Inspection Service
AUV	autonomous underwater vehicle
BMP	best management practices
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO_2	Carbon dioxide
CO_3	Carbonate
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
dB	Decibels
DO	dissolved oxygen
E&T	Endangered and threatened
EEZ	exclusive economic zone
EFH	Essential Fish Habitat
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FDA	Food and Drug Administration
FMC	Fishery Management Council
FMP	Fishery Management Plan
FONSI	Finding of No Significant Impact
GDP	gross domestic product
GHG	greenhouse gas
HAPC	Habitat Areas of Particular Concern
IO	input-output
MBTA	Migratory Bird Treaty Act
MMPA	Marine Mammal Protection Act
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NAAHP	National Aquatic Animal Health Plan
NAHP&S	National Aquaculture Health Plan and Standards
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NM	nautical mile
NMSA	National Marine Sanctuaries Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOS	NOAA National Ocean Service
NRHP	National Register of Historic Places
OCS	Office of Coast Survey
ONMF	Office of National Marine Sanctuaries
ORF	Operations, Research, and Facilities
P&D	Promote and Develop
PDM	promotion, development, and marketing
PEA	Programmatic Environmental Assessment
PEIS	Programmatic Environmental Impact Statement
PIAMP	Pacific Islands Aquaculture Management Program
PRAS	Partial reuse aquaculture systems
RAS	Recirculating Aquaculture System
RHA	River and Harbors Act
ROD	Record of Decision

Acronym or Abbreviation	Meaning
ROV	remotely operated vehicle
SAV	submerged aquatic vegetation
S-K	Saltonstall-Kennedy
S-K Program	Saltonstall-Kennedy Research and Development Program
T&E	threatened and endangered
UAS	unmanned aerial systems
USFWS	U.S. Fish and Wildlife Service
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USDA	United States Department of Agriculture
USGCRP	U.S. Global Change Research Program

Executive Summary

The National Oceanic and Atmospheric Administration (NOAA) has prepared this Programmatic Environmental Impact Statement (PEIS) for the implementation of the Saltonstall-Kennedy (S-K) Research and Development Program (S-K Program). The Saltonstall-Kennedy Act of 1954 (S-K Act; 15 U.S. Code [U.S.C.] 713c-3) established a program to provide financial support for research and development of any aspect of U.S. commercial fisheries (e.g., commercial wild capture, recreational, cultural and subsistence, and marine aquaculture). The S-K Program implements projects that foster the promotion, marketing, research, and development of U.S. fisheries and their associated fishing sectors. The focus of this PEIS is the activities and projects under the S-K Program, which interface with numerous programs within NOAA. The S-K Program funds projects that address the needs of fishing communities, optimize economic benefits by building and maintaining sustainable fisheries (where the term "fisheries" includes commercial wild capture, recreational fishing, cultural and subsistence fishing, and marine aquaculture), and increase other opportunities to keep working waterfronts viable.

NOAA proposes to continue funding projects that address the needs of fishing communities, optimize economic benefits by building and maintaining sustainable fisheries, and increase other opportunities to keep working waterfronts viable, as consistent with NOAA's S-K Program. As required by the National Environmental Policy Act (NEPA), this PEIS analyzes the environmental consequences of NOAA's Proposed Action to continue funding and implementing projects consistent with NOAA's S-K Program through its existing programmatic framework. Projects implemented or funded through the S-K Program vary in terms of their size, scale, scope, complexity, and geographic location. NOAA facilitates S-K Program activities in coordination with its non-federal partners through grants and cooperative agreements. These activities are prioritized based on available funding and the effectiveness of each S-K Program project at addressing the needs of fishing communities and optimizing economic benefits by building and maintaining sustainable fisheries.

This PEIS identifies and evaluates the general environmental impacts, issues, and concerns related to the Proposed Action of comprehensive management and implementation of the S-K Program and includes potential mitigation. It provides a programmatic-level assessment of the potential impacts of NOAA's S-K Program and the projects that receive funding as part of the program. A programmatic approach may be used when initiating or re-evaluating a federal program for compliance with NEPA. It takes a broad look at issues and alternatives and provides a baseline for future management actions, which provides an overarching effects analysis promoting greater efficiency in NEPA for site- and project-specific proposals. In addition to the Proposed Action, this PEIS considers the No Action Alternative of not continuing to fund and implement the S-K Program. The Proposed Action would enable NOAA to continue focusing its funding and activities on seafood promotion and marketing, gear testing and bycatch reduction studies, aquaculture, research and monitoring, socioeconomic research, and outreach, education, and planning. This PEIS provides a programmatic-level assessment of the potential impacts of NOAA's S-K Program and the projects that receive funding as part of the program. This PEIS assesses the potential direct, indirect, and cumulative impacts of the alternatives.

This PEIS contains four chapters.

- Chapter 1. Introduction: Describes the purpose and need for the analysis, as well as background information on the activities and projects under the S-K Program.

- Chapter 2. Alternatives: Describes the two alternatives considered in this PEIS – A No Action Alternative and a Proposed Action.

- Chapter 3. Affected Environment: Describes the affected environment as it currently exists.

- Chapter 4. Environmental Consequences: Describes the probable direct, indirect, and cumulative impacts on the environment that may result from the continued implementation of the S-K Program.

Under the No Action Alternative, the S-K Program would not fund projects that address the needs of fishing communities, optimize economic benefits by building and maintaining sustainable fisheries, and increase other opportunities to keep working waterfronts viable. No impacts to resources within the physical, biological, or social environments would occur from any of the S-K Program project types because S-K Program funded projects would not occur. However, the long-term beneficial impacts resulting from these projects would also not be realized. The S-K Program would continue to exist and receive funds from permanent appropriation of a portion of import duties on marine products through the S-K Act. However, any evaluation of potential alternative uses of those funds or potential effects from such uses would be speculative in nature and are not included in the analysis of the No Action Alternative.

Under the Proposed Action—the Promotion, Marketing, Research, and Development Alternative—NOAA proposes to continue funding projects that address the needs of fishing communities, optimize economic benefits by building and maintaining sustainable fisheries, and increase other opportunities to keep working waterfronts viable, as consistent with NOAA's S-K Program. The Proposed Action would enable NOAA to continue focusing its funding and activities on seafood promotion and marketing, gear testing and bycatch reduction studies, aquaculture, research and monitoring, socioeconomic research, and outreach, education, and planning. Under the Proposed Action, continuing to fund S-K Program projects would have no potential for significant impacts. Anticipated impacts from the six main project types are summarized below.

- Seafood Promotion and Marketing: Minor to moderate, direct and indirect, short-term, beneficial impacts to socioeconomic resources. No impacts to biological and physical resources.

- Research and Monitoring: Minor, direct, short-term, adverse impacts, and minor, indirect, long-term, beneficial impacts to all resources within all environments, except socioeconomic resources. Minor to moderate, direct and indirect, short-term, beneficial impacts to socioeconomic resources.

- Gear Testing, Bycatch Reduction and Processing Studies: Minor, direct, short-term, adverse impacts and minor, indirect, long-term, beneficial impacts to all resources within all environments, except socioeconomic resources. Minor to moderate, direct and indirect, short-term, beneficial impacts to socioeconomic resources.

- Aquaculture: Minor, direct, short-term, adverse impacts to all resources within all environments, except water quality and socioeconomic resources. Minor, indirect, long-term, beneficial impacts to all resources within all environments, except socioeconomic resources. Minor to moderate, direct, short-term, adverse and beneficial impacts to water quality. Minor to moderate, direct and indirect, short-term, beneficial impacts to socioeconomic resources.

- Socioeconomic Research: Minor to moderate, direct and indirect, short-term, beneficial impacts to socioeconomic resources. No impacts to physical and biological resources.

- Outreach, Education and Planning: Minor to moderate, direct and indirect, short-term, beneficial impacts to socioeconomic resources. No impacts to physical and biological resources.

1 Introduction

1.1 Overview

The National Oceanic and Atmospheric Administration (NOAA) has prepared this Programmatic Environmental Impact Statement (PEIS) for the implementation of the Saltonstall-Kennedy (S-K) Research and Development Program (S-K Program). The S-K Program implements projects that foster the promotion, marketing, research, and development of U.S. fisheries and their associated fishing sectors. The focus of this PEIS is the activities and projects under the S-K Program, which interface with numerous programs within NOAA. It is NOAA's intention that this PEIS may also cover those activities and projects implemented by other NOAA programs and offices that are consistent with the scope of the S-K Program. The S-K Program funds projects that address the needs of fishing communities, optimize economic benefits by building and maintaining sustainable fisheries (where the term "fisheries" includes commercial wild capture, recreational fishing, cultural and subsistence fishing, and marine aquaculture), and increase other opportunities to keep working waterfronts viable.

1.2 Summary of the Proposed Action (Preferred Alternative)

NOAA proposes to continue funding projects that address the needs of fishing communities, optimize economic benefits by building and maintaining sustainable fisheries, and increase other opportunities to keep working waterfronts viable, as consistent with NOAA's S-K Program. The Proposed Action would enable NOAA to continue focusing its funding and activities on seafood promotion and marketing, gear testing and bycatch reduction studies, aquaculture research and monitoring, socioeconomic research, and outreach, education, and planning.

The types of activities that NOAA anticipates implementing are described further in Chapter 2, Alternatives of this PEIS. The S-K Program would continue to be implemented across NOAA's five fisheries regions, which are Alaska, New England/Mid-Atlantic, Pacific Islands, Southeast, and West Coast (Figure 1-1). The S-K Program may also fund projects within adjacent or continuous habitats in Canada or Mexico that support living coastal and marine resources under NOAA trusteeship. The geographic extent is depicted in Figure 1-1, and the program structure activities are described in detail in the description of the Proposed Action and Alternatives (Sections 2.2, Proposed Action – Promotion, Marketing, Research, and Development Alternative and 2.3, Screening Criteria for Developing Reasonable Alternatives). Types of projects funded by the S-K Program include, but are not limited to, seafood promotion and marketing; research and monitoring; gear testing, bycatch reduction, and processing studies; aquaculture; gear testing; bycatch reduction engineering; socioeconomic research; and outreach, education, and planning.

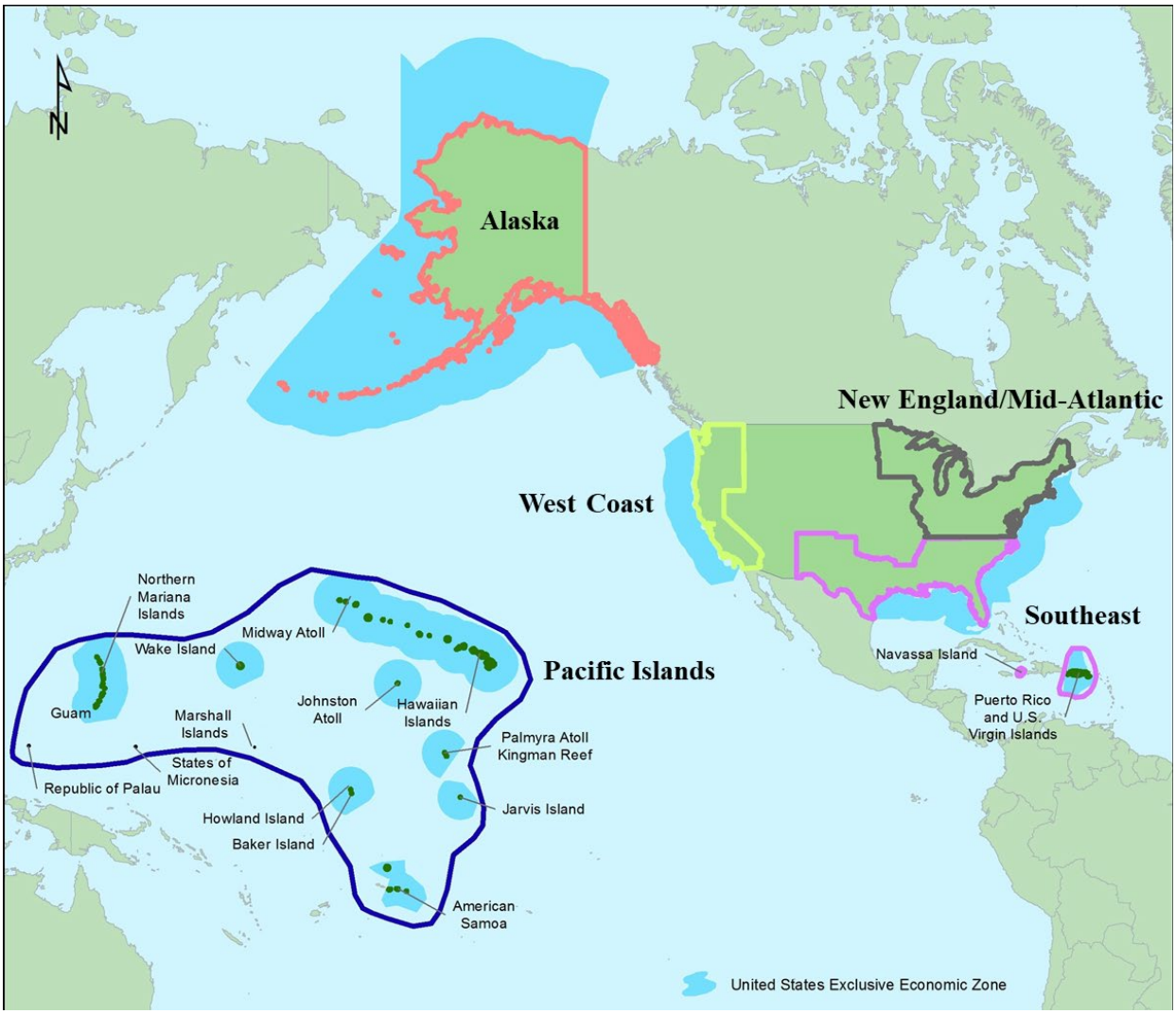
1.3 History of the S-K Program

The Saltonstall-Kennedy Act of 1954 (S-K Act; 15 U.S. Code [U.S.C.] 713c-3) established a program to provide financial support for research and development of any aspect of U.S. commercial fisheries (e.g., commercial wild capture, recreational, cultural and subsistence, and marine aquaculture). The S-K Act created a fund (known as the S-K Fund) that is financed by a permanent transfer of a portion of import duties on marine products. S-K funds are distributed by the Secretary of Commerce as grants and cooperative agreements to address the needs of the U.S. fishing industry, including but not limited to harvesting, processing, marketing, and associated infrastructure. S-K funding is allocated to the National Marine Fisheries Service (NMFS) within NOAA to fund agency activities related to marine fisheries research and management that are consistent with the intent of the S-K Act. The intent of the S-K Act is to

address the needs of U.S. fisheries and associated fishing sectors by funding projects that benefit fishing communities through promotion, development, and marketing (PDM).

Since its creation, the S-K Fund's authorizing language and funding priorities have evolved with changes to the fishing industry, new or amended federal laws governing fisheries management, and changing federal agency responsibilities. In 1980, the American Fisheries Promotion Act amended the S-K Act to authorize a competitive grant program (known as the S-K Program) and a National Program to support those priorities not otherwise funded through the competitive process. The National Program is designed to fund needed fishery industry projects that are not addressed through the competitive grants program. Both programs are administered by NMFS. Grants and cooperative agreements are provided under both the S-K Program and the National Program and can occur in any of NOAA's five fisheries regions (Figure 1-1). In the 1980s, the S-K Program focused on fisheries development, but in recent years (2010–2020) funding priorities generally shifted to PDM resource conservation and management. The S-K Program has supported a variety of projects, such as gear technology research, seafood marketing, aquaculture, and others.

Figure 1-1. Geographic Overview of S-K Program Project Locations, Including NOAA's Five Fisheries Regions and the United States Exclusive Economic Zone



S-K funding has ranged from $0 to $15 million but averages $8–$10 million annually. Individual projects are currently capped at $300,000. Grants have been provided to fishermen, individuals, private businesses, fishing organizations, universities, states, research institutes, non-governmental organizations, and others. Projects funded by the S-K Program are typically completed over the short term, until funding is exhausted.

The S-K Program collaborates with internal and external partners, including key constituents during the development of priorities, on an annual basis. NMFS conducts an open and fair selection process to determine the recommended recipients of the competitive S-K Program grants. Historically, the S-K Program has had a diverse set of funding priorities, selecting between two and seven funding priorities annually. A comprehensive list of funding priorities from 2010 to 2021 includes:

- Adapting to Climate Change and Other Long-Term Ecosystem Change
- Adapting to Environmental Changes and Other Long-Term Impacts in Marine Ecosystems
- Aquaculture
- Conservation Engineering
- Ecosystem Studies
- Fisheries Socioeconomics
- Fishery Data Collection
- Improve the Cost-Effectiveness and Capacity for Observations
- Improve the Quality and Quantity of Fishery Information from the U.S. Territories
- Increase the Supply, Quality, and Diversification of Domestic Seafood
- Maximize Fishing Opportunities and Jobs
- Optimum Utilization of Harvested Resources under Federal or State Management
- Promotion, Development and Marketing
- Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting
- Techniques for Reducing Bycatch and other Adverse Impacts
- Territorial Science

The permanent, primary priority will always be projects that meet the purpose of PDM of the U.S. fisheries and their associated fishing sectors; however, additional priorities can change, and have changed, annually, and may include, for example, science and technology projects that promote sustainable seafood and harvesting.

1.4 Purpose and Need

1.4.1 Purpose

The proposed federal action is to fund projects that are consistent with the scope of the S-K Program. The purpose of the Proposed Action is threefold:

(1) Address the needs of fishing communities, consistent with NOAA's mandate through the S-K Act;

(2) Ensure that NOAA continues to meet the intent and requirements of the S-K Act; and

(3) Assist NOAA in meeting its mission, "To understand and predict changes in climate, weather, oceans, and coasts, to share that knowledge and information with others, and to conserve and manage coastal and marine ecosystems and resources."

1.4.2 Need

The Proposed Action is needed to implement the S-K Act and funding program to build and maintain sustainable fisheries, optimize economic benefits, and increase other opportunities to keep working waterfronts viable.

1.5 Programmatic Scope

The Council on Environmental Quality (CEQ) regulations at 40 CFR §§ 1500.4(k) and 1501.11 encourage the development of program-level National Environmental Policy Act (NEPA) environmental documents and tiering, for eliminating repetitive discussions and to focus on the issues specific to the subsequent action. A PEIS supports tiered, site-specific NEPA reviews by narrowing the spectrum of environmental impacts to focus on during project-level reviews as needed. A PEIS can also establish an environmental decision-making framework to support compliance with other environmental statutes such as the Endangered Species Act (ESA), Marine Mammal Protection Act (MMPA), Clean Water Act (CWA), Coastal Zone Management Act (CZMA), and Magnuson-Stevens Fishery Conservation and Management Act (MSA).

Projects implemented or funded through the S-K Program vary in terms of their size, scale, scope, complexity, and geographic location. The S-K Program funds projects throughout the United States and jurisdictions of NOAA's five fisheries regions including Alaska, New England/Mid-Atlantic (includes the U.S. Great Lakes), Pacific Islands (includes U.S. territories in the Pacific Ocean, the Marshall Islands, the Republic of Palau, and the States of Micronesia.), Southeast (includes U.S. territories in the Gulf of Mexico and the Caribbean Sea), and West Coast (Figure 1-1). The S-K Program may also fund projects within adjacent or continuous habitats in Canada or Mexico that support living coastal and marine resources under NOAA trusteeship. The affected environment associated with the Proposed Action includes all coastal, estuarine, and marine habitats in the United States and its territories. It also includes rivers, streams, and creeks affecting marine or estuarine waters, or that support migratory fish populations.

NOAA facilitates S-K Program activities in coordination with its nonfederal partners through grants and cooperative agreements. These activities are prioritized based on available funding, as well as the effectiveness of each S-K Program project at addressing the needs of fishing communities and optimizing economic benefits by building and maintaining sustainable fisheries.

This PEIS identifies and evaluates the general environmental impacts, issues, and concerns related to the Proposed Action of comprehensive management and implementation of the S-K Program and includes a description of best management practices to minimize and avoid impacts (Section 2.2.3, Best Management Practices for All Project Types). In addition to the Proposed Action, this PEIS considers the No Action Alternative of not continuing to fund and implement the S-K Program. NOAA is conducting this programmatic review to consider whether the proposed activities would adversely impact resources within physical, biological, and social environments. If NOAA chooses to move forward with the Proposed Action, anticipated environmental effects would be caused by site-specific, project-level activities when implementing S-K Program funded projects. Projects that are outside of the S-K Program but consistent with the S-K Program's goal of fostering promotion, marketing, research, and development of U.S. fisheries and their associated fishing sectors could be tiered from this PEIS if they are covered by this analysis. In other words, to the extent NEPA review is required for those projects, it may tier from and rely on analysis set forth in this PEIS and focus on location-specific and project-specific details (40 CFR §§ 1501.11, 1508.1(ff)).

This PEIS is being prepared using the 2020 CEQ NEPA Regulations. The effective date of the 2020 CEQ NEPA Regulations was September 14, 2020, and reviews begun after this date are required to apply the 2020 regulations unless there is a clear and fundamental conflict with an applicable statute (40 CFR §§ 1506.13, 1507.3(a)). This PEIS began on February 23, 2021, and accordingly proceeds under the 2020 regulations. The CEQ regulations expressly recognize and encourage the discretionary preparation of PEISs for agency programs. NOAA has decided to exercise its discretion to prepare a PEIS for projects consistent with NOAA's S-K Program. The programmatic scope of this document and its intended future use in S-K Program environmental decision-making are described in Sections 1.6, Scope and Structure of this PEIS, through 1.9, Statutory/Regulatory Compliance Requirements. NOAA's decision to prepare a PEIS for the S-K Program is a program-specific decision and does not reflect a broader agency policy.

1.6 Scope and Structure of this PEIS

This PEIS provides a programmatic-level assessment of the potential impacts of NOAA's S-K Program and the projects that receive funding as part of the program. A programmatic approach may be used when initiating or reevaluating a federal program for compliance with NEPA. It takes a broad look at issues and alternatives and provides a baseline for future management actions. Programmatic documents are intended to ensure NEPA compliance, as well as to facilitate compliance with other applicable laws and regulations such as the ESA. This PEIS assesses the potential direct, indirect, and cumulative impacts of the alternatives. The chapters that follow describe the activities proposed for continued implementation of projects consistent with the S-K Program (Proposed Action) and their associated potential impacts, compared to those associated with the No Action Alternative (Chapter 2, Alternatives), the affected environment as it currently exists (Chapter 3, Affected Environment), and the probable direct, indirect, and cumulative impacts on the human environment that may result from the continued implementation of the S-K Program (Chapter 4, Environmental Consequences).

The scope of this PEIS covers projects consistent with the S-K Program that:

- Address the needs of fishing communities.
- Optimize economic benefits by building and maintaining sustainable fisheries (where "fisheries" means commercial wild capture, recreational, cultural and subsistence, and marine aquaculture).
- Increase other opportunities to keep working waterfronts viable.

- Include jurisdictions throughout the United States and of NOAA's five fisheries regions—Alaska, New England/Mid-Atlantic (includes the U.S. Great Lakes), Pacific Islands (includes U.S. territories in the Pacific Ocean, the Marshall Islands, the Republic of Palau, and the States of Micronesia.), Southeast (includes U.S. territories in the Gulf of Mexico and the Caribbean Sea), and West Coast. The S-K Program may also fund projects within adjacent or continuous habitats in Canada or Mexico that support living coastal and marine resources under NOAA trusteeship.

- The S-K Program and its supported activities are described in detail in the Description of the Proposed Action (Sections 2.2, Proposed Action - Promotion, Marketing, Research, and Development Alternative, and 2.3, Screening Criteria for Developing Reasonable Alternatives).

1.7 How to Use this Document for NEPA Coverage

This PEIS covers the environmental effects generally expected to occur as result of implementing typical S-K Program projects and provides a foundation for analyzing projects consistent with the S-K Program. For purposes of this PEIS, S-K Program projects are categorized into the six main project types summarized below and described in detail in Section 2.2.2.1, Seafood Promotion and Marketing, through Section 2.2.2.6, Outreach, Education, and Planning:

- Seafood promotion and marketing
- Research and monitoring
- Gear testing, bycatch reduction, and processing studies
- Aquaculture
- Socioeconomic research
- Outreach, education, and planning

The project types described in this PEIS differ from the S-K Program funding priorities that are identified annually and described in Section 1.3, History of the S-K Program. The PEIS project types describe the primary activities being conducted during S-K project implementation. The six project types identified provide a specific characterization of the type of work implemented by the 359 projects that have been funded by the S-K Program in the past 11 years and analyzed in this PEIS.

S-K Program funding priorities are developed annually with internal and external partners, including key constituents. Projects funded under the S-K Program must identify a specific funding priority to which their project relates. Funding priorities are often broad enough that the suite of projects funded under a single funding priority may include more than one of the S-K Program project types. In addition, although projects are categorized by their primary activity, some projects may include additional activities that are expected to occur during project implementation. For example, a project may have been funded under the S-K Program funding priority "Promotion, Development and Marketing" with the primary activity of creating a market for a specific type of aquaculture product (seafood promotion and marketing) but also include activities related to socioeconomic research and outreach, education, and planning.

Figure 1-2 displays the relative distribution of the projects funded under all the S-K Program funding priorities between 2010 and 2021 categorized by the project types identified in this PEIS. Each S-K Program project funded identifies a single funding priority that most closely matches the type of work performed; however, many S-K Program projects crosscut more than one priority and often multiple project types, and that is reflected in Figure 1-2.

Each S-K Program funded project undergoes an environmental review under NEPA and other applicable environmental laws and Executive Orders (EO). This PEIS may be applied to individual projects to provide NEPA coverage, in whole or in part. This document analyzes projects and project types the S-K Program has funded to date, with the intent to provide NEPA coverage for all S-K Program funded projects that are executed by the means and methods within each project type defined in Section 2.2.2, Project Types. In addition, NEPA requirements for other projects funded by NOAA that are consistent with the scope of S-K Program project types included in this PEIS may also be covered. If S-K Program or other projects would be implemented by methods generally prescribed in this PEIS, including the implementation of best management practices (BMPs) described in Section 2.2.3, Best Management Practices for All Project Types, in most cases no additional environmental review would be required under NEPA.

Section 4.5, Environmental Consequences of the Proposed Action, describes the potential environmental impacts of the Proposed Action for the six project types described in Section 2.2.2, Project Types. Table 1-1 identifies thresholds, based on those impacts, for excluding a project from complete NEPA coverage under this PEIS. Additional environmental review and/or consultations may be required under NEPA or other applicable laws or EOs, and that will be determined on a project-specific basis. The environmental review process for S-K Program funded projects is described in Appendix A.

Portions of the analysis provided by this PEIS may also help support compliance with some of the pertinent laws and other applicable statutes described in Section 1.9, Statutory/Regulatory Compliance Requirements, and Section 3.5, Regulatory Considerations. Although specific activities may require development of more focused and refined analyses to comply with some laws (e.g., ESA), information and assessments provided here may be useful as part of the assessments required by these laws.

This PEIS also relies on and incorporates by reference several pre-existing NEPA documents and other relevant analyses that have considered effects of activities from finfish, shellfish, and seaweed marine aquaculture. Where the document incorporates by reference, the information incorporated is summarized and cited.

Figure 1-2. PEIS Project Types Funded under 2010-2021 S-K Program Funding Priorities

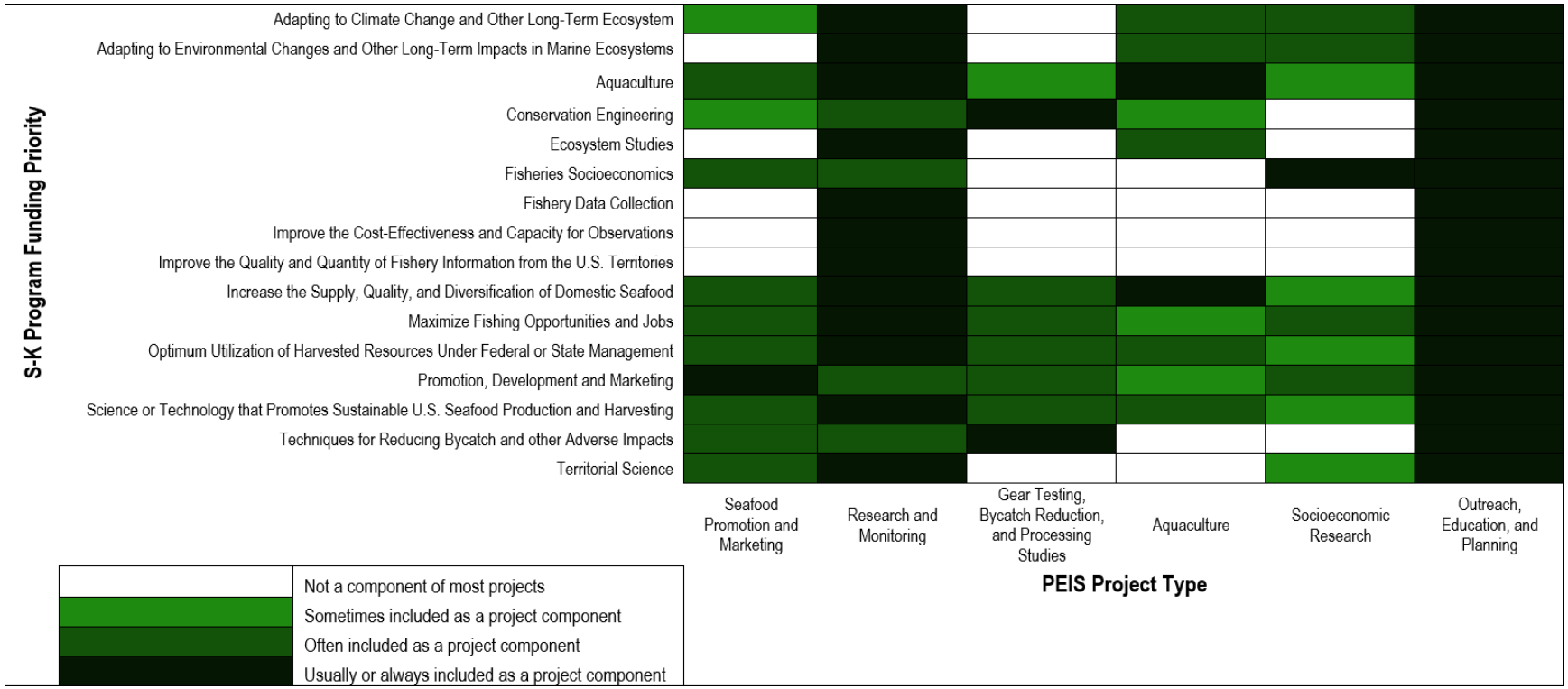


Table 1-1. List of Project Types and Criteria for Exclusion from this Analysis (Projects are excluded when their impacts are greater than described in Section 4.5.)

PEIS Section	Project Type	Criteria for Exclusion from Analysis
2.2.2.1	Seafood promotion and marketing	Impacts are greater than those described
2.2.2.2	Research and monitoring	Lethal take of species or degradation of habitat, beyond what is permitted or authorized by laws, including but not limited to those described in Section 1.9 and impacts are greater than those described
2.2.2.3	Gear testing, bycatch reduction, and processing studies	Lethal take of species or degradation of habitat, beyond what is permitted or authorized by laws, including but not limited to those described in Section 1.9 and impacts are greater than those described
2.2.2.4	Aquaculture	Lethal take of species or degradation of habitat, beyond what is permitted or authorized by laws, including but not limited to those described in Section 1.9 and impacts are greater than those described
2.2.2.5	Socioeconomic research	Impacts are greater than those described
2.2.2.6	Outreach, education, and planning	Impacts are greater than those described

1.8 Public Involvement

On February 23, 2021, NOAA published a Notice of Intent to prepare an EIS in the *Federal Register* (86 FR 10941). This Notice of Intent initiated a 30-day scoping period during which the public and agencies were invited to provide input on the scope of the EIS. In addition, NOAA hosted three virtual public scoping meetings between March 9 and 11, 2021. To help shape the scope of the analysis in this PEIS, NOAA considered the public and agency scoping comments received during the scoping period. The Scoping Report attached in Appendix G summarizes the issues identified during the scoping period.

The publication of a Notice of Availability (NOA) in the *Federal Register* on April 22, 2022, and subsequent publication in the U. S. Environmental Protection Agency's weekly NOA, on May 13, 2022, initiated a 45-day public comment period, which ended on June 27, 2022. Appendix H summarizes the issues identified during the public comment period.

1.9 Statutory and Regulatory Compliance Requirements

Pursuant to the S-K Act, NOAA is the federal agency that administers the S-K Program and its activities evaluated in this PEIS. These proposed activities may trigger a broad range of regulatory compliance processes because they may cause impacts to the public trust resources that are regulated by various statutes. NEPA may be considered an umbrella law, under which NOAA uses NEPA analyses to help satisfy compliance requirements of other applicable environmental laws, statutes, and EOs. The administration of the S-K Program and its funded projects may trigger a broad range of environmental compliance processes because of the potential for impacts to regulated public trust resources. Each project funded under the S-K Program is required to undergo a NEPA review. NEPA review is conducted during the grant review and allocation process and is required to be completed prior to any action taken. During the NEPA review process, the project is analyzed under all other environmental laws, statutes, and EOs.

While this PEIS does not address compliance with other potential environmental laws, statutes, and EOs, Table 1-2 presents a brief summary of some of these potentially applicable laws that would be addressed

during site-specific project reviews. This information is provided to aid the reader in understanding the material presented later in this PEIS and is not intended to provide a comprehensive summary of these laws or to be a complete listing of all legislation potentially applicable to the Proposed Action.

Table 1-2. Selection of Laws Potentially Applicable to S-K Program Funded Activities

Law	Summary of Law
Coral Reef Conservation Act of 2000	The purpose of the Coral Reef Conservation Act is to: 1) preserve, sustain and restore the condition of coral reef ecosystems; 2) promote wise management and sustainable use of coral reef ecosystems to benefit local communities and the Nation; 3) develop sound scientific information on the condition of coral reef ecosystems, and the threats to such ecosystems; 4) assist in the preservation of coral reefs by supporting conservation programs, including projects that involve affected local communities and nongovernmental organizations; 5) provide financial resources for those programs and projects; and 6) establish a formal mechanism for collecting and allocating monetary donations from the private sector to be used for coral reef conservation projects.
Marine Mammal Protection Act (MMPA)	The MMPA protects all marine mammals, including cetaceans (i.e., whales, dolphins, and porpoises), pinnipeds (i.e., seals, walrus, and sea lions), sirenians (i.e., manatees and dugongs), sea otters, and polar bears within waters under the jurisdiction of the U.S. The MMPA provides for an incidental take authorization to be obtained for the unintentional "take" of marine mammals incidental to otherwise lawful activities.
Endangered Species Act (ESA)	The purpose of the ESA is to protect and recover imperiled species and the ecosystems upon which they depend. Under the ESA, species may be listed as either endangered or threatened. "Endangered" refers to a species that is in danger of extinction throughout all or a significant portion of its range. "Threatened" refers to a species that is likely to become endangered within the foreseeable future. ESA also provides for the designation and protection of critical habitat, specific geographic area(s) that contains features essential to the conservation of a threatened or endangered species. Section 7(a)(2) requires Federal agencies, in consultation with the U.S. Fish and Wildlife Service or the NMFS, to ensure that any action authorized, funded, or carried out by the agency is not likely to jeopardize the continued existence of listed species or destroy or adversely modify their critical habitat.
Magnuson-Stevens Fishery Conservation and Management Act (MSA)	The MSA is the primary law governing marine fisheries management in U.S. federal waters. First passed in 1976, the MSA fosters long-term biological and economic sustainability of our nation's marine fisheries in the U.S. Exclusive Economic Zone. Key objectives of the MSA are to 1) prevent overfishing; 2) rebuild overfished stocks; 3) increase long-term economic and social benefits; 4) use reliable data and sound science; 5) conserve essential fish habitat (EFH) (under the 1996 amendment Sustainable Fisheries Act); and ensure a safe and sustainable supply of seafood. The MSA includes provisions concerning the identification and conservation of EFH, which is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Federal agencies that authorize, fund, or undertake actions that may adversely affect EFH must consult with NMFS, and NMFS must provide conservation recommendations to federal and state agencies regarding actions that would adversely affect EFH.
National Marine Sanctuaries Act (NMSA)	The NMSA authorizes the Secretary of Commerce to designate and protect areas of the marine environment with special national significance due to their conservation, recreational, ecological, historical, scientific, cultural, archaeological, educational, or esthetic qualities as national marine sanctuaries. Section 304(d) requires interagency consultation between NOAA and federal agencies that are "likely to destroy, cause the loss of, or injure" any sanctuary resource. A permit or other approval is required to conduct an activity within a sanctuary that is otherwise prohibited.
Migratory Bird Treaty Act of 1918 (MBTA)	The Migratory Bird Treaty Act of 1918 implements four international conservation treaties that the U.S. entered into with Canada in 1916, Mexico in 1936, Japan in 1972, and Russia in 1976. It is intended to ensure the sustainability of populations of all protected migratory bird species. The law has been amended with the signing of each treaty, as well as when any of the treaties were amended, such as with Mexico in 1976 and Canada in 1995. The Migratory Bird Treaty Act (MBTA) prohibits the take (including killing, capturing, selling, trading, and transport) of protected migratory bird species without prior authorization by the Department of Interior U.S. Fish and Wildlife Service. The Migratory Bird Treaty Reform (MBTRA) Act of 2004 amended the MBTA by stating the MBTA applies only to migratory bird species that are native to the United States or U.S. territories, and that a native migratory bird species is one that is present as a result of natural biological or ecological processes. The 2020 update identifies species belonging to biological families referred to in treaties the MBTA implements but are not protected because their presence in the United States or U.S. territories is solely the result of intentional or unintentional human-assisted introductions. It reflects the most current scientific information on taxonomy and natural.

Law	Summary of Law
Coastal Zone Management Act (CZMA)	The CZMA provides for the management of the nation's coastal resources, including the Great Lakes. The goal is to "preserve, protect, develop, and where possible, to restore or enhance the resources of the nation's coastal zone". The CZMA requires that federal actions which have reasonably foreseeable effects on any coastal use (land or water) or natural resource of the coastal zone be consistent with the enforceable policies of a state's federally approved coastal management program.
National Historic Preservation Act (NHPA)	The NHPA requires Federal agencies to take into account the effects of their undertakings, such as construction projects, on properties covered by the NHPA, such as historic properties, properties eligible for listing on the National Register of Historic Places, or properties that an Indian Tribe regards as having religious and/or cultural importance.
Clean Water Act (CWA)	The CWA regulates surface water quality in states, territories, and authorized tribal lands. Under Section 404 of the CWA, a permit is required from the U.S. Army Corps of Engineers before filling, constructing on, or altering a jurisdictional water or wetland (see 33 U.S.C. 1344). Under Section 402 of the CWA, permits are required from the U.S. Environmental Protection Agency or states with approved programs for discharges of pollutants other than discharges of dredged or fill material into waters of the United States, which include coastal waters inhabited by corals. Discharges of storm water into the waters of the U.S. from municipal or industrial facilities require Section 402 permits (see 33 U.S.C. 1342(p)).
Fish and Wildlife Coordination Act	The Fish and Wildlife Coordination Act requires that federal agencies consult with the U.S. Fish and Wildlife Service, the NMFS, and State agencies for activities that affect, control, or modify waters of any stream or bodies of water, in order to minimize the adverse impacts of such actions on fish and wildlife resources or habitat.
Rivers and Harbors Act of 1899	Under Section 10 of the Rivers and Harbors Act, permits from the U.S. Army Corps of Engineers are required for obstructions or alterations of navigable water of the U.S. that affect the course, location, condition, or capacity of those waters.
National Aquaculture Act of 1980	The National Aquaculture Act of 1980 (P.L. 96-362, as amended) is intended to promote and support the development of private aquaculture and to ensure coordination among the various federal agencies that have aquaculture programs and policies. It provided for a national aquaculture policy, including a formal National Aquaculture Development Plan; established a Joint Subcommittee on Aquaculture on which officials of USDA, Commerce, the Interior, and nine other federal agencies sit; designated USDA as the lead agency for coordination; and authorized the National Aquaculture Information Center within the National Agricultural Library.
National Aquaculture Development Act of 1991	The National Aquaculture Development Act of 1991 “amends the National Aquaculture Act of 1980 to add specified tasks to the aquaculture duties of the Secretary of Agriculture, the Secretary of Commerce, and the Secretary of the Interior (the Secretaries); sets forth requirements regarding the location and functioning of the National Aquaculture Information Center; requires the interagency aquaculture coordinating group to establish a working relationship with the industry advisory councils of regional aquaculture centers and with national organizations and commodity associations; mandates reports to the Congress regarding: (1) the application of the Lacey Act Amendments of 1981 to aquaculture; and (2) actions taken to revise the National Aquaculture Development Plan; removes provisions requiring the concurrence of the Secretaries in order to specify which of the Secretaries has responsibility for implementing each action in the Plan; and shifts certain requirements and powers from the Secretaries to the Secretary of Agriculture.”
Marine Debris Act	The NOAA Marine Debris Program is authorized by Congress to work on marine debris through the Marine Debris Act, signed into law in 2006 and amended in 2012, 2018, and 2020. The Act requires the program to “identify, determine sources of, assess, prevent, reduce, and remove marine debris and address the adverse impacts of marine debris on the economy of the United States, marine environment, and navigation safety.” NOAA’s Marine Debris Program aims to create a cleaner environment, ensure safer waters for people, animals, and navigation, and increase the health of coastal and marine environments by identifying and evaluating the adverse impacts of marine debris upon the marine environment and living marine resources, creating better marine debris education for the public, minimizing the amounts of marine debris entering the oceans, and designing and implementing materials and programs to inform industry and the public of the problem caused by persistent marine debris and of the range of available solutions.

2 Alternatives

2.1 No Action Alternative

The CEQ NEPA regulations require that an EIS include the no action alternative (40 CFR § 1502.14(c)). Under the No Action Alternative, the S-K Program would not fund projects that address the needs of fishing communities, optimize economic benefits by building and maintaining sustainable fisheries, and increase other opportunities to keep working waterfronts viable. Under the No Action Alternative, no impacts on the physical, biological, and social environments would occur from any of the S-K Program project types. The S-K Program would continue to exist and receive funds from permanent appropriation of a portion of import duties on marine products through the S-K Act (see Section 1.3, Summary of the Proposed Action). The No Action Alternative serves as a baseline against which the impacts of the Proposed Action are compared.

2.2 Proposed Action – Promotion, Marketing, Research, and Development Alternative (Preferred Alternative)

2.2.1 Implementation

Under the Proposed Action, NOAA proposes to continue funding projects that are consistent with the scope of the S-K Program. This PEIS does not describe the number, scale, and location of projects because decisions regarding funding and project proposal, approval, and implementation vary over time. Rather, the Proposed Action clearly describes the component activities that would predictably be implemented over time using S-K grant program funding. Therefore, the description is qualitative, not quantitative. This approach is programmatic and provides enough information to predict the general impacts anticipated from implementation of the projects consistent with the S-K Program. Project-specific impacts will be evaluated on a case-by-case basis where the specific parameters of the scope and scale of each project have been clearly described. Describing the Proposed Action in this way provides a foundation to properly evaluate the context and intensity of impacts at a programmatic scale.

Implementation of the S-K Program under the Proposed Action would allow for the funding of actions through federal financial assistance, for all possible types of projects that meet the intent of the S-K Act and the needs of U.S. fishing communities, consistent with the scope of the S-K Program. The Proposed Action would provide the S-K Program with flexibility in choosing priorities each year while also considering the funding environment. The projects funded through the S-K Program would vary by project type, geographic location, and funding recipient.

Projects funded through the S-K Program would fall under several categories, including but not limited to:

- Seafood promotion and marketing
- Research and monitoring
- Gear testing, bycatch reduction, and processing studies
- Aquaculture
- Socioeconomic research
- Outreach, education, and planning

Chapter 3, Affected Environment, describes the physical, biological, and social environments, and associated resources, where the effects of S-K Program funded projects may occur. Geographically, this would include the United States and NOAA's five fisheries regions—Alaska, New England/Mid-Atlantic (includes the U.S. Great Lakes), Pacific Islands (includes U.S. territories in the Pacific Ocean, the Marshall Islands, the Republic of Palau, and the States of Micronesia), Southeast (includes U.S. territories in the Gulf of Mexico and the Caribbean Sea), and West Coast (Figure 1-1). The S-K Program may also fund projects within adjacent or continuous habitats in Canada or Mexico that support living coastal and marine resources under NOAA trusteeship.

2.2.2 Project Types

Historically, the S-K Program has had a diverse set of funding priorities (see Section 1.3, Summary of the Proposed Action). The primary priority is for projects that meet the purpose of promotion, development, and marketing of U.S. fisheries and their associated fishing sectors. Additional priorities change annually and may include, among others, science and technology projects that promote sustainable seafood and harvesting.

Although selected projects fulfill a specific funding priority in any given year, the projects themselves may relate to multiple disciplines across natural and social sciences and integrate varied methods and techniques. Given the diversity of projects, this PEIS provides a framework for programmatically assessing the environmental impacts of projects that are consistent with the scope of the S-K Program, and categorizes these projects into the six project types, the settings where those project types take place, and the methods and techniques the project types utilize. In addition, although projects are categorized by their primary activity, some projects may include additional activities that are expected to occur during project implementation. The action area is defined as all coastal, estuarine, and marine habitats in the United States and its territories within the geographic extent presented in Figure 1-1. The action area also includes rivers, streams, and creeks affecting marine or estuarine waters, or that support migratory fish populations.

The following descriptions of project types identified and analyzed in this document (Sections 2.2.2.1, Seafood Promotion and Marketing, through 2.2.2.6, Outreach, Education, and Planning) provide a specific characterization of the type of work implemented by the 359 projects that have been funded by the S-K Program in the past 11 years analyzed in this PEIS. S-K Program funded projects occur in two general settings: office/laboratory settings; and field-based settings on land, water, or under water. Table 2-1 through Table 2-6 identify methods and the associated techniques generally used to implement those methods, in each of the two general settings in which projects occur (office/laboratory and field), for each of the six project types, respectively. Additionally, examples of project objectives are provided to give a general sense of the scope of the specific project types, and example project titles are provided for further context of the projects funded by the S-K Program. However, the scope of projects that may be funded in the future is not limited to the project objectives or example project titles that are provided herein.

A complete list of projects funded through the S-K Program, from 2010 through 2021, is included in Appendix B.

2.2.2.1 Seafood Promotion and Marketing

Proposed projects, categorized within the seafood promotion and marketing project type (i.e., seafood promotion and marketing projects), could include conducting research in product and market development to create and sell more value-added products into the marketplace. Methods may include desktop synthesis of market information, laboratory research to determine viability of underutilized species in the seafood market, and social science interviews and surveys utilized for performing market research. These projects

generally take place in an office or laboratory setting; however, some projects may take place in field settings (Table 2-1).

Table 2-1. Seafood Promotion and Marketing Projects – Methods and Techniques in Office or Laboratory and Field Settings

Action Setting	Methods	Techniques to Implement each Method
Office or laboratory	• Desktop analysis • Interviews and surveys • Workshops, trainings, informational surveys • Laboratory research	• Conduct surveys, interviews, market research, outreach activities via in-person surveys, or phone, paper-, or web-based surveys. • Undertake routine laboratory analysis within a confined laboratory setting (e.g., analyze previously collected water, animal, plant, benthic, seafood samples to characterize environment, evaluate disease, examine genetics; develop disease or toxin assays). • Manage, analyze, and synthesize data; develop and use databases. • Develop and use computer-based tools.
Field (land, water, or underwater)	• Interviews and surveys • Workshops, trainings, informational surveys	• Conduct in-person social science interviews and other site-based social research in the field (on board fishing vessels, ports and harbors, seafood markets, restaurants). These activities will be limited to interviews, observations, polling, or other socially based activities.

Seafood promotion and marketing project objectives may include developing models for other fisheries in the United States to show how value-added processing and marketing can create new market demand at higher dollar values for a previously underutilized resource. Additionally, these projects may focus on efforts to reduce waste, improve handling of commercially caught species, and improve the quality of the overall fishery product. Some projects may work to connect seafood harvesters with culturally and economically diverse consumers, expanding the products' reach to a new group of retail customers as well as a diverse group of restaurants. These components would enable direct sales of locally harvested seafood to a diverse group of new retail consumers and restaurants as well as engage a new group of consumers in issues facing fishing communities.

Example project objectives may include but are not limited to:

- Engaging underrepresented communities of color and low-income communities about issues facing fishing communities.
- Strengthening existing U.S. fishing communities and optimizing economic benefits for fisheries through improved practices and sustainable market expansion.
- Conducting research to develop science- and technology-based pilot projects that would lead to the strengthening of markets for frozen seafood and increase consumer access to and confidence in frozen products.
- Addressing increased threats to fisheries due to competition with foreign imports, annual catch limit allocation issues with the recreational sector, loss of working waterfronts, and vulnerability of fisheries to natural and anthropogenic stressors.

Example projects may include but are not limited to:

- Gathering Essential Fishery Information for the Brown Box Crab, *Lopholithodes foraminatus*, to Assess the Potential for a New California Trap Fishery.
- Improving Business Practices to Reduce Mortality in the Lobster Supply Chain.
- Fishadelphia: Expanding a Successful Program Connecting NJ Seafood Harvesters with Culturally and Economically Diverse Seafood Consumers.
- Resolving Barriers to Sustainable Fishery Certification for the Gulf of Mexico Federal Otter Trawl Shrimp Fishery.

2.2.2.2 Research and Monitoring

Proposed projects, categorized within the research and monitoring project type (i.e., research and monitoring projects) may include, among other things, stock assessments, fish and shellfish distribution studies, and ecosystem studies conducted in office or laboratory settings, or in field settings. Methods and techniques for these projects are provided in Table 2-2. Research and monitoring projects may collect data for research, management, and improvement of finfish or shellfish fisheries, and may also integrate species-specific research with broad-scale ecosystem change modeling. These types of projects may use a variety of research methods including desktop synthesis, field and laboratory biological research, social science methods including interviews and surveys, and outreach activities with local and industry fish harvesters (Table 2-2). Potential environmental impacts from research and monitoring projects may include impacts due to the capture, tagging, and tracking of individuals, the collection of genetic samples from individuals, and laboratory and hatchery operations.

Table 2-2. Research and Monitoring Projects – Methods and Techniques in Office or Laboratory, and Field Settings

Action Setting	Methods	Techniques to Implement each Method
Office or laboratory	• Biological lab research • Desktop analysis • Interviews and surveys • Workshops, trainings, informational surveys	• Undertake routine analysis within a controlled/semi-controlled indoor or outdoor setting (e.g., analyze previously collected water, animal, plant, benthic, seafood samples to characterize environment, evaluate disease, examine genetics; develop disease or toxin assays). • Manage, analyze, and synthesize data; develop and use databases. • Conduct computer modeling, GIS. • Develop and use computer-based tools.
Field (land, water, or underwater)	• Biological field research • Interviews and surveys	• Collect field data at ports and harbors directly from fishers and processors. • Collect data or samples using the following methods: o Mark or otherwise tag finfishes or invertebrates using standard procedures and safeguards; collect fin clips or seaweed samples for genetic or laboratory analyses. o Undertake field surveys and monitoring to take benthic samples to study organisms in the seafloor or lake beds. o SCUBA or video survey. o Install short-term moored or shore-based instrumentation for observational purposes (e.g., cameras).

Action Setting	Methods	Techniques to Implement each Method
		○ Use benthic devices for anchoring of moored instrumentation. ○ Collect information from new or existing buoys, or other floating instrumentation. ○ Operation of vessels for research and monitoring. ○ Use remotely operated vehicles (ROVs) or autonomous underwater vehicles (AUVs). ○ Use echosounders, which use sonar technology for the measurement of underwater physical and biological components.

Stock Assessments

Stock assessments generally involve biological field research and sampling to detect and track specific finfish or shellfish species to inform recreational and commercial fishing practices and fisheries management. At-sea samples may be collected with associated metadata to evaluate rates of catch per unit effort on a stock-specific basis for various finfish fisheries. Genetic samples, such as fin clips or other tissues, may be collected to produce fine-scale stock-specific distribution and abundance models. Additionally, genetic samples, such as otoliths, may be collected and archived for future research. These samples and associated metadata may be collected by commercial fishermen during normal fishing operations and some projects may collect non-retention samples and data outside of regular fishery seasons aboard research vessels.

Types of gear used for collection may include fishery-dependent and fishery-independent bottom longlines, gillnets, hook and line, and trawl nets, and other gear types typical for specific fisheries. In some cases, collection of life-history data may require capturing individuals that are then euthanized, measured to length, weighed, assessed for reproductive status, and used for other biological sampling protocols for life history data.

Additional information such as capture location and depth data may be used to produce fine-scale stock-specific distribution models. Biological sampling may also provide insights into fish spawning dynamics and reproductive capacity.

Research techniques may also utilize genetic samples collected from existing fisheries efforts or as part of new research projects where samples are collected outside of an existing fishery. Genetic samples would be analyzed in a laboratory setting using a variety of genomic technologies depending upon the study objectives. These projects may inform future stock assessments, stock definitions, and our understanding of fish stock boundaries and population dynamics of offshore and nearshore coastal fisheries.

Example project objectives may include but are not limited to:

- Developing methodology to incorporate both genetic identification data and fine-scale harvest data in management decisions for various commercial and recreational fishery species, including temperate, tropical, and freshwater fishes.
- Producing fine-scale stock-specific distribution and abundance models.
- Assessing genetic stock structure of populations of commercially or recreationally exploited fish and shellfish to understand exploitation rates, stock status, population connectivity, and genetic resilience.

- Utilizing fish tissue samples to create length-weight relationships (including sex-based differences), understand size-at-maturity for each sex, understand reproductive mode, and derive sex ratios (overall and size-specific), length-fecundity relationships, age and growth curves, and reproductive periodicity (lunar, seasonal).

Example projects may include but are not limited to:

- Large-Scale Movements, Spawning Locations, and Structure of the Gulf of Mexico Blue Crab Spawning Stock.
- Determining Natal Sources of Adult Winter Flounder in the GOM and SNE/MA Stocks: Tracking Fish Using Otolith Chemical Signatures as Natural Tags.
- Using Spatial Variation in Demography and Life History to Improve Stock Assessments of West Coast Groundfish
- Stock Structure and Life History of the Bonnethead, *Sphyrna tiburo*, in U.S. Waters.
- Investigating the Stock Structure and Life History of Atlantic Halibut, a Species of Concern off New England.

Fish and Shellfish Distribution Studies

Finfish and shellfish distribution studies aim to understand spatial and temporal movements of those organisms within a habitat. Fish and shellfish may be collected and tagged during an existing fishery season or as part of a separate research project. Tags (e.g., Pop-up Satellite Tags) may be attached temporarily and programmed to detach after a prescribed window, transmitting a signal for later retrieval. Projects may incorporate ROVs or other remote technologies to assess and ground-truth distribution models to better characterize species-habitat associations. Projects may also incorporate acoustic surveys to track the movement and locations of specific species of finfish.

Example project objectives may include but are not limited to:

- Collecting data to better inform a commercial or recreational fishery harvest.
- Understanding past and present fish distribution patterns by mapping habitat use.
- Determining spawning and migration areas for specific fish stocks.
- Incorporating research to reduce bycatch of overfished species by informing bycatch avoidance plans and maximizing fishing opportunities for underutilized species.

Example projects may include but are not limited to:

- Ecosystem Studies of Atlantic Cod Spawning Aggregations in Relation to Fisheries Interactions Using Novel Active and Passive Acoustic Approaches.
- Seasonal and Ontogenetic Movements of Pacific Cod from Genetic Stock Identification.
- Continuation of the Maine Inshore Acoustic Herring Survey: Collaborative Research to Support the Maine Lobster Industry.

Ecosystem Studies

Projects funded by the S-K Program include ecosystem studies that assess adaption and resiliency parameters in response to climate and other long-term ecosystem changes. Ecosystem studies may integrate, complement, or augment other types of projects discussed above and below, such as aquaculture, by including variables to account for long-term ecosystem changes. These projects may be multi-faceted and include desktop synthesis, biological field and laboratory research, and outreach activities. Such studies are intended to inform fishery managers and fish harvesters on how changing ocean conditions impact catch rates, composition, and growth of targeted species. Many of these studies aim to develop adaptive capacity and resilience planning for fishery managers, and industry and local fish harvesters, to address projected long-term ecosystem changes. For projects that utilize only desktop analysis, impacts to the natural environment are not anticipated to occur.

S-K Program funded projects may also integrate field and laboratory research with desktop synthesis. These projects may integrate stock assessment and/or species distribution studies with climate or ocean models to generate forecasts for species distribution, relative abundance, and/or changing habitat conditions. Studies may also examine the role of such ecosystem change factors (i.e., elevated ocean temperatures, ocean acidification) as causative agents of species population decline as they relate to health and disease susceptibility and species physiological capacity to combat additional stressors. Biological field research to tag and track individuals may be utilized to understand distribution and abundance as they relate to changing ecosystem conditions. These field investigations may occur on land or water settings including on or below the surface. Other investigations may integrate laboratory studies to examine physiological adaptation capacity in finfish and shellfish species when exposed to multiple levels of ocean acidification, hypoxia, and/or other treatment conditions. Ecosystem studies that incorporate field or laboratory research are anticipated to have some level of impact on natural resources, which are examined in Chapter 4, Environmental Consequences.

Example project objectives may include but are not limited to:

- Evaluating the effects of disease, climate change, and ocean acidification on certain commercially and recreationally important species.
- Understanding relationships within food webs, food resources, ecosystem health, and climate change. Laboratory and hatchery experimentation may be conducted to understand physiobiological responses to changing ocean conditions.
- Assessing the impact of changing ocean conditions (temperature) or large-scale ocean perturbations (El Niño Southern Oscillation) on abundance, population size and structure, and demographics of socioeconomically and ecologically important fish, shellfish, and other marine species.

Project examples may include but are not limited to:

- Adapting to Long-term Ecosystem Change in the Gulf of Maine – Surveillance Tools and Climate Model Projects for Epizootic Shell Disease in Lobsters.
- Improving Oceanographic Models of Bottom Temperature within the Mid-Atlantic Bight Through Novel Data Assimilation and Stakeholder Input.
- Coupling U.S. Gulf State Stock Assessments to Shell-budget Modeling to Determine Sustainable Harvest of Oysters Across the Gulf of Mexico.

- Using Climate Change Scenarios to Project Loggerhead Turtle Distributions in the U.S. Mid-Atlantic. Assessing the effects of oceanographic variability on body condition and reproductive output in economically important rockfishes (*Sebastes* spp) in the California Current Ecosystem.

- Understanding Stock Boundary and Migration Phenology of Atlantic Cobia under a Changing Climate to Inform Management.

2.2.2.3 Gear Testing, Bycatch Reduction, and Processing Studies

Proposed projects categorized within the gear testing, bycatch reduction, and processing studies project type (i.e., gear testing, bycatch reduction, and processing projects) have been implemented under the S-K Program, under various funding priorities that target technologies for the sustainable harvest of seafood. These projects may include, among other things, gear testing and bycatch reduction studies, and processing studies, that take place in office or laboratory, or field-based settings and include typical research methods such as desktop analysis and laboratory research, in addition to social science interviews and surveys, and outreach to fishing groups and biological field-based research (Table 2-3).

Table 2-3. Gear Testing, Bycatch Reduction, and Processing Studies Projects – Methods and Techniques in Office or Laboratory, and Field Settings

Action Setting	Methods	Techniques to Implement each Method
Office or laboratory	• Biological lab research • Desktop analysis • Interviews and surveys • Workshops, trainings, informational surveys	• Conduct gear testing in a laboratory setting. • Undertake routine laboratory analysis within a confined laboratory setting (e.g., analyze alternative baits/feed). • Manage, analyze, and synthesize data; develop and use databases. • Conduct computer modeling, GIS. • Develop and use computer-based tools.

Field (land, water, or underwater)	• Biological field research
	• Interviews and surveys
		• Conduct hook and line surveys.
		• Operation of vessels for research and monitoring.
		• Use exclusion devices within the pelagic environment and benthic habitats:
		  ○ Testing and use of alternate bottom trawls, alternative/decoy baits, lights, acoustic devices, other deterrent devices.
		  ○ Use of turtle exclusion devices during non-target species harvest.
		  ○ Use of underwater drilling machine to install anchors and testing of line rigidity for turtle exclusion from aquaculture facilities.
		• Deploy and retrieve control and experimental traps.
		• Conduct routine monitoring and evaluation related to bycatch assessments, fish/shellfish handling methods, and prototype grid systems.

Gear Testing and Bycatch Reduction

Implementation of experimental gear is generally conducted in field settings including on or under water, where trawls, traps, and nets may come into contact with benthic sediments, reef habitats, and rocky outcroppings. Vessels and experimental gear may operate where ESA-listed fish and marine mammals may be present. Gear testing may include new bycatch excluder devices, deep-water release devices, and new,

more efficient, and less-substrate-damaging bottom trawl designs for finfish and shellfish commercial fisheries. New methods to minimize post-release and bycatch mortality to ESA-listed and non-listed fish, turtle, and invertebrate species in recreational and commercial fisheries may include development of new trawl designs, net designs, lighting configurations, and adaptations to hook and line configurations. Experimental gear may be tested within an existing fishery or be conducted as part of a separate research effort outside of the current fishery season. Data may be collected to compare catch rates, performance, and efficiencies between traditional and new gear methodologies.

Past focus of gear testing projects has included testing new lobster traps that facilitate escape of Atlantic Cod and other groundfish off the coast of Maine. Projects may also test the efficacy of new trap technologies that target predatory invasive species, such as Lionfish, while reducing bycatch of other non-target species across reef and mid-water coastal habitats.

Example project objectives may include but are not limited to:

- Refining the design of prototype devices to evaluate durability and practicality for oceanic fishing conditions.
- Identifying non-estuarine spawning locations of non-target fish species to maximize protection during spawning seasons.
- Working with industry leaders to develop more sustainable and environmentally friendly products through monitoring traps designed to allow the escape of sublegal species and evaluating baits that utilizes more low-cost, low-impact ingredients.
- Designing and developing multi-panel grid systems for trawl fisheries to reduce bycatch (e.g., German FRESWIND grid system).

Example projects may include but are not limited to:

- Field Testing an Electric Decoy for Reducing Elasmobranch Bycatch in Longline Fisheries.
- Complementary Testing of Off-bottom Trawls to Target Georges Bank Haddock.
- Evaluation of Conservation Gear Technology to Reduce Black Sea Bass Bycatch in the Small Mesh Longfin Squid Fishery.
- Reducing Yellowtail and Windowpane Flounder Bycatch: Application of a Modified European Grid System in the Georges Bank Haddock Fishery.
- TickleDredge: Bycatch Reduction for the Sea Scallop Fishery.

Processing Studies

Processing improvement studies may include modernizing equipment or developing new processing protocols to reduce waste, improve quality of products, or develop methods to produce more marketable products. Projects may seek to determine and improve shelf life (e.g., nutrient density, oxidation, texture) and consumer acceptability of frozen seafood. Projects may also aim for full utilization of processed fish by identifying economic opportunities for lower grades of certain species or finding non-culinary uses for fish parts that are currently “wasted” during processing.

Example project objectives may include but are not limited to:

- Assessing the feasibility of developing local fishmeal plants to build resiliency in local fishing communities by producing locally sourced aquafeed.
- Creating processing capacity for fish species where none currently exists.
- Enhancing the long-term viability of local seafood exchanges by improving the capacity to purchase, process, and market underutilized species.

Example projects may include but are not limited to:

- Consumer Acceptability and Shelf-life Assessment of Frozen Seafood for Market Success.
- Application of Dry-Extrusion Technology Using By-Products from Seafood Processing to Produce Novel Marine Ingredients for Aquafeeds.
- A Culinary Engineering Approach to Increasing the Value of Local Fisheries: Reducing Fish Discards at Sea and Promoting Full Utilization.
- Bioconversion of Squid and Scallop Processing Byproducts into Specialty Aquaculture Feed Ingredients Employing Energy Efficient Hydrolysis and Low-Cost Drying Processes.

2.2.2.4 Aquaculture

Proposed projects categorized within the aquaculture project type (i.e., aquaculture projects) focus on laboratory and field-based research of finfish, shellfish, crustaceans, algae, and other economically important species, as well as aquaculture habitat assessments. Aquaculture projects can involve routine laboratory analysis within a confined laboratory setting or partially enclosed, land-based systems (e.g., Recirculating Aquaculture Systems [RAS] and Partially Recirculating Aquaculture Systems [PRAS]) and research and assessments in field settings. Similar to the research and monitoring project type, aquaculture projects may analyze previously collected water, animal, plant, benthic, or seafood samples to advance S-K Program aquaculture projects.

Within laboratory settings, these projects may include genetic-based and selective breeding experiments, rearing and culturing trials, feed and food science, and health and disease assessments of existing and candidate aquaculture species. These projects may result in the development, evaluation, and refinement of procedures for the culture of finfish and shellfish encompassing all life stages—from the hatchery to harvest. Aquaculture projects that occur in an office or laboratory setting would have little to no effect on the surrounding environment.

Aquaculture projects that take place in field settings or partially enclosed, land-based systems can impact the surrounding environment through the release of wastewater effluent, nutrient releases, interactions between natural and hatchery-raised individuals of the same species, and further ecosystem-related interactions that impact the biological environment and associated resources (Table 2-4). RAS use a technology for farming fish or other aquatic organisms by reusing water. RAS are considered closed with limited potential for dispersal of impacts beyond the closed borders. RAS can be completely indoors, partially indoors/outdoors, or completely outdoors. PRAS are similar to RAS, but with PRAS, a higher percentage of water is flow-through and is not recirculated. Therefore, PRAS are not considered closed systems, and there is potential for dispersal impacts beyond the closed borders. These projects can involve production system development, rearing, culturing, genetics and breeding research, feed and food science, and health and disease assessments.

Aquaculture projects funded under the S-K Program are primarily implemented at existing facilities or aquaculture locations. The S-K Program can contribute funding toward the development and construction of pilot-scale hatchery, storage, processing, and nursery facilities and fund laboratory research to evaluate the potential for aquaculture of new species. Aquaculture projects may be integrated with other types of projects such as research and monitoring; outreach, education, and planning; socioeconomic research, gear testing, bycatch reduction, and processing studies; and seafood promotion and marketing.

Table 2-4. Aquaculture Projects – Methods and Techniques in Office or Laboratory, and Field Settings

Action Setting	Method	Techniques to Implement each Method
Office or laboratory	• Biological lab research • Desktop analysis • Interviews and surveys • Workshops, trainings, informational surveys	• Conduct laboratory and desktop analysis of previously collected water, animal, plant, benthic, or seafood samples to examine genetics or develop disease and toxin assays. • Manage, analyze, and synthesize data; develop and use databases. • Test prototypes. • Conduct computer modeling, GIS. • Develop and use computer-based tools.
Field (land, water, or underwater)	• Biological field research	• Use SCUBA divers, ROVs, or AUVs for survey and mapping of seafloor and freshwater benthic habitats. • Operation of vessels for research and monitoring. • Collect broodstock and specimens of shellfish, finfish, seaweed from wild populations and habitats. • Mark or tag finfishes or invertebrates using standard procedures and safeguards. • Collect fin/tissue clips or seaweed samples for genetic or laboratory analyses. • Outplant laboratory reared finfish, shellfish, crustaceans, algae, and other economically important species at existing aquaculture facilities. • Conduct field-based testing of new feeds and therapeutants. • Conduct routine monitoring and evaluation related to developing aquaculture methods for existing/candidate species. • Conduct field testing of new gear, monitoring equipment, and exclusion devices at existing aquaculture facilities (see Section 2.2.2.3, Gear Testing, Bycatch Reduction, and Processing Studies).

Laboratory and Rearing Research on Finfish, Shellfish, Algae, and Other Economically Important Species

Laboratory and rearing research projects may develop, evaluate, and refine procedures for the culture of finfish and shellfish encompassing all life stages, from the hatchery to harvest. Laboratory and rearing research focus on various aspects involving the culture of animals, the environment to which they are exposed, and the culture system in which they are reared. These projects may accelerate aquaculture project development of candidate species through training and transfer of best practices.

Example project objectives may include but are not limited to:

- Researching, developing, and testing of new aquaculture finfish feeds that do not include traditional fishmeal, including replacement with macroalgae and fish processing trimmings.

- Testing new aquaculture technologies and approaches within a confined laboratory to improve harvest levels, increase sustainability of a product, and reduce overall cost.

- Developing finfish and shellfish aquaculture protocols to optimize production and quality, determining the optimal rearing temperatures, optimizing water conditions for survival and growth,

determining optimal densities for outdoor grow-out to market size, and assessing the economic feasibility of commercial production.

- Training and transfer of best practices, through workshops, working groups, and document development (e.g., training manuals), to accelerate aquaculture project development of candidate species.

Example projects may include but are not limited to:

- Increasing Fishing Opportunities and Creating Jobs through Baitfish Aquaculture.
- Nutritional Approaches in Larval Marine Fish Culture to Maximize Fish Production and Quality for Stocking and Farming Programs.
- Pilot-commercial Evaluation of Salt-incorporated Diets for Black Sea Bass Production in a Low-salinity Recirculating Aquaculture System: Expanding Siting Options for Land-based Finfish Mariculture.
- Development of Aquaculture Methods for Hogfish.
- Development of a Fishermen Operated Pilot-scale Queen Conch (*Lobatus gigas*) Hatchery and Nursery Facility for Sustainable Seafood Supply and Restoration of Wild Populations in Puerto Rico.
- Establishing a Supply and Training Program for Aquaculture Production of Hawaiian Sea Cucumber.

Field Research and Assessment of Finfish, Shellfish, Algae, and Other Economically Important Species

Field research and assessment of finfish, shellfish, and algae aquaculture projects encompass surveys and monitoring, broodstock and specimen collection, marking and/or tagging, and shellfish outplanting with the goal of evaluating performance of aquaculture projects under commercial conditions as well as a determination of environmental impacts and effects. These projects may involve production system development, rearing, culturing, genetics, and breeding research, feed and food science, and health and disease assessments. Finfish and shellfish aquaculture projects may utilize a variety of methods including desktop analysis, laboratory research and experimentation, and field research at existing aquaculture facilities. Projects may occur as part of existing or new hatcheries and facilities. The S-K Program can contribute funding toward the development and construction of pilot-scale hatchery, storage, processing, and nursery facilities and fund laboratory research in laboratory settings, to evaluate the potential for aquaculture of new species.

Example project objectives may include but are not limited to:

- Developing an understanding of the genetic basis of traits that currently limit/enhance the development and progress of domestic aquaculture of finfish species for environmentally friendly and economically sustainable aquaculture.
- Developing new offshore shellfish production locations as part of developing major sustainable shellfish industries to help meet growing consumer demand, reduce U.S. dependency on seafood imports, and create jobs in coastal communities.
- Conducting research targeting minimizing adverse effects (e.g., sea lice infestations) of rearing finfish, such as salmon, in captivity and net pens.

- Outplanting laboratory-reared shellfish on commercial aquaculture farms or leases for small-scale, experimental grow-out.

- Incorporating observations of and improving shellfish testing for harmful algal blooms, phytoplankton community composition, and increasing the capacity to produce oyster seed and invertebrate larvae.

Example projects may include but are not limited to:

- Aquaculture Methods to Advance Fishery Restoration and Commercial Production of Bay Scallop (*Argopecten irradians*) on the Eastern Shore of Virginia.

- Build a State-of-the-Art Wet Storage and Depuration Facility for Off Bottom Oysters on Dauphin Island utilizing Vacuum Air Lift ™ Technology.

- Demonstrating Aquaculture Technologies Designed to Increase the Supply, Quality, and Diversification of Domestic Seafood: Field Experiments with Cultured Arctic Surfclams, *Mactromeris polynyma*.

- Development of a Fishermen Operated Pilot-Scale Queen Conch (*Lobatus gigas*) Hatchery and Nursery Facility for Sustainable Seafood Supply and Restoration of Wild Populations in Puerto Rico.

- Development of Red Sea Cucumber (*Parastichopus californicus*) Poly-aquaculture for Nutrient Uptake and Seafood Export.

- Fishmeal Replacement Using the Byproducts from Microalgae Based Biofuel Production and Food Processing in the Diets of High Value Marine Finfish.

- Submerged Culture of Steelhead Trout for Open Ocean Aquaculture in the Northeastern United States.

- Sustainable Capture-based Aquaculture, of Siganids, with associated Hatchery-based Aquaculture Development, in Pohnpei, FSM, an Alternative Income and Food Security for Rural Fishing Communities.

Aquaculture Habitat Assessments

Habitat assessment projects generally assess the impacts of existing aquaculture facilities on nearshore estuarine, mudflat, and rocky intertidal habitats. Habitat assessment projects may also assess interactions between aquaculture facilities and marine species. These studies generally primarily involve desktop synthesis; however, research in field settings including in-water testing of gear, and biological sampling or observation may also occur.

Example project objectives may include but are not limited to:

- Measuring and quantifying the effect of shellfish culture on seagrass and its function as habitat for fish and invertebrates.

- Determining the distribution of, and spatial relationship between, existing shellfish culture and seagrass within coastal estuaries.

- Developing multi-trophic, all-season aquaculture equipment for finfish, shellfish, algae, and other economically important species.
- Synthesizing data and parameterizing production functions for higher trophic level species of interest (English sole, crab, salmon) across habitat types.
- Addressing the potential for interactions between marine farm gear (e.g., nets, cages, and mooring and shellfish lines) and protected marine species, including fish, sea turtles, birds, and marine mammals such as sea otters, pinnipeds (seals and sea lions), odontocetes (toothed whales, dolphins, and porpoises), and baleen whales.

Example projects may include but are not limited to:

- Quantification of Functional Relationships Between Shellfish Culture and Seagrass in US West Coast Estuaries to Inform Regulatory Decisions.
- Comparative Habitat Use of Estuarine Habitats with and without Clutch-on-Longline Gear Present.
- Monitoring Interactions and Reducing Probability of Protected Species Entanglement in Marine Aquaculture Gear: Physical Measurements and Stakeholder Workshop.
- Developing Whale and Turtle-friendly Subtidal Aquaculture Gear.

2.2.2.5 Socioeconomic Research

Proposed projects categorized within the socioeconomic research project type (i.e., socioeconomic research projects) may, among other things, integrate multidisciplinary social science and ethnographic studies including surveys, interviews, and legal and policy research. This research is intended to manage, analyze, and synthesize data to develop and utilize databases. As part of this research, meetings, workshops, conferences, and trainings may be convened to engage in strategic planning exercises. Typical techniques applied to such projects are provided in Table 2-5.

Table 2-5. Socioeconomic Research Projects – Methods and Techniques in Office or Laboratory, and Field Settings

Action Setting	Method	Techniques to Implement each Method
Office or laboratory	• Desktop analysis • Interviews and surveys • Workshops, trainings, informational surveys	• Manage, analyze, and synthesize data; develop and use databases. • Conduct computer modeling, GIS. • Develop and use computer-based tools. • Conduct surveys, interviews, legal and policy research via in-person surveys, or phone-, paper-, or web-based surveys.
Field (land, water, or underwater)	• Interviews and surveys • Workshops, trainings, informational surveys	• Conduct social science interviews and other research methodologies in the field (on board fishing vessels, ports and harbors, seafood markets, restaurants). These activities will be limited to interviews, observations, polling, or other socially based activities.

Proposed actions focused on social science, legal and policy research, and planning would primarily occur within office or laboratory settings. Interviews and surveys, workshops, trainings, and informational surveys could also take also take place in a field setting. Proposed activities could include human interaction research (discussions, interviews, surveys), computer-based work and analyses, and modeling efforts that are intended to improve the management and development of commercial and recreational fisheries in collaboration with regional, state, and federal agencies. Proposed activities may also include researching

possible development and implementation of fisheries co-ops and co-op–owned fish markets for underserved and underdeveloped fisheries resources.

Example project objectives may include but are not limited to:

- Improving stakeholder engagement or developing advisory councils to improve communication among fish harvesters, legislators, scientists, managers, and nongovernmental organizations.
- Documenting fishing practices and harvest patterns to evaluate changes in fishing behavior and characterize observed changes and other behavioral responses to regulatory, ecological, and socioeconomic factors.
- Developing integrated business tools and mechanisms to support the needs of commercial fishermen.
- Supporting the establishment of cooperative endeavors, such as consortia, networks, business incubators, and/or inter-agency agreements or to apply for a permit.

Example projects may include but are not limited to:

- Supply Chains for Aquacultured Oysters: Enhancing Opportunities for Businesses and Shellfish Growers and Examining Traceability and Food Safety.
- Improving the Profitability of Fishermen by Expanding Fishing Specific Financial and Business Planning Resources.
- Social and Ecological Consequences of Regulatory Change in the Alaska Recreational Halibut Fishery.
- Characterizing the Behavior and Preferences of Anglers in the Recreational Fishery for Atlantic Bluefin Tuna (*Thunnus thynnus*) Along the U.S. East Coast.

2.2.2.6 Outreach, Education, and Planning

Proposed projects categorized within the outreach, education, and planning project type (i.e., outreach, education, and planning projects) may, among other things, integrate outreach, education, and planning activities as a component of a proposed project or as the primary intent of a proposed project. Typical methods and techniques applied to such projects are provided in Table 2-6.

Table 2-6. Outreach, Education, and Planning Projects – Methods and Techniques in Office or Laboratory, and Field Settings

Action Setting	Method	Techniques to Implement each Method
Office or laboratory	• Desktop analysis • Interviews and surveys • Workshops, trainings, informational surveys	• Convene meetings, workshops, conferences, trainings; engage in strategic planning exercises. • Develop and deliver presentations and briefings. • Develop permanent and semi-permanent learning displays and exhibits. • Develop written materials, brochures, 1-pagers, educational and outreach materials. • Develop websites, digital media and content, social media presence. • Provide support to establish cooperative endeavors, such as consortia, networks, business incubators, and/or inter-agency agreements or to apply for a permit.
Field (land, water, or underwater)	• Interviews and surveys • Workshops, trainings, informational surveys	• Use SCUBA, vessel, or other means to develop multi-media products and videos.

Some outreach and education activities may occur in an outdoor field setting and include site visits to project-specific locations. Outreach and education programs may take place with collaborating seafood industry developers, commercial and recreational fishermen, the seafood consuming public, or research partners.

Example project objectives may include:

- Training new natural-resource professionals to use newly developed methods for fish life history data collection and rapid, low-cost, reproductive analysis of coral-reef fishes.
- Providing training, methodology, and equipment for reduction in fish mortality and the safe release of bycatch from line fishing, processing, and storage of chilled, gutted fish.

Past example projects under this project type that have been funded under the S-K Program include:

- Municipal Outreach for Restoring and Growing the Softshell Clam Industry in Maine through Aquaculture.
- The Old(er) Men of the Sea: Graying of the Fishing Industry and its Impact on Local Community Resiliency.
- Expanding Fisheries and Economic Opportunities for Pohnpei, Micronesia Coral Reef Fishers.

2.2.3 Best Management Practices for All Project Types

For all projects funded under the S-K Program, or similar projects, NMFS expects that BMPs will be implemented in an effort to avoid or minimize potential effects on physical and biological resources in the affected environment. These measures include standard practices typically employed by researchers and vessel operators and include, but are not limited to, the following:

- As part of the S-K Program application process, NOAA requires all applicants to provide a description of all necessary federal, state, and local government permits and approvals that are

necessary for the proposed work to be conducted; a determination of whether or not permits or approvals have been satisfied; and a list of existing federal, state, or local government programs or activities that the project would affect.

- Where practical, research vessels should use fixed moorings, drifting, or live boating (maintaining a stationary location using the vessel engine) to avoid substrate impacts from anchoring.
- All vessel operators should be licensed and highly trained, with an appropriate U.S. Coast Guard (USCG) license or equivalent NOAA Corps experience for the vessel size.
- Researchers conducting studies funded by the S-K Program will report incidental marine mammal and sea turtle observations as part of their regular protocols.
- When practical, shore-based research activities should avoid sensitive timing periods in areas known to support sea turtle nesting, marine bird nesting, or marine mammal haulouts and rookeries unless those areas are the direct subject of research activities.
- If sensitive marine mammal breeding and rearing areas cannot be avoided during sensitive periods, researchers must comply with the MMPA and obtain an Incidental Harassment Authorization, as applicable.
- All research vessels must attempt to maintain a safe distance between marine mammals and their vessels at all times.
- All vessels operated under S-K Program grants should transit live bottom/artificial habitats at slow speeds and avoid transiting near tide lines where turtles may be foraging.
- Aircraft operations, if required for research or monitoring, would not occur below 200 feet in elevation in proximity to marine mammal haulout sites.
- Projects that outplant shellfish will use only disease-free individuals that are either native to or naturalized to the local environment.
- Projects that require the use of equipment placed on the seafloor, lakebed, or riverbed including anchors will properly secure equipment to minimize bottom disturbance and impacts on benthic habitats.
- All S-K Program aquaculture projects, which utilize field research and assessments of shellfish and laboratory and rearing research on finfish and shellfish, will adhere to the Aquaculture Best Management Practices described in Appendix E.

2.3 Screening Criteria for Developing Reasonable Alternatives

NEPA requires that any federal agency proposing a major action (as defined under NEPA) consider reasonable alternatives to the Proposed Action. The CEQ NEPA regulations define reasonable alternatives as those that are technically and economically feasible, meet the purpose and need for the proposed action, and, where applicable, meet the goals of the applicant (40 CFR § 1508.1(z)). NOAA has developed screening criteria specific to this PEIS to determine whether an alternative is reasonable. The following discussion identifies the screening criteria used in this PEIS; evaluates various alternatives against the screening criteria, and identifies those alternatives found to be reasonable; identifies those alternatives found not to be reasonable; and for the latter, provides the basis for these findings. Alternatives considered but found not to be reasonable are not evaluated in detail in this PEIS.

Based on environmental issues identified through scoping and the purpose and need of the Proposed Action, NOAA developed and evaluated a reasonable range of alternatives for implementing the S-K Program in accordance with NEPA, CEQ's implementing regulations, and NOAA's internal implementing procedures set forth in the Companion Manual to NOAA Administrative Order 216-6A. Based on the purpose and need described in Section 1.4, Purpose and Need, an alternative for implementation of the S-K Program must meet the following criteria to be considered a reasonable alternative carried forward for detailed consideration:

1) It meets the intent of the S-K Program requirements to address the needs of fishing communities in optimizing economic benefits by building and maintaining sustainable fisheries and practices, dealing with the impacts of conservation and management measures, and increasing other opportunities to keep working waterfronts viable.

2) It meets the intent of the NOAA mission and relevant strategic plans or, alternatively, maximizes public benefit (NOAA must allocate funding to ensure the maximum amount of NOAA trust resources benefit from the Proposed Action).

3) It can be implemented irrespective of the amount of funding available (funding neutral).

4) It provides flexibility and allows the S-K Program to prioritize projects annually based on current events, input from partners, and potentially from Congress.

5) It provides flexibility in priorities within the S-K Grant Program.

6) It allows projects to be funded in any U.S. region or territory including the Marshall Islands, Republic of Palau, or the States of Micronesia.

2.4 Alternatives Analysis

2.4.1 Alternatives Carried Forward for Detailed Analysis

NEPA and CEQ regulations require all EISs to consider alternatives to a proposed action, including a No Action Alternative, and require federal agencies to "study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources" (42 U.S.C. 4332(C) and (E)). This PEIS considers a No Action Alternative and the Proposed Action (Promotion, Marketing, Research, and Development).

2.4.2 Alternatives Considered but Not Carried Forward for Further Analysis

Agencies must evaluate all reasonable alternatives to a proposed action and, for alternatives the agency eliminated from detailed study, briefly discuss the reasons for their elimination. It is well accepted that an agency must only consider "reasonable alternatives" bounded by the agency's purpose and need for acting and need not speculate or consider alternatives that are not viable. The following discusses those alternatives that were considered but not carried forward for further analysis.

2.4.2.1 No Offshore Finfish Aquaculture

At the conclusion of the public scoping process (see Section 1.8, Public Involvement), several comments suggested removing offshore finfish aquaculture projects from the list of possible S-K Program projects to be funded. This alternative was considered, and although removal of offshore finfish aquaculture projects from the S-K Program may align with the purpose and need, this alternative does not meet all of the

screening criteria considered for viable alternatives (Section 2.3, Screening Criteria for Developing Reasonable Alternatives). In particular, excluding offshore finfish aquaculture projects from the S-K Program does not meet NOAA's Aquaculture Strategic Plan (NOAA 2015b), which envisions a "robust U.S. marine aquaculture sector that creates jobs, provides sustainable seafood, and supports healthy oceans." NOAA supports science and research to grow sustainable aquaculture in the United States, while supporting commercial and recreational fisheries and complementing NOAA's comprehensive strategy for maintaining healthy and productive marine populations, ecosystems, and vibrant coastal communities (NOAA 2015b).

2.4.2.2 Fund Only Promotion, Development, and Marketing Projects

The alternative to fund only PDM projects within the S-K Program was considered but not carried forward for further analysis because this alternative does not meet all of the screening criteria considered for viable alternatives (Section 2.3, Screening Criteria for Developing Reasonable Alternatives). In particular, excluding projects that are not PDM projects does not provide flexibility in priorities within the S-K Grant Program. This alternative would limit the S-K Program to one primary funding priority as opposed to the 16 other funding priorities that have been used since 2010 (see Section 1.3, History of the S-K Program).

2.4.2.3 Terminate the S-K Program

The alternative to terminate the S-K Program was considered but not carried forward for analysis because it does not meet most of the screening criteria for developing reasonable alternatives, including the purpose and need of the S-K Program, NOAA's mission statement, or relevant strategic plans. Terminating the S-K Program would not address the needs of fishing communities because projects would not be funded that optimize economic benefits by building and maintaining sustainable fisheries and practices, dealing with the impacts of conservation and management measures, or increasing other opportunities to keep working waterfronts viable. This alternative would reduce programmatic and national funding flexibility and not allow programs to prioritize projects annually based on current events or input from partners (e.g., Congress). This potential alternative would weaken NOAA's efforts to address its mission of understanding and predicting changes in climate, weather, oceans, and coasts; sharing that knowledge and information with others; and conserving and managing coastal and marine ecosystems and resources.

3 Affected Environment

This chapter describes resources likely to be affected directly, indirectly, or cumulatively by the No Action Alternative and the Proposed Action. This chapter summarizes the environments that comprise the affected environment for locations where projects funded under the S-K Program, or similar projects consistent with the scope of the S-K Program, may occur. Based on an analysis of projects funded under the S-K Program from 2010 to 2021, the affected environment associated with the Proposed Action is widely variable and includes the following categories:

- Physical Environment
- Biological Environment
- Social Environment

Since this is a programmatic document, the description of the affected environment focuses only on primary environmental resources that may be impacted by S-K Program projects or projects consistent with the scope of the S-K Program. In addition, Section 3.5, Regulatory Considerations, describes some of the federal environmental regulations that are likely to apply to S-K Program projects. Data and information necessary to describe the affected environment at a programmatic level are available via desktop research and previously released NOAA programmatic NEPA documents.

The affected environment includes all marine, estuarine, and coastal habitats in the United States and territories (Table 3-1). It also includes rivers, streams, and creeks affecting marine or estuarine waters, or that support migratory fish populations. It may also include adjacent or continuous habitats in Canada or Mexico that support living coastal and marine resources under NOAA trusteeship. NOAA trust resources are living marine resources that include commercial and recreational fishery resources (marine fish and shellfish and their habitats); EFH; anadromous species; threatened and endangered (T&E) marine species and their habitats; marine mammals, turtles, and their habitats; marshes, mangroves, seagrass beds, coral reefs, and other coastal habitats; and resources associated with National Marine Sanctuaries and National Estuarine Research Reserves.

The geographic extent considered herein encompasses a wide-spanning area over the following NOAA Fisheries regions (Figure 1-1):

- Alaska
- New England/Mid-Atlantic (includes the U.S. Great Lakes)
- Pacific Islands (includes U.S. territories in the Pacific Ocean, the Marshall Islands, the Republic of Palau, and the States of Micronesia)
- Southeast (includes U.S. territories in the Gulf of Mexico and the Caribbean Sea)
- West Coast

The descriptions use a broad location approach for brevity (i.e., for all regions presented in Table 3-1); however, for resources that differ greatly among regions, efforts are made to highlight resources on a regional basis.

Table 3-1. Impacted Resources by Environment

Environment	Resource
Physical	Offshore (Pelagic; Benthic)
Physical	Nearshore (Reefs; Intertidal, Sandy Beach and Dunes; Estuaries; Coastal Wetlands)
Physical	Freshwater (Streams and River Channels)
Physical	Water Quality
Biological	Submerged Aquatic Vegetation, Algae, and Macroalgae
Biological	Benthic Organisms
Biological	Fish (T&E; EFH)
Biological	Protected Species (Marine Mammals, Turtles, Marine Birds)
Social	Recreation and Tourism
Social	Cultural and Historic Resources
Social	Socioeconomics

3.1 Physical Environment

NOAA S-K Program funded projects that include field-based research have the potential to affect physical environments and associated resources. Resources of the physical environment include offshore, nearshore, and freshwater, and their associated habitats (Table 3-1). Water quality is also described as a resource of the physical environmental that may be affected by S-K Program funded projects. A description of the physical environment and associated resources is provided below.

3.1.1 Offshore

For purposes of this PEIS, offshore is defined as the open marine environment 3 nautical miles (NM) to 200 NM offshore. This area is generally consistent with NOAA's jurisdiction to manage fisheries in the U.S. exclusive economic zone (EEZ[1]). Beyond 200 NM is commonly referred to as the high seas. Those areas are beyond the jurisdiction of the United States and are not considered for this PEIS.

About 15 percent of offshore area lies on the geologic continental shelf and is shallower than 200 meters (656 feet). Another 10 to 15 percent lies on the continental slope and rise, between 200 and 2,000 meters (656 and 6,562 feet) water depth. The remaining 70–75 percent is abyssal plain where water depths reach 3,000–5,000 meters (9,843–16,405 feet). The offshore environment can be divided into pelagic habitats (i.e., the water column) and benthic habitats (i.e., the seafloor). Productivity of the offshore ecosystem supports a great diversity and abundance of invertebrates, fishes, seabirds, and marine mammals.

3.1.1.1 Pelagic

The pelagic zone refers to open and free waters in the body of the ocean that stretch between the ocean surface and the ocean bottom. Separated into epipelagic, mesopelagic, bathypelagic, abyssopelagic, and hadopelagic subzones, areas in the pelagic zone are distinguished by their depths and the ecology of the zone (MarineBio 2021b). The surface layer, or the epipelagic zone, includes the upper 200 meters (650 feet) of the water column. The mesopelagic zone starts 200 meters below the surface and extends to 1,000

[1] The MSA defines the inner boundary of the EEZ as "a line coterminous with the seaward boundary of each of the coastal States." 16 U.S.C. 1802(11). The seaward boundary is 3 NM for all but two states and one territory. The seaward boundaries of Texas, the Gulf coast of Florida, and Puerto Rico are 9 NM.

meters (3,300 feet). The bathypelagic zone is from 1,000 to 4,000 meters (13,000 feet). The abyssopelagic zone is 4,000 meters and below. The surface layer is the area where the water is mixed by currents, waves, and weather. Conditions in the water column change with depth, pressure increases, the temperature and amount of light decrease, and the salinity and amount of dissolved oxygen (DO), as well as micronutrients such as iron, magnesium, and calcium that change to varying degrees.

The temperature of ocean water is important to oceanographic systems. For example, the temperature of the mixed layer has an effect on the evaporation rate of water into the atmosphere, which in turn is linked to the formation of weather. The temperature of water also produces density gradients within the ocean, which prevents mixing of the ocean layers (Bigg et al. 2003). The amount of dissolved salt or salinity varies between ocean zones, as well as across oceans. For example, the Atlantic Ocean has higher salinity levels than the Pacific Ocean due to input from the Mediterranean Sea (several large rivers flow into the Mediterranean). The average salt content of the ocean is 35 parts per thousand, but it can vary at different latitudes depending on evaporation and precipitation rates. Salinity is lower near the equator than at middle latitudes due to higher rainfall amounts. Salinity also varies with depth, creating vertical salinity gradients often observed in the oceans (Bigg et al. 2003).

The circulation of ocean water is a complex system involving the interaction between the oceans and the atmosphere. The system is driven primarily by solar radiation that results in wind being produced from the heating and cooling of ocean water, and the evaporation and precipitation of atmospheric water. Except for the equatorial region, which receives a nearly constant amount of solar radiation, the latitude and seasons affect how much solar radiation is received in a particular region of the ocean. This, in turn, has an effect on sea-surface temperatures and the production of wind through the heating and cooling of the system (Tomczak and Godfrey 2003).

Ocean currents can be thought of as organized flows of water that exist over a geographic scale and time period in which water is transported from one part of the ocean to another (Levington 1995). In addition to water, ocean currents also transport plankton, fish, heat, momentum, salts, oxygen, and carbon dioxide. Wind is the primary force that drives ocean surface currents; however, Earth's rotation and wind determine the direction of current flow. The sun and moon also influence ocean water movements by creating tidal flow, which is more readily observed in coastal areas than in open-ocean environments (Tomczak and Godfrey 2003).

The upper portion of the epipelagic zone receives sunlight that drives photosynthesis in microscopic floating plants called phytoplankton. Phytoplankton form the base of the complex and diverse open-ocean food web. Upwelling in the spring and summer fuels blooms of phytoplankton, which in turn feed zooplankton and some planktivorous fishes such as anchovies and sardines. Zooplankton such as larvae, copepods, krill, and gelatinous organisms are eaten by a wide variety of large, highly mobile animals, including squid, fishes, sea turtles, seabirds, and mammals. Invertebrates such as jellyfish, squids, octopus, and krill are also found in the pelagic zone. Large ocean vertebrates such as crustaceans, fish, and sea turtles live or migrate through the pelagic zone. Marine birds can be found above the pelagic zone.

Commercial, recreational, and other human interests play an important role in the open ocean. Areas that are productive for fisheries also attract marine organisms that are not harvested, such as seabirds, leatherback sea turtles, and whales. Human impacts, such as commercial vessel traffic and marine debris, have the potential to harm or disturb the natural behavior of open-ocean animals. Vessel spills, for example, are a serious potential threat to marine resources.

3.1.1.2 Benthic

The benthic zone is the ecological region at the bottom of the sea. It includes the sediment surface and some subsurface layers. Marine organisms living in this zone, such as clams and crabs, are called benthic

organisms or, collectively, the benthos. The demersal zone is just above the benthic zone. It can be significantly affected by the seabed and the life that lives there. Fish that live in the demersal zone are called demersal fish and can be divided into benthic fish, which are denser than water so they can rest on the bottom, and benthopelagic fish, which swim in the water column just above the bottom. Demersal fish are also known as bottom feeders and groundfish.

The benthic region of the ocean generally extends from nearshore coastal environments downward along the surface of the continental shelf out to sea. The continental shelf is a gently sloping benthic region that extends away from the land mass. At the continental shelf edge, usually about 200 meters (660 feet) deep, the gradient greatly increases and is known as the continental slope. The continental slope drops down to the deep-sea floor. The deep-sea floor is called the abyssal plain and is usually about 4,000 meters (13,000 feet) deep. The ocean floor is not all flat but has submarine ridges and deep ocean trenches known as the hadal zone.

Benthic organisms are different from those elsewhere in the water column as they have adapted to live on the substrate and under the physical conditions in the benthic zone. Many organisms have adapted to deep-water pressure and cannot survive in the upper parts of the water column. Because light generally does not penetrate very deep into the water column, the energy source for the benthic ecosystem is often marine snow. Marine snow is organic matter from higher up in the water column that drifts down to the depths. This dead and decaying matter sustains the benthic food chain; most organisms in the benthic zone are scavengers or detritivores. Some microorganisms use chemosynthesis to produce biomass.

Benthic invertebrates such as lobsters, crabs, scallops, clams, and sea urchins support important commercial and recreational fisheries, including some of the highest valued fisheries in the United States. These commercially valuable fisheries have often been the subject of projects funded through the S-K Program.

3.1.2 Nearshore

For purposes of this PEIS, the nearshore is defined as aquatic and semi-aquatic habitat within coastal areas from 3 NM offshore to the coastal zone, including reefs, intertidal, sandy beach, dunes, estuaries, and coastal wetlands. The following descriptions of the nearshore focus on the common habitats that exist in the nearshore and coastal areas throughout NOAA's five geographic regions. Nearshore resources potentially impacted by projects funded under the S-K Program vary greatly among and within regions.

3.1.2.1 Reefs

A reef is a ridge of material at or near the surface of the ocean. Reefs may be natural or artificial. The most common natural reefs are coral reefs and oyster reefs. Artificial reefs may be intentionally designed benthic structures to protect, enhance, or restore components of marine ecosystems, or may be a result of submerged shipwrecks, as well as oil and gas platforms, bridges, lighthouses, and other offshore structures (see Section 3.3.4, Marine Artificial Structures).

Coral reefs are among the most productive of marine ecosystems and are critically important for the ecosystem services they provide. They are complex and diverse ecosystems with high levels of biodiversity and productivity. Coral reefs are found throughout the Southeast Atlantic, Gulf of Mexico, and Pacific regions of the coastal United States. The United States has jurisdiction over an estimated 19,700 square kilometers (km^2) of coral reefs (Turgeon et al. 2002). Twenty-two threatened coral species from the Caribbean and Indo-Pacific regions are listed under the ESA. Coral reefs provide habitat for thousands of species of fish and shellfish, hundreds of species of corals, algae, sponges, echinoderms, mollusks, bryozoans, and crustaceans, and many other groups of organisms. Therefore, the health of coral reefs has

profound implications for these species and the marine ecosystem as a whole. Generally, shallow-water corals require fully marine waters, warm water, ample sunlight, and the presence of suitable substratum.

In addition to their exceptionally important ecological role, coral reefs provide numerous human use values. These include but are not limited to shoreline protection (through dissipation of wave energy); habitat for reef and pelagic fish species (re: human food/subsistence); diving, snorkeling, and other recreational opportunities and associated economic benefits; and potential medicinal uses.

3.1.2.2 Intertidal, Sandy Beach, and Dunes

Intertidal habitat lies between the high and low tide marks and is regularly covered and exposed by the advance and retreat of tides. Because they are repeatedly subjected to air and sun as well as the incessant action of waves when underwater, plants and animals that occupy these habitats must be hardy and adaptable. Despite the formidable challenges that intertidal habitats present, they include a high biodiversity of organisms (many of them at the edge of their physical and ecological tolerances) that have adapted to the unique niche zones present.

The interface between land and ocean such as sandy bluffs, embayments, barrier islands, and dunes are areas naturally unstable due to constant action of waves, currents, and winds. Materials that make up these areas are fine to coarse (diameters from 0.5 to 2 millimeters) and may contain substantial amounts of shell fragments. Beaches, characterized by sand and cobbles and having few fine-grained silts and clays, are formed by waves and tides sufficient to winnow away the finer particles. The sand also typically "migrates" offshore and onshore seasonally. Sand dunes form when wind and waves push sand above the usual water level and it is trapped by gravel and vegetation.

3.1.2.3 Estuaries

An estuary is a partially enclosed body of water in which saltwater from the ocean mixes with freshwater from rivers, streams, and creeks. These areas of transition between the land and the sea are tidally driven but are sheltered from the full force of ocean wind and waves. Estuaries are generally enclosed in part by the coastline, marshes, and wetlands; the seaward border may be barrier islands, reefs, and sand flats or mud flats. Estuaries are biologically productive and directly support thousands of species of plants and animals, as well as sequestering and storing substantial amounts of carbon from the atmosphere, particularly in vegetated coastal wetlands. Bodies of water that may be estuaries include sloughs, bays, harbors, sounds, inlets, and bayous.

Estuaries are particularly sensitive to human activities on surrounding lands such as diking and filling, which has resulted in more than 70 percent of the estuarine habitat in the Pacific Northwest and California. Generally, estuarine conditions are poorest in the Gulf of Mexico and Greater Atlantic region (EPA 2012). However, restoration efforts throughout the action area, such as the removal and relocation of dikes and levees, are ongoing and beginning to restore many degraded estuaries (NMFS 2015b).

Some nutrient inputs to coastal waters (e.g., nitrogen and phosphorous) are necessary for a healthy, functioning estuarine ecosystem. But when nutrients from sources such as sewage and fertilizers are introduced into an estuary, the concentration of available nutrients can increase beyond natural background levels, resulting in eutrophication. Excess nutrients can lead to excess plant production (i.e., algal blooms) and thus to increased chlorophyll, which can decrease water clarity and lower concentrations of dissolved oxygen, and generally degrade the habitat value of affected waters (EPA 2004).

3.1.2.4 Coastal Wetlands

Coastal wetlands include saltwater, brackish, and freshwater wetlands located within coastal watersheds. These wetlands can be tidal or non-tidal, freshwater or saltwater, and can occur close to freshwater, estuarine, and shallow marine areas, typically at the interface between terrestrial and aquatic habitat types. This broad category includes a wide variety of habitat features such as marshes, swamps, and mangrove forests.

Coastal wetlands compose roughly one-third of all wetlands in the United States. Within the EEZ, the Alaska region has the highest quality coastal wetlands, whereas coastal wetlands in the West Coast region and in the Gulf of Mexico are rated as "poor" overall (EPA 2012). As awareness of their ecological and economic importance has increased and a regulatory apparatus has developed to protect them, wetland loss has decreased. Wetland loss is now at a level that is 3 percent of the rate it was prior to the mid-1970s, but coastal wetlands experienced a net increase in the loss rate from 1998 to 2009.

Wetlands provide numerous beneficial ecological functions, including protection of shorelines from waves and storm surges, erosion control and buffering, carbon sequestration and storage, water storage, maintenance of water quality, removal of sediments, groundwater recharge, nutrient and pollution filtering, spawning and nursing areas for many fish species, and food and habitat for numerous species of aquatic and terrestrial plants and animals. Wetlands are among the most productive ecosystems in the world, supporting thousands of species of plants, animals, shellfish, finfish, birds, invertebrates, and microbes (NMFS 2004). Wetlands also provide important recreational and economic benefits for humans, such as opportunities for boating, fishing, hiking, waterfowl hunting, nature observation, and photography, among many others.

3.1.3 Freshwater

Freshwater habitats consist of rivers, marshes, streams, lakes, and ponds that have no saltwater concentration. The quantity of freshwater available globally to support freshwater habitats is limited. Despite their limited availability, freshwater habitats support a substantial number of described species and are extremely important ecologically (Hitt et al. 2015). Nontidal (freshwater) waters impacted by past projects funded under the S-K Program included waters such as streams and river channels that support migratory fish or are hydrologically connected to coastal, marine, or estuarine resources or wetlands. This included the Great Lakes region, which is largely considered to be nontidal. The Great Lakes constitute the largest freshwater ecosystem in the world and support approximately 3,500 species of plants and animals, including more than 170 species of fish (NOAA 2020a).

3.1.3.1 Stream and River Channels

Tidal and nontidal stream and river systems are located in every region of the United States where projects are funded under the S-K Program. Many rivers and streams along the coast are tidal, with the effects of ocean tides extending upstream. The channel of a stream or river is the portion of the cross section that is usually submerged and totally aquatic (EPA Office of Water 2004). Channel substrates may be composed of various materials, including cobbles, boulders, sand, clay, and silt. Portions of a river channel often contain biological elements such as oyster reefs or submerged aquatic vegetation (SAV) beds (i.e., grasses or seagrasses) that help shape or define the channel.

Stream and river channels are critical to the viability of living coastal and marine resources. In addition to providing freshwater, rivers and streams transport nutrients and provide habitat for thousands of aquatic and terrestrial species, including birds, shellfish, finfish, amphibians, reptiles, mammals, plants, and

invertebrates. Vegetation that grows along the banks of rivers and streams stabilizes the banks, shades the water, and provides cover and food for animals and nutrients for the ecosystem (e.g., from fallen leaves).

The integrity of stream and river channels is important to the viability of not only the streams and rivers themselves, but also of the estuaries, oceans, marshes, and wetlands connected to them. Processes such as accelerated channel erosion, pollution, diking, damming, channel alteration, scouring, and dumping can drastically affect rivers and streams and their receiving waters by causing accelerated sedimentation and alteration of temperature and water quality, among other factors.

3.1.4 Water Quality

Water quality is a generic term used to represent the general "cleanliness" of the water of a certain resource. It is based on the relationship between the concentrations of various chemical and physical contaminants or pollutants and the ability of the water resource to support its ecosystem adequately. Impacts on water quality are assessed as a separate physical environment, as certain actions associated with S-K Program funded projects have the potential to affect specific water quality parameters such as turbidity, and may occur throughout the defined physical environment (e.g., offshore, nearshore, and freshwater).

Although water quality is a function of many factors, five primary indicators are often used to assess the quality of surface water in an estuary or freshwater body—nitrogen, phosphorous, chlorophyll a, dissolved oxygen content, and water clarity. Several regulatory statutes protect beaches, coasts, and the marine environment from pollution and development. Permitting requirements of Section 404 of the CWA are discussed in Section 1.9, Statutory/Regulatory Compliance Requirements, and many other regulations have been established by agencies such as the EPA, NOAA, U.S. Fish and Wildlife Service (USFWS), and U.S. Army Corps of Engineers (USACE) for the protection of water resources. For example, in 2000, the EPA was directed under EO 13158 to "expeditiously propose new science-based regulations, as necessary, to ensure appropriate levels of protection for the marine environment. Such regulations may include the identification of areas that warrant additional pollution protections and the enhancement of marine water quality standards."

Marine offshore waters are threatened in the United States and elsewhere by changes in water quality. Contamination of the marine environment from point and non-point source pollution and climate change has caused alteration or loss of habitat; reductions in numbers of species and individuals that live in these waters; reductions in seawater pH levels (ocean acidification); increases in floating trash and debris, and advisories concerning fish consumption and swimming; and the loss of recreational and commercial opportunities (EPA Office of Water 2004). For marine aquaculture, the affected environment consists of aquatic ecosystems, including marine and estuarine ecosystems in the United States. Due to the large geographic scale of the affected environment (i.e., the entire United States and its territories), as well as the many past and present human activities that have shaped the affected environment, it is only practical to describe the affected environment in general terms. Further, it is not possible to describe the environmental conditions for specific sites where projects funded by the S-K Program, or projects similar to those funded by the S-K Program, may be implemented.

The EPA (2017) has classified the quality of approximately 64 percent of the bays and estuaries in the United States and determined that approximately 20 percent of these habitats are "good" quality, while the remainder are impaired. For coastal habitats, the EPA has assessed only about 8 percent in the United States, and of these 28 percent are good quality and the remainder are impaired. Waters classified as "good" meet all their designated uses. A water is classified as "impaired" if it does not meet one of its designated uses. For bays and estuaries, the top 10 sources of impairment are legacy/historic pollutants, urban-related runoff/stormwater, unknown sources, atmospheric deposition, municipal discharges/sewage, unspecified non-point sources, other sources, natural/wildlife, agriculture, and industrial. The top 10 sources of

impairment of coastal shorelines are municipal discharges/sewage, urban-related runoff/stormwater, unknown sources, recreational boating and marinas, hydromodification, industrial, unspecified non-point sources, agriculture, legacy/historic pollutants, and land application/waste sites/tanks (EPA 2017).

As of 2017, the EPA had assessed approximately 12.8 percent of ocean and near-coastal waters in the United States and determined that only 10 percent of these waters were good quality and nearly 90 percent were impaired. The top 10 sources of impairment of ocean and near-coastal waters are atmospheric deposition, unknown sources, unspecified non-point sources, other sources, recreation and tourism (non-boating), recreational boating and marinas, urban-related runoff/stormwater, hydromodification, municipal discharges/sewage, and construction.

Most causes and sources of impairment identified by states in the EPA's 2017 water quality summary are due to indirect effects of upland land use and are not directly related to aquaculture. Inputs of sediments into aquatic ecosystems can result from erosion occurring within a watershed (Gosselink and Lee 1989; Beechie et al. 2013). As water moves through a watershed, it carries sediments and pollutants to streams (e.g., Allan 2004; Dudgeon et al. 2005; Paul and Meyer 2001) and wetlands (e.g., Zedler and Kercher 2005; Wright et al. 2006). Non-point sources of pollution (i.e., pollutants carried in runoff from farms, roads, and urban areas) are largely uncontrolled (Brown and Froemke 2012) because the CWA currently requires permits only for point source discharges of pollutants

As a whole, oceanic areas have higher water quality, lower turbidity, less disturbed bottom substrate, and lower concentrations of contaminants, and oceanic areas provide more habitat value to dependent species than freshwater or nearshore areas within the action area (NMFS 2015b); the National Coastal Condition Report IV rated the overall condition of national coastal waters as "fair" and freshwater waters as "poor to fair" (EPA 2012). Local jurisdictions monitor, report, and respond to coastal water quality issues.

3.2 Biological Environment

NOAA S-K Program funded projects may have the potential to affect the biological environment and associated resources. These resources are described below.

3.2.1 Submerged Aquatic Vegetation, Algae, and Macroalgae

SAV differs from most other wetland plants in that it is almost exclusively subtidal, resides mainly in marine salinities, and uses the water column for support. Seagrasses occur across a wide depth range, from rocky intertidal habitats to depths of 40 meters and, for some species, across broad latitudinal ranges. Distribution patterns are influenced by physical (waves, currents, tides), geological (sediment grain size), and geochemical factors (Koch 2001). Seagrasses supply many habitat functions, including (1) support of large numbers of epiphytic organisms; (2) damping of waves and slowing of currents, which enhances sediment stability and increases the accumulation of organic and inorganic material; (3) binding by roots of sediments, thus reducing erosion and preserving sediment microflora; and (4) providing horizontal and vertical complexity to habitat, which, together with abundant and varied food sources, supports densities of fauna generally exceeding those in un-vegetated habitats (Wood et al. 1969; Thayer et al. 1984).

Kelp "forests" are subtidal marine communities dominated by large brown algae (kelps) that form floating canopies on the surface of the sea. Kelp forest communities are found from sea level to as deep as 60 meters, depending on light penetration (Foster and Schiel 1985). The combination of nutrients, warm temperatures, and other macrophytes determines the distribution of kelp forest at low latitudes, whereas kelp forest distribution is dependent on light at high latitudes (Steneck et al. 2002). The major species that form floating surface canopies along the West Coast are *Macrocystis pyrifera* and *Nereocystis luetkeana* off California, Oregon, and Washington, and *Alaria fistulosa* in Alaska (Druehl 1970). A kelp canopy can reduce bottom

light to less than 3 percent but usually less than 1 percent of surface influx, thus affecting species composition and growth rates in the understory (Reed and Foster 1984). Severe water motion can modify kelp communities by removing the kelp plants (Cowen et al. 1982; Dayton and Tegner 1984), but in milder conditions the floating canopy can act as an offshore damper that reduces wave forces (Schiel and Foster 1992). Kelps with floating canopies do not occur along the East Coast, although plants can obtain heights of over 6 meters above the bottom. Kelp forests are highly productive and create a three-dimensional aspect to the nearshore environment, providing habitat and food for hundreds of other species of plants (algae) and animals. Kelp forests on hard reef areas can harbor lush understory layers of red and brown algae, as well as mobile and encrusting invertebrates. Hundreds of species of fish occur throughout the kelp forest, as do vertical layers of vegetation that vary with depth (Schiel and Foster 1992). Food is exported from kelp forests to associated communities such as sandy beaches and the deep sea.

Seaweeds (e.g., rockweeds) are brown macroalgae such as *Ascophyllum* spp. and *Fucus* spp. Like kelps, they are primary producers, converting inorganic nutrients into organic biomass by using the energy of the sun. They lack true roots, stems, and leaves, and because they lack a vascular system, absorb dissolved nutrients directly through the blades. The holdfast is used to attach the algae to intertidal rocks. Without attachment to hard substrates, algae will die. Relative to kelp, rockweeds have a higher light requirement, water temperature tolerance (0–28 degrees Celsius [°C]), and tolerance to low-salinity waters. To some degree, they can resist desiccation, ultraviolet radiation, and overheating. Rockweeds can grow vegetatively or sexually. For *Fucus* spp., sexual reproduction can occur year-round, whereas *Ascophyllum nodosum* reproduces in the late spring and early summer. In Maine, the life span of rockweeds ranges from approximately 3 years for *Fucus vesiculosus* to 16 years for *Ascophyllum nodosum* (Wippelhauser 1996). Rockweed reproduction is restricted to local adult plants; if all adults are gone, an area can be devoid of rockweeds for years.

3.2.2 Benthic Invertebrates

Benthic organisms can be divided into two categories based on whether they make their home on the ocean floor or a few centimeters into the ocean floor. Those living on the surface of the ocean floor are known as epifauna. Those that live burrowed into the ocean floor are known as infauna. Extremophiles, including piezophiles, which thrive in high pressures, may also live there.

Invertebrates are animals without backbones and are the most diverse and numerous categories of animals in the biosphere (New and Yen 1995), comprising more than 98 percent of the animal species on Earth classified to date (MarineBio 2021a). Aquatic macroinvertebrates are those aquatic invertebrates visible without the aid of a microscope. They evolved to live underwater in one or more stages of their life history, in both freshwater and saltwater (marine) habitats. They are an extremely varied assortment of organisms that span a considerable number of taxonomic phyla.

Marine invertebrates are a diverse group that includes corals, jellyfish, sponges, gastropods, cephalopods, bivalves, sea cucumbers, sea urchins, and crustaceans. Benthic invertebrates are the invertebrates that live in the benthic zone. Most invertebrates are mobile and can move freely in the environment. However, corals and sponges remain in one location upon settling out of the water column as larvae. In shallower nearshore areas, corals, sponges, and invertebrates occur in much higher densities than in deeper offshore habitats.

Marine macroinvertebrates have been classified into more than 30 different phyla, a very large number representing considerable biological diversity. A phylum is a major taxonomic category that ranks just above class and just below kingdom (as in plant, animal, and fungus kingdoms); it classifies organisms by their fundamental body plans.

The more prominent and better known and studied phyla of marine macroinvertebrates include the following (MarineBio 2021a):

- Annelids – segmented worms, including polychaetes (bristle worms).
- Arthropods – animals with exoskeletons, especially the crustaceans in marine habitats, including lobsters, crabs, shrimp, amphipods, barnacles, and copepods.
- Brachiopods – marine animals with hard "valves" or shells on their upper and lower surfaces.
- Bryozoans – moss animals or sea mats.
- Cnidaria – includes jellyfish, sea anemones, and corals.
- Echinoderms – includes sea stars, sea urchins, sea cucumbers, sand dollars, and crinoids.
- Mollusks – includes gastropods (e.g., sea snails, whelks, limpets, abalone), bivalves (clams, mussels, oysters, scallops), cephalopods (e.g., squid, octopus), and chitins.
- Porifera – sponges.
- Tunicates – sea squirts or sea pork.

Marine macroinvertebrates are very important ecologically (New and Yen 1995). They constitute a vital food source for vertebrates such as diving seabirds, fish, sea turtles, and marine mammals in the marine food web. Benthic macroinvertebrates have many important ecological functions, such as regulating the flow of materials and energy in ecosystems through their food web linkages. Because of this correlation between flow of energy and nutrients, benthic macroinvertebrates have the ability to influence food resources on fish and other organisms in aquatic ecosystems.

Marine macroinvertebrates, including crustaceans (e.g., lobster, crab, shrimp) and mollusks (e.g., clam, mussel, oyster, scallop, squid, octopus), support economically and socially important industries, both commercial and sport. Associated fishing techniques such as bottom trawling are widely believed to have negative impacts on benthic habitats and organisms; these include modification of the substrate, disturbance of soft-bottom communities, and removal of non-target fish species. Additionally, benthic invertebrates may be impacted by vessel or structure anchoring, and coastal construction.

3.2.3 Fish

The action area includes both marine fish in the U.S. EEZ and freshwater fish in the Great Lakes and rivers. These include fish species that are listed under the ESA (see Section 3.2.3.1, Threatened and Endangered Fish Species and Critical Habitat, for a complete discussion of T&E species), are associated with designated EFH (see Section 3.2.3.2, Essential Fish Habitat, for a complete discussion of EFH), or are considered the basis of important fisheries.

More than 30,000 species of fish have been identified throughout marine and freshwater environments. Some fish are diadromous species that spend a portion of their life cycle in both fresh water and salt water. Anadromous fish (e.g., salmon, smelt, shad, striped bass, and sturgeon), a subset of diadromous species, hatch in fresh water, spend most of their lives in the ocean, and then return to fresh water to spawn. Catadromous fish (e.g., eels) do the opposite; they live in fresh water and enter salt water to spawn. Marine and freshwater fish are discussed separately, but the discussion of hearing ability and sensitivity to sound applies to all fish.

Marine fish include the following:

- Coastal fish that inhabit the sea between the shoreline and the edge of the continental shelf.
- Deep sea fish that live below the photic zone of the ocean (i.e., where not enough light penetrates for photosynthesis to occur).
- Pelagic fish that live near the surface of the ocean.
- Demersal fish that live on or near the bottom of the ocean.
- Coral reef fish that are associated with coral reefs.

Marine fish occupy a wide variety of water depths and habitats. The vast majority of marine fishes are free-swimming pelagic forms. Other diverse and sometimes abundant fish species inhabit near-bottom and demersal (bottom) habitats, including flatfishes; sharks, skates, and rays; hagfishes; sturgeons; cods; rattails; and many others (Nelson 2007). In general, sturgeons (order Acipenseriformes), the herring-like fishes (order Clupeiformes), and the cod-like fishes (order Gadiformes) tend to occur only within the confines of the continental shelf. Other groups of fish are more widely dispersed. Some are highly migratory (e.g., tunas [order Perciformes], lampreys [order Petromyzontiformes], herrings, and salmons [order Salmoniformes]), whereas others show high site fidelity (e.g., tropical reef fishes) (NSF and USGS 2011).

Most marine fish are piscivorous, meaning that they eat primarily other fish. A few, such as anchovies (order Clupeiformes), whale sharks (*Rhincodon typus*), and basking sharks (*Cetorhinus maximus*), are predominantly or exclusively planktivorous, consuming primarily small invertebrates (e.g., krill, zooplankton). Relatively few are primarily dependent on phytoplankton or macroalgae (e.g., seaweed like kelp) as food for much of their life cycle (NSF and USGS 2011).

Fish species distributions vary relative to major environmental factors such as water depth, salinity, temperature, and habitat type; but when viewed on a broad scale, they collectively segregate into recognizable multi-species assemblages. Many species overlap to some degree in these ecological groups, due in part to the different habitat areas used during different life stages (NMFS 2016). Based on general ecology and the three-dimensional occurrence of marine fish in the sea, fish assemblages can be grouped as nearshore-demersal, nearshore-pelagic, oceanic-demersal, and oceanic-pelagic. An additional assemblage unique to polar regions is the cryopelagic fish assemblage. The term “cryopelagic” is used to describe fish that actively swim in nearshore or oceanic waters but are associated during their life cycle with ice or water immediately below the ice (NMFS 2016). An example is the Arctic cod (*Arctogadus glacialis),* which often occurs in ice holes, near the ice edge, or among broken ice.

Freshwater fish spend some or all of their lives in fresh water, such as rivers and lakes, with a salinity of less than 1.05 percent. These environments differ from marine conditions in many ways, the most obvious being the difference in levels of salinity. Freshwater fish are generally separated into one of three different categories (warmwater, coldwater, or coolwater) based on water temperature and the associated amount of oxygen in the water at each temperature range. For example, cold water holds more oxygen than warm water, which means coldwater fish require higher oxygen levels in order to survive.

More than 150 native fish species occur in the Great Lakes. There are three major thermal groupings for fish communities in the Great Lakes based on their preferred summer temperature preference: warmwater (e.g., shad [Clupeidae family], catfishes [Ictaluridae family], basses and sunfishes [Centrarchidae family], and drum [Sciaenidae family]); coolwater (e.g., yellow perch [*Perca flavescens*], walleye [*Sander vitreus*], sturgeon [*Acipenseriformes*], and pikes [*Esox* spp.]); and coldwater (e.g., trout and salmon [Salmonidae family], whitefishes [*Coregonus* spp.], and deepwater sculpin [*Myoxocephalus thompsonii*]) (USACE 2019).

3.2.3.1 Threatened and Endangered Fish Species and Critical Habitat

Under the ESA, a species is listed as endangered if it is "in danger of extinction throughout all or a significant portion of its range." A species is listed as threatened if it "is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." Nineteen ESA-listed fish species (comprising 49 distinct species, subspecies, Evolutionarily Significant Units [ESUs], or Distinct Population Segments total) potentially occur throughout the action area (see Appendix C: Species Tables, Table C-1). Additionally, one salmon ESU is a candidate for listing. Of all listed species, two are perch-related species, eight are salmonid species, two are scorpionfishes, four are sharks and rays, and three are sturgeons.

Critical habitat is also designated for T&E species. Critical habitat is defined as specific areas within the geographical area occupied by a species at the time of listing that contains physical or biological features essential to conservation, and which may require special management considerations or protection. Specific areas outside the geographical area occupied by the species may also be designated as critical habitat, if it is determined that the area is essential for conservation. All but eight of the listed fish also have designated critical habitat (see Appendix C, Table C-1). No federally listed T&E fish species are present within the Great Lakes.

3.2.3.2 Essential Fish Habitat

The passage of the MSA in 1976 and its subsequent amendments, including the Sustainable Fisheries Act of 1996, authorized three important management responsibilities to NMFS:

- To manage fisheries within the 200-mile-wide U.S. EEZ along the coasts of the United States.
- To address human impacts on coastal and marine environments.
- To prioritize identification and management of EFH.

EFH is defined in the MSA as "... those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 U.S.C. 1802(10)). The MSA established eight regional Fishery Management Councils (FMCs)—North Pacific, Pacific, Western Pacific, Gulf of Mexico, Caribbean, South Atlantic, Mid-Atlantic, and New England—and mandated that Fishery Management Plans (FMPs) be developed to responsibly manage fish and invertebrate species in waters within the U.S. EEZ. Under the MSA, NMFS is required to designate and conserve EFH for species managed under existing FMPs. This was intended to minimize, to the extent practicable, any adverse effects on habitat caused by human activities and to encourage the conservation and enhancement of such habitat. EFH regulations provide guidance to FMCs for identifying and defining EFH, clarify the intent of key terms, and require that federal agencies consult with NMFS when planning or authorizing activities that could affect EFH. NMFS works with the FMCs to designate EFH, which has been described for more than 1,000 managed species to date.

NMFS regulations, at 50 CFR § 600.10, provide additional interpretation of the EFH definition. Waters include "aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include aquatic areas historically used by fish where appropriate." Substrate includes "sediment, hard bottom, structures underlying the waters, and associated biological communities." Necessary is defined as "the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem." Fish includes "finfish, mollusks, crustaceans, and all other forms of marine animal and plant life other than marine mammals and birds," and "spawning, breeding, feeding or growth to maturity" covers the complete life cycle of those species of interest. Ecologically, EFH includes waters and substrate that include distribution and range zones such as migration corridors, spawning areas,

and rocky reefs, as well as water characteristics such as turbidity zones and salinity gradients. EFH is not only a geographic area where a species occurs, but an all-encompassing habitat designation.

High priorities for EFH conservation include areas (called Habitat Areas of Particular Concern [HAPC]) that meet conditions that have major ecological functions, sensitivity to decline, stress from development, and rare habitat.

3.2.4 Protected Species and Critical Habitat: Marine Mammals, Sea Turtles, and Marine Birds

Certain species of marine mammals, sea turtles, and marine birds are protected under the ESA. The ESA provides for the conservation of species listed as endangered or threatened, as well as designation of critical habitat for these species. The current ESA listings can be found at 50 CFR §§ 17.11, 223.102, and 224.101. The NMFS Office of Protected Resources and USFWS webpages also contain up-to-date listings (http://www.nmfs.noaa.gov/pr/species/ and http://endangered.fws.gov, respectively). All marine mammals and certain marine birds also receive protections under the MMPA and the Migratory Bird Treaty Act, respectively, among other federal statutes.

3.2.4.1 Marine Mammals

All marine mammals are protected in U.S. waters under the MMPA (16 U.S.C. 1631 et seq.). The MMPA organizes marine mammals into separate stocks for management purposes. By definition, a stock is a group of animals in common spatial arrangement that interbreed (NMFS 2015b). Some species receive additional protection if they are listed as endangered or threatened under the ESA (16 U.S.C. 1531 et seq.).

Sixty-nine species of marine mammals are located throughout U.S. coastal and marine waters extending seaward to the limits of the U.S. EEZ (USFWS 2021). These species represent four classifications of marine mammals: Cetaceans (51 species of whales, dolphins, and porpoises), Pinnipeds (15 species of seals, sea lions, and walrus), Sirenians (one species of manatee), and Fissipeds (two species: sea otters and polar bears). Critical habitat has been designated for five species of cetaceans [North Atlantic Right Whale (*Eubalaena glacialis*), North Pacific Right Whale (*Eubalaena japonica*), Beluga Cook Inlet DPS (*Delphinapterus leucas*), Killer Whale Southern Distinct Population Segment (DPS) (*Orcinus orca*), False Killer Whale Main Hawaiian Islands Insular DPS (*Pseudorca crassidens*)], three species of pinnipeds [Steller Sea Lions Western DPS (*Eumetopias jubatus*), Steller Sea Lions Eastern DPS (*Eumetopias jubatus*), Hawaiian Monk Seal (*Neomonachus schauinslandi*)], one species of sirenians [West Indian Manatee Florida subspecies (*Trichechus manatus latirostris*), and two species of fissipeds [Northern Sea Otter SW Alaska DPS (*Enhydra lutris kenyoni*), Polar Bear (*Ursus maritimus*)]. See Appendix C, Table C-2 and Table C-3, for lists of cetaceans and of pinnipeds, sirenians, and fissipeds, respectively, that may occur in the action area.

3.2.4.2 Sea Turtles

Seven species of sea turtles occur worldwide: loggerhead (*Caretta caretta*), green (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*), Kemp's ridley (*Lepidochelys kempii*), olive ridley (*Lepidochelys olivecea*), leatherback (*Dermochelys coriacea*), and flatback (*Natator depressus*). All but the flatback (which is endemic to northern Australia) are present in U.S. coastal and marine waters, including all navigationally significant U.S. waters, extending seaward to the limits of the U.S. EEZ. See Appendix C, Table C-4, for information on sea turtle species in the action area.

All six sea turtle species in U.S. waters are protected under the ESA. The hawksbill, Kemp's ridley, and leatherback turtles are listed as endangered throughout their ranges. The green turtle is listed as threatened,

except for the Central South Pacific DPS and Central West Pacific DPS, which are listed as endangered. The Northwest Atlantic population of the loggerhead turtle is currently classified as threatened, while the North Pacific Ocean DPS is listed as endangered. Mexico's Pacific Coast breeding populations of olive ridley turtle are listed as endangered, while all other populations are threatened. Critical habitat has been designated for loggerhead (Northwest Atlantic DPS), green (North Atlantic DPS), hawksbill, and leatherback. Because sea turtles use terrestrial and marine environments at different life stages, USFWS and NMFS share jurisdiction over sea turtles under the ESA. The USFWS has jurisdiction over nesting beaches, and NMFS has jurisdiction in the marine environment.

3.2.4.3 Marine Birds

There are roughly 10,000 species of birds in the world (Barrowclough et al. 2016), 1,000 species of birds in the United States, and 100 ESA-listed species of birds in states and territories adjoining the water bodies of the action area (USFWS 2021). Birds most relevant to the Proposed Action include seabirds, shorebirds, waterfowl, and wetland birds (henceforth collectively referred to as "birds"), and ESA-listed species within these groups (see Appendix C, Table C-5). Critical habitat has been established for the following bird species: marbled murrelet (*Brachyramphus marmoratus*), piping plover *(Charadrius melodus*), Western snowy plover *(Charadrius nivosus*), whooping crane *(Grus americana*), Steller's eider (*Polysticta stelleri*), and spectacled eider (*Somateria fischeri*). Almost all birds are protected under the Migratory Bird Treaty Act (16 U.S.C. 703-712). The MBTA and EO 13186, Responsibilities of Federal Agencies to Protect Migratory Birds, provide protection for all migrating bird populations. Under the ESA and MBTA regulations, NMFS is required to analyze the potential impacts its actions may have on T&E and migratory birds.

3.3 Social Environment

NOAA S-K Program funded projects may have the potential to affect the social environment and associated resources. A description of the social environments and associated resources is provided below.

3.3.1 Recreation and Tourism

This sector includes a wide range of businesses that attract or support ocean-based tourism and recreation: eating and drinking establishments, hotels and lodging, scenic water tours, parks, marinas, recreational vehicle parks and campsites, and associated sporting goods manufacturing (OCM 2019). While this sector employs more people and pays more in total wages than any of the other sectors of the ocean economy, the seasonal nature of the activities and the large number of part-time jobs (which are often held by students and others just entering the workforce) accounts for the relatively low average annual wages for employees ($25,000). From 2015 to 2016, tourism and recreation gained 73,000 jobs, accounting for most of the employment growth in the ocean economy. The majority of the jobs are in hotels and restaurants. These two industries together account for 94 percent of employment and 92 percent of gross domestic product (GDP) in this sector. Although vacationers stay at hotels and eat in restaurants, many of the coastal and oceanic amenities that attract visitors are free, such as beach visitation and swimming. These "nonmarket" activities generate no direct employment, wages, or GDP. However, they are usually key drivers for all of the market-based activity and can be greatly affected by ecosystem health, water quality, and associated aesthetics (OCM 2019). California and Florida are the two major contributors to the sector, accounting for more than one-third of the sector's total employment and GDP in 2016 (OCM 2019).

3.3.2 Cultural and Historic Resources

Section 106 of the National Historic Preservation Act of 1966 (NHPA, 54 U.S.C. 300101 et seq.), as amended, and its implementing regulations (36 CFR Part 800) require federal agencies to take into account potential effects of their undertakings on historic properties. "Historic property means any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places [NRHP] maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural significance to an Indian tribe or Native Hawaiian organization and that meet the National Register criteria" (36 CFR § 800.16(l)(1)). The tenets of the Section 106 process include: identification of historic properties within the area of potential effect of a federal project, assessment of the project's impact on historic properties, and resolution of adverse effects to any historic properties if any such properties exist and will be adversely affected by the project.

Per CEQ's NEPA regulations (40 CFR Parts 1500–1508), major federal actions must take into account significant effects on historic and cultural resources within the affected environment. Under NEPA, historic and cultural resources can include more than historic properties as defined under Section 106 of the NHPA. While historic and cultural resources are not defined in NEPA, they would generally include "historic properties, other culturally valued pieces of real property, cultural use of the biophysical environment, and such 'intangible' sociocultural attributes as social cohesion, social institutions, lifeways, religious practices, and other cultural institutions" (National Preservation Institute 2020). While NEPA and Section 106 are separate requirements with different parameters for what is afforded consideration in each review, it is anticipated that the information gathering and consultation done in the Section 106 review will inform the NEPA review, and vice versa. The timing of both reviews will be guided and informed by the Advisory Council on Historic Preservation (ACHP) and the CEQ's 2013 Handbook.

3.3.3 Socioeconomics

Socioeconomics may refer to a combination or interaction of social and economic factors, or the social science discipline that studies how social processes shape economic activity. Here, socioeconomics refers to the social and economic characteristics of S-K Program grantees and their projects. Eligible S-K Program grant recipients include:

- U.S. citizens.
- Citizens of the Republic of the Marshall Islands, the Republic of Palau, or the Federated States of Micronesia.
- Representatives of an entity that is a corporation, partnership, association, or other non-federal entity, non-profit or otherwise (including Indian tribes), if such entity is a citizen of the United States, or as defined by section 2 of the Shipping Act, 1916, as amended (46 U.S.C. 5050).
- S-K Program grant recipients may not be employees of the federal government or Regional Fishery Management Councils, or representatives of Regional Fishery Management Councils.

Between 2010 and 2021, nearly $91 million has been allocated to grant recipients who use the funds to support projects that address the needs of fishing communities, optimize economic benefits by building and maintaining sustainable fisheries, and increase other opportunities to keep working waterfronts viable, with additional specific priorities that change annually. In recent years, each individual grant has been capped at $300,000, and the maximum grant term is 2 years. Between 2010 and 2021, 359 grants were awarded, and the average award was $253,407.

S-K Program projects have sought to benefit fisheries and aquaculture industries; therefore, coastal states (including the Great Lakes) and fishery-related industries are more likely to be affected than others. S-K Program grant recipients have included public and private academic research institutions, non-governmental organizations, tribes, local and state government agencies, aquaculture businesses and farms, commercial harvesters, recreational anglers, seafood processors, and associations representing commercial or recreational fisheries or aquaculture. Socioeconomic effects pertain not only to those directly involved in S-K Program projects, but also the broader geographic socioeconomic context of projects and their ultimate socioeconomic effects. Socioeconomic conditions that have been affected by S-K Program projects include education, employment, income, production of goods and services, quality of life, and values and attitudes. Economic and social conditions have been either directly or indirectly affected—for example, the grantees themselves have been directly affected, but through purchasing of equipment, supplies, or support services, other industry sectors and communities where projects are based may have been indirectly affected. S-K Program funding priorities vary annually, and as a result different industries and entities have been affected.

In 2017, U.S. commercial and recreational fisheries generated more than $244 billion in sales impacts, supported 1.74 million jobs, and generated $111 billion in value-added impacts (NMFS 2018a). Commercial fisheries accounted for the bulk of jobs (74 percent), sales (70 percent), and value-added impacts (63 percent). Total commercial landings revenue across all states has increased since 2007 from $4.4 billion to $5.4 billion in 2017 and $5.5 billion in 2019 (NMFS 2021). In recent years, Alaska has accounted for the largest share in total landings by volume and value for any single state, at 5.6 billion pounds and $1.75 billion in 2019. The West Coast and Pacific Islands regions accounted for 1.04 billion pounds and $700 million. The New England/Mid-Atlantic region accounted for 5.5 billion pounds and $1.93 billion. The Southeast region accounted for 1.51 billion pounds and $1.03 billion.

In 2019, marine recreational anglers made nearly 187 million fishing trips in the continental United States and Hawaii (not including Alaska), catching nearly 950 million fish weighing 350 million pounds (NMFS 2021). Due to ongoing changes in the way recreational fishing data are collected by the Marine Recreational Information Program, the best available estimate of total participation, or the number of recreational saltwater anglers, is 8.5 million as of 2018. Overall, 54 percent of catch came from inland waters, whereas 36 percent came from state territorial waters and 9 percent came from the U.S. EEZ. The Atlantic Coast accounted for the majority of trips (69 percent) and catch (63 percent), followed by the Gulf Coast (27 percent of trips, 35 percent of catch). The Pacific Coast accounted for 2 percent of trips and 1 percent of catch (NMFS 2021).

In the United States, total marine and freshwater aquaculture production was 680 million pounds with a value of $1.5 billion in 2018, a 7.8 percent increase in production from 2017 (NMFS 2021). Freshwater production is primarily composed of catfish, crawfish, and trout, whereas marine production is dominated by Atlantic salmon and oysters. While oyster production comes from all U.S. regions, the Gulf Coast states produce more oysters by volume (28.7 million pounds), but the Atlantic and Pacific Coast states produce more oysters, mussels, and clams by value ($134.5 and $120.7 million, respectively). Overall, the Gulf Coast states have the highest share of marine aquaculture production volume, at 51 percent, while the Atlantic and Pacific regions each produce 28 percent and 21 percent, respectively. Value, by contrast, is dominated by the Atlantic and Pacific regions at 41 percent and 36 percent of value, compared to 23 percent by the Gulf.

For more information on U.S. commercial and recreational fisheries, see NMFS' Fisheries Economics of the United States website (https://www.fisheries.noaa.gov/national/sustainable-fisheries/fisheries-economics-united-states) or the Fisheries of the United States report (NMFS 2021).

Due to the large geographic scale of the affected environment (i.e., the entire United States and its territories), as well as the many past and present human activities that have shaped the affected environment,

it is only practical to describe the affected environment in general terms. Further, it is not possible to describe the socioeconomic conditions for specific sites where the projects funded by the S-K Program took place, or locations where projects similar to those funded under the S-K Program may occur in the future.

3.4 Resources Considered but Dismissed from Further Analysis

NEPA and the CEQ regulations direct agencies to prepare NEPA documents that are "concise, clear, and to the point" (40 CFR § 1502.1). The CEQ regulations further state that: "Environmental Impact Statements shall discuss impacts in proportion to their significance. There shall be only brief discussion of other than significant issues. As in a finding of no significant impact, there should be only enough discussion to show why more study is not warranted" (40 CFR § 1502.2(b). In those cases where impacts from the Proposed Action are not anticipated or are expected to be imperceptible or nondetectable, resources are dismissed from detailed analysis. Two such resources were identified (air quality, and geology and soils), and the rationale for the dismissal of each of these resources is provided below. In addition, environmental justice was considered but not analyzed further in this document, for the reasons explained below.

3.4.1 Air Quality

NMFS considered air quality with regard to discharges from equipment used in projects funded through the S-K Program. Analysis of air quality as a resource considers atmospheric conditions such as the concentration of criteria air pollutants and greenhouse gases (GHGs). Equipment, vessels, and aircraft would emit a variety of criteria air pollutants including nitrogen oxides, sulfur oxides, particulate matter, volatile organic compounds, carbon monoxide, and GHG emissions (e.g., CO_2). The potential impacts on air quality from air emissions are minimized through compliance with comprehensive maritime protocols, namely the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78 Annexes). The United States is a signatory to the MARPOL 73/78 annex, which provides for implementing legislation, law and/or regulations, or applicable Coast Guard guidance for the prevention of air pollution from ships.

NMFS and subsequent S-K Program funded projects adhere to NOAA's environmental procedures that comply with MARPOL 73/78 and relevant air quality implementing legislation, regulations, and guidance. In addition, projects funded through the S-K Program are dispersed throughout the action area, which would minimize any impact from air emissions from a single vessel or aircraft. S-K Program funded project vessels also represent only a negligible portion of total oceanic vessel traffic, and any resulting impacts produced would be indistinguishable from those produced by all other vessels within the action area. Therefore, potential impacts from emissions on air quality are generally expected to be imperceptible or nondetectable and are not analyzed further.

3.4.2 Geology and Soils

Impacts on soils and geological resources occur primarily in terrestrial areas and tend to be from activities that come in direct contact with them. Projects funded through the S-K Program are predominantly aquatic actions that infrequently encounter terrestrial areas. The disturbance resulting from S-K Program funded activities on land is minimal and impacts on soils and geology would be imperceptible or nondetectable.

3.4.3 Environmental Justice

E.O. 12898 "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" requires that federal agencies consider as a part of their action any disproportionately high and adverse human health or environmental effects to minority and low-income populations. Agencies are

required to ensure that these potential effects are identified and addressed. In addition, agencies are required to identify subsistence use of resources and effects on users.

The S-K Program collaborates with internal and external partners to develop funding priorities on an annual basis, and then conducts an open and fair selection process to determine the recommended recipients of the competitive S-K Program grants. Projects are prioritized based on available funding, as well as the effectiveness of each S-K Program project at addressing the needs of fishing communities and optimizing economic benefits by building and maintaining sustainable fisheries. Because the funding priorities and individual projects funded vary on an annual basis, evaluating individual projects and their potential relative effects on minority and low-income populations in comparison to other populations would be too speculative and is not possible to do at the programmatic level. Consequently, impacts related to environmental justice are unable to be evaluated at the programmatic level. For this reason, environmental justice is not analyzed further in this PEIS.

However, individual S-K Program funded projects will continue to be analyzed on a case-by-case basis, as appropriate, and any potential environmental justice impacts, including any potential disproportionately high and adverse human health or environmental effects of an individual project on minority or low-income populations, would be identified and addressed on a project-specific basis.

3.5 Regulatory Considerations

Regulatory considerations refer to the federal statutes and regulations applicable to the proposed action. The following sections describe some of the statutory regimes that may apply to S-K Program funded projects. In specific cases, S-K Program funded projects may require additional analysis and/or separate approvals or permits to comply with the applicable statutes and regulations, which will be determined on a project-specific basis.

3.5.1 Coral Reef Conservation Act of 2000

The purposes of the Coral Reef Conservation Act are to (1) preserve the condition of coral reef ecosystems; (2) promote wise management and sustainable use of coral reef ecosystems to benefit local communities; (3) develop sound scientific information on the condition of coral reef ecosystems; (4) assist in the preservation of coral reefs by supporting conservation programs; (5) provide financial resources for those programs and projects; and (6) establish a formal mechanism for collecting and allocating monetary donations to be used for coral reef conservation projects. Consistent with existing practice under the S-K Program, individual consultations with the National Ocean Service (NOS), NMFS, Office of Oceanic and Atmospheric Research, and National Environmental Satellite, Data and Information Service may be required for compliance with the Coral Reef Conservation Act.

3.5.2 Marine Mammal Protection Act

The MMPA protects all marine mammals, including cetaceans (i.e., whales, dolphins, and porpoises), pinnipeds (i.e., seals and sea lions), sirenians (i.e., manatees and dugongs), sea otters, and polar bears within the waters of the United States. Three federal entities share responsibility for implementing the MMPA: NMFS, USFWS, and the Marine Mammal Commission. The MMPA[2] provides for an incidental take authorization to be obtained for the unintentional "take" of marine mammals incidental to otherwise lawful activities. Types of projects that would require an incidental take authorization would include (1) in-water

[2] Although the MMPA also provides for directed take for scientific research, S-K Program funded projects have not required directed take to complete project objectives.

construction projects, whether offshore, nearshore, or freshwater, that could produce underwater noise with the potential to disturb or harass marine mammals; (2) projects that have the potential to disturb or harass marine mammals; and (3) projects that tag or collect samples from marine mammals. Consistent with existing practice under the S-K Program, an incidental take authorization based on the criteria listed above may be required for compliance with the MMPA.

3.5.3 Endangered Species Act

The purpose of the ESA is to protect and recover imperiled species and the ecosystems upon which they depend. NMFS and USFWS share responsibility for implementing the ESA. Under the ESA, species may be listed as either endangered or threatened. The ESA also provides for the designation and protection of critical habitat, which are the specific geographic areas that contain the physical or biological features essential to the conservation of T&E species and that may need special management or protection. Consistent with existing practice under the S-K Program, individual Section 7 consultations would be initiated during the planning process for site-specific projects if there is an ESA-listed species that may be affected by the proposed activity. S-K projects would be required to adhere to any project modifications or other mandatory minimization and avoidance measures, such as terms and conditions for incidental take resulting from formal consultations.

3.5.4 Magnuson-Stevens Act – Essential Fish Habitat

The MSA is the primary law governing marine fisheries management in U.S. federal waters. Under the MSA, NMFS monitors the status of federally managed fish stocks to ensure they are harvested and managed at sustainable levels. First passed in 1976, the MSA fosters long-term biological and economic sustainability of our nation's marine fisheries in the EEZ. Key objectives of the MSA are to (1) prevent overfishing, (2) rebuild overfished stocks, (3) increase long-term economic and social benefits, (4) use reliable data and sound science, (5) conserve essential fish habitat (under the 1996 amendment Sustainable Fisheries Act), and (6) ensure a safe and sustainable supply of seafood. The MSA includes provisions concerning the identification and conservation of EFH, which is defined as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.” Federal agencies that authorize, fund, or undertake actions that may adversely affect EFH must consult with NMFS, and NMFS must provide conservation recommendations to federal and state agencies regarding actions that would adversely affect EFH. Consistent with existing practice under the S-K Program, individual EFH consultations with NMFS may be required for compliance with the MSA.

3.5.5 National Marine Sanctuaries Act

The National Marine Sanctuaries Act (NMSA) authorizes the Secretary of Commerce to designate and manage areas of the marine environment with special national significance due to their conservation, recreational, ecological, historical, scientific, cultural, archaeological, educational, or esthetic qualities as national marine sanctuaries. Day-to-day management of national marine sanctuaries has been delegated to NOAA’s Office of National Marine Sanctuaries. Section 304(d) of the NMSA requires interagency consultation between the Office of National Marine Sanctuaries and federal agencies taking actions, including authorization of private activities, “likely to destroy, cause the loss of, or injure a sanctuary resource.” In addition to consultation, a permit or other approval from a sanctuary is required when any person wishes to conduct any activity within that sanctuary that is otherwise prohibited. Prohibitions are sanctuary-specific, but commonly include disturbance of submerged lands, discharges, or injury to historic or cultural resources. Consistent with existing practice under the S-K Program, projects funded by the S-K Program that take place in areas designated as National Marine Sanctuaries may require consultation with

the Office of National Marine Sanctuaries or, if they include a prohibited activity, will require approvals from the specific sanctuary where the action will take place.

3.5.6 Coastal Zone Management Act

The CZMA was enacted in 1972 to encourage coastal states, Great Lake states, and U.S. Territories and Commonwealths (collectively referred to as "coastal states" or "states") to preserve, protect, develop, and where possible, to restore or enhance the resources of the nation's coastal zone. This act, administered by NOAA, provides for the management of the nation's coastal resources, including the Great Lakes. The CMZA is a voluntary program, and 34 states and territories where S-K Program projects are implemented have coastal management programs. The federal consistency provision, Section 307, requires federal actions (inside or outside a coastal zone) that affect any coastal zone resource, to be consistent with the enforceable policies of the state/territorial approved coastal management program. The S-K Program will coordinate with each jurisdiction to develop an approach for federal consistency with their enforceable policies for activities covered by this PEIS.

3.5.7 National Historic Preservation Act

Section 106 of the NHPA requires federal agencies to take into account the effects of their undertakings on historic properties in accordance with regulations issued by the ACHP at 36 CFR Part 800. The regulations require that federal agencies consult with the ACHP, states, tribes, and other interested parties (consulting parties) when establishing an area of potential effects, identifying properties within the area of potential effects and determining their eligibility for inclusion in the NRHP making effects determinations to historic properties, and resolving adverse effects. The NRHP is an official Federal Government list of significant historical properties in architecture, engineering, archaeology, history, and culture in general. Authorized by NHPA, the NRHP is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect America's historic and archaeological resources. While it is possible to coordinate with the ACHP to develop potential approaches for addressing programmatic activities, the S-K program does not have any plans to develop a programmatic approach at this time. Therefore, consistent with existing practice, for projects that occur where cultural or historical properties may be found, the S-K Program will continue to address the requirements of the NHPA on a project-specific basis.

3.5.8 Clean Water Act

Surface water quality in states, territories, and authorized tribal lands are required to be reported to EPA every 2 years under CWA Sections 305(b) and 303(d) for waters that have been assessed and indicate water quality that does not support healthy aquatic life. Under Section 404 of the CWA, permits are required from USACE, or states approved by the EPA for discharges of dredged or fill material into jurisdictional waters and wetlands, including coastal waters. Under Section 402 of the CWA, the EPA or states with approved programs require that an interested party obtain a permit before discharging pollutants (including stormwater) into jurisdictional waters and wetlands (33 U.S.C. 1342). Under Section 404 of the CWA, the USACE requires that an interested party obtain a permit before filling, constructing on, or altering a jurisdictional wetland (33 U.S.C. 1344). Under Section 401 of the CWA, states have the authority to determine whether a discharge authorized by a federal permit complies with applicable water quality standards, and either issue, deny, or waive water quality certification. Given the significant impacts that stormwater and land-based sources of pollution have had on coastal fisheries resources, the protections are critical to ensuring wetlands continue to provide mitigating ecosystem services. Consistent with existing practice under the S-K Program, certain actions associated with S-K Program funded projects may require a separate permitting process for compliance with CWA Section 401 and 404.

3.5.9 Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act requires that federal agencies consult with the U.S. Fish and Wildlife Service, NMFS, and state agencies for activities that affect, control, or modify waters of any stream or bodies of water, in order to minimize the adverse impacts of such actions on fish and wildlife resources or habitat. Consistent with existing practice under the S-K Program, individual Fish and Wildlife Coordination Act consultations would be initiated during the planning process for site-specific S-K projects if the proposed activity will result in the control or modification of a body of water. Typical actions that would fall under the jurisdiction of the Fish and Wildlife Coordination Act include discharges of pollutants, including industrial, mining, and municipal wastes or dredged and fill material into a body of water or wetlands. S-K projects would be required to adhere to any project modifications or other mandatory minimization and avoidance measures.

3.5.10 Rivers and Harbors Act

Under Section 10 of the Rivers and Harbors Act of 1899 (RHA), USACE regulates structures or work that alters the course, location, condition, or capacity of navigable waters of the United States. Examples of activities that require Section 10 permits from USACE are dredging, installation of aids to navigation, installation of mooring buoys, construction of outfall structures in or over tidal waters, construction of piers, construction of artificial islands or reefs, bank stabilization structures, and the construction of permanent mooring structures. Although the S-K Program does not generally fund the types of construction activities described above, consistent with existing practice under the S-K Program individual projects that may contain applicable construction elements, such as the installation of mooring buoys, may require a separate permit from the USACE for compliance with the Rivers and Harbors Act.

3.5.11 National Aquaculture Act of 1980 and the National Aquaculture Development Act of 1991

The National Aquaculture Act was enacted to, among other things, declare a national aquaculture policy and encourage aquaculture activities in both the public and private sectors of the economy. The Act required the Secretaries of Agriculture, Commerce, and the Interior to establish the National Aquaculture Development Plan. In implementing the Plan, the Secretaries are required to provide advisory, educational, and technical assistance, consult and cooperate with interested persons, encourage the implementation of aquacultural technology in the rehabilitation and enhancement of publicly owned fish and shellfish stocks, and promulgate regulations necessary to implement the plan. The Act also established the Joint Committee on Aquaculture within the Office of Science and Technology Policy to increase the overall effectiveness and productivity of federal aquaculture research, transfer, and assistance programs.

The National Aquaculture Development Act of 1991 “amends the National Aquaculture Act of 1980 to add specified tasks to the aquaculture duties of the Secretary of Agriculture, the Secretary of Commerce, and the Secretary of the Interior (the Secretaries); sets forth requirements regarding the location and functioning of the National Aquaculture Information Center; requires the interagency aquaculture coordinating group to establish a working relationship with the industry advisory councils of regional aquaculture centers and with national organizations and commodity associations; mandates reports to the Congress regarding: (1) the application of the Lacey Act Amendments of 1981 to aquaculture; and (2) actions taken to revise the National Aquaculture Development Plan; removes provisions requiring the concurrence of the Secretaries in order to specify which of the Secretaries has responsibility for implementing each action in the Plan; and shifts certain requirements and powers from the Secretaries to the Secretary of Agriculture.” Coordination under this Act may be required for those projects funded under the S-K Program that involve aquaculture and associated facilities or actions.

3.5.12 Marine Debris Act

The NOAA Marine Debris Program is authorized by Congress to work on marine debris through the Marine Debris Act, signed into law in 2006 and amended in 2012, 2018, and 2020. The Act requires the program to "identify, determine sources of, assess, prevent, reduce, and remove marine debris and address the adverse impacts of marine debris on the economy of the United States, marine environment, and navigation safety." Consistent with existing practice under the S-K Program, individual projects reviews would be initiated during the planning process for site-specific S-K projects if the proposed activity could result in the creation of marine debris entering the oceans. Initial S-K project review and planning would aim to assess, prevent, and reduce marine debris during the implementation of S-K projects.

4 Environmental Consequences

This chapter describes the potential environmental impacts of two programmatic alternatives for implementation of the S-K Program: the No Action Alternative and the Proposed Action. The intent of this PEIS is to provide a document from which subsequent, project-specific actions may be tiered, followed by narrower, decision-focused reviews, as appropriate, to avoid repetitive, broad-level analyses in subsequent tiered NEPA reviews, were the Proposed Action selected and implemented. In the assessment of individual and cumulative effects in this PEIS, NOAA considers the suite of activities authorized under the S-K Program over the past 11 years (2010–2021) and evaluates similar activities for the program going forward in a generalized manner for the entire United States and territories that are defined as part of the affected environment (Chapter 3, Affected Environment). Future project-specific environmental analysis, as required, will describe the specific effects of each project or activity not fully addressed within this PEIS.

4.1 Approach to Analysis

The environmental effects of activities are evaluated by assessing the direct, indirect, and cumulative effects that those activities have on the current environmental conditions (Canter 1996), as described in Chapter 3, Affected Environment. Current environmental conditions are the product of the cumulative or aggregated effects of human activities that have persisted over time, as well as the natural processes and human activities and other interventions (e.g., management) that have influenced, and continue to influence, the structure, functions, and dynamics of ecosystems. The current environmental condition can vary substantially in different areas of the country and in different waterbodies and is dependent in part on the degree to which past and present human activities have altered aquatic and terrestrial resources in a particular geographic area over time.

This analysis assesses potential direct, indirect, and cumulative environmental impacts of the Proposed Action as compared with the No Action Alternative for relevant resources throughout the United States and jurisdictions of NOAA's five fisheries regions (Figure 1-1).

For the S-K Program project types evaluated herein, NOAA may be required to undertake additional NEPA analysis if the proposed project has adverse effects that are beyond the scope of those analyzed here, including adverse effects that are significant. Although it is NMFS' intent that this analysis help inform future site-specific analyses, this PEIS does not commit NOAA to a future action that would have impacts on the environment.

4.1.1 Affected Environments and Resources Assessed

This section assesses impacts on the following environments and resources, which were described in Chapter 3, Affected Environment.

- Physical Environment
    - Offshore
        - Pelagic
        - Benthic
    - Nearshore
        - Reefs
        - Intertidal, sandy beach, dunes
        - Estuaries
        - Coastal wetlands
    - Freshwater
        - Stream and river channels
    - Water quality
- Biological Environment
    - SAV, algae, macroalgae
    - Benthic invertebrates
    - Fish
        - T&E species and critical habitat
        - EFH
    - Protected species
        - Marine mammals
        - Sea turtles
        - Marine birds
- Social Environment
    - Recreation and tourism
    - Cultural and historic resources
    - Socioeconomics

4.1.2 Types of Impacts Evaluated

Impact evaluations must include direct, indirect, and cumulative effects. These categories are used to describe the timing and location of potential impacts of the action. They have no bearing on the significance of the potential impacts, as described below, and are used only to describe or characterize the nature of the potential impacts. An impact may be significant whether it is direct, indirect, or cumulative. Impacts are characterized as follows:

- Direct effects: Caused by the action and occur at the same time and place as the action.
- Indirect effects: Caused by the action and occur later in time or farther removed in distance but are still reasonably foreseeable.
- Cumulative effects: Result from the incremental effect of the activity, added to other past, present, or reasonably foreseeable future actions.

4.1.3 Context

The context of the analysis presented in this PEIS includes the consideration of duration, geographic extent and scale, magnitude, and quality of potential impacts.

4.1.3.1 Duration

The duration of the potential impact can be defined as either short-term, long-term, or permanent and indicates the period during which the environmental resource would be impacted. Duration considers the permanence of an impact or the potential for natural attenuation of an impact. The duration of each potential impact is defined as follows:

- Short-Term Impact: A known or potential impact of limited duration, relative to the proposed project and the environmental resource. For the purposes of this analysis, these impacts may be instantaneous or may last minutes, hours, days, or up to 2 years (consistent with the maximum grant term of recent S-K grants).
- Long-Term Impact: A known or potential impact of extended duration, relative to the proposed project and the environmental resource. For the purposes of this analysis, these impacts to a given resource would last longer than 2 years.
- Permanent Impact: A known or potential impact that is likely to remain unchanged indefinitely.

4.1.3.2 Geographic Extent and Scale

Projects funded under the S-K Program may impact resources at a variety of geographic scales. For the purposes of this analysis, impacts are assessed in two ways:

- Localized: Site-specific and generally limited to the immediate surroundings of a project site.
- Beyond the Project Site: Unconfined or unrestricted to the project site. These impacts may extend throughout a watershed, marine waters, or beyond, to include large-scale—e.g., global or basin-wide effects, effects on large-scale migration patterns.

4.1.3.3 Magnitude

The magnitude, or intensity, of an impact refers to the severity of the impact (NOAA 2009a) and could include the timing of the action (e.g., more intense impacts would be expected during critical periods such as spawning, breeding, or storm events). No quantitative guidance regarding magnitude of impacts is offered by CEQ, and agencies may identify relevant thresholds. Therefore, further clarification is provided with respect to criteria used in this PEIS to determine the potential significance based on differing levels of magnitude of an impact on a resource. This analysis defines the magnitude or intensity of a known or potential impact on the following levels: minor, moderate, and major. The qualitative assessment of magnitude is thus based on: a review of the available and reference material; professional judgment using standards that include consideration of the permanence of an impact or the potential for natural attenuation of an impact; uniqueness or irreplaceability of the resources; abundance or scarcity of the resource; geographic, ecological, or other context of the impacts; and the potential that mitigation measures can offset the anticipated impact.

- Minor: This relative term is generally used to describe impacts to the structure or function of a resource that are detectable, short-term, localized (or, potentially, larger scale), and not severe. These are typically localized to a project site but may extend beyond a project site.

- Moderate: This relative term is generally used to describe impacts to the structure or function of a resource that are detectable, short-term or long-term, localized, and possibly severe; or impacts that are detectable, long-term, localized or larger scale, and not severe.

- Major: This relative term is generally used to describe impacts to the structure or function of a resource that are obvious, detectable, and/or measurable, long-term, large-scale, and severe. They may result in substantial structural or functional changes to the resource.

These thresholds are in relation to the degree of effect compared with the baseline condition.

4.1.3.4 Quality

The quality of an impact is described in terms of whether the impact would be beneficial or adverse. A single act might result in adverse impacts on one resource and beneficial impacts on another.

- Adverse: This relative term is used to describe impacts that have unfavorable or undesirable outcomes for the environment relative to a benchmark condition.

- Beneficial: This relative term is used to describe impacts that have favorable or advantageous outcomes relative to a benchmark condition.

4.1.3.5 Summary of impacts

The potential for direct, indirect, and cumulative impacts on physical, biological, and social environments is assessed based on projects previously funded under the S-K Program or projects consistent with the scope of the S-K Program (Table 4-1).

Table 4-1. Summary of Terms used to Describe Environmental Impacts

Type	Duration	Geographic Extent and Scale	Magnitude	Quality
Direct	Short-Term	Localized	None (no effect)	Adverse
Indirect	Long-Term	Beyond Project Site	Minor	Beneficial
Cumulative	Permanent		Moderate	
			Major	

4.2 Mitigation Measures

Pursuant to the CEQ regulations, agencies must analyze appropriate means to mitigate adverse effects that are not already included in the Proposed Action (see 40 CFR §§ 1502.16(a)(9) and 1502.14(e)). The Proposed Action includes BMPs for some S-K Program funded project activities, such as ensuring that all instruments placed in contact with the sea floor are properly secured to minimize bottom disturbance (Section 2.2.3, Best Management Practices for All Project Types), and these BMPs are discussed and included in the effects analysis, where relevant.

This analysis within this PEIS concludes that the Proposed Action is not anticipated to result in significant impacts for any resource (Section 4.5, Environmental Consequences of the Proposed Action). As such, NOAA has not proposed a discrete set of additional mitigation measures for this Draft PEIS. NOAA will engage in interagency consultation as required by other relevant environmental laws, statutes, and Executive Orders—including the MMPA, ESA, MSA, and NHPA—on a project-specific basis. The most commonly triggered legislation is described in more detail in Section 1.9, Statutory/Regulatory Compliance Requirements, and Section 3.5, Regulatory Considerations. Any additional mitigation measures and BMPs would be identified through these consultations and incorporated into an action on a project-specific basis, as appropriate. Measures suggested through public comment will be considered as part of the analysis in the Final PEIS.

4.3 Activities Addressed in Previous NEPA Assessments and Incorporated by Reference

This PEIS incorporates, by reference, impacts analyses derived from other completed NEPA documents, when the activities and resources affected were substantially similar to those being proposed. NOAA's NEPA Procedures (NOAA Administrative Order 216-6A, Companion Manual [NEPA Manual 2017]) state that "[d]ecision makers may use existing NOAA environmental assessments and environmental impact statements (EAs and EISs) to analyze effects associated with a proposed action, when doing so would build on work that has already been done, avoid redundancy, and provide a coherent and logical record of the analytical and decision-making process (NOAA 2017b)." The primary NEPA analyses used for this PEIS are briefly summarized below and were used as references, where relevant, throughout this PEIS to support impacts analyses for substantially similar activities and resources:

- The NOAA NOS Draft Programmatic Environmental Impact Statement for Surveying and Mapping Projects in U.S. Waters for Coastal and Marine Data Acquisition (NOAA 2021b), cited hereafter as the NOS PEIS, analyzed the potential environmental impacts associated with NOS's recurring data collection projects to characterize submerged features (e.g., habitat, bathymetry, marine debris). The document is relevant to this PEIS because it analyzed the same or similar activities and resources, particularly the use of vessels and research equipment within the marine environment, to analyze the potential environmental impacts associated with recurring data

collection projects. NOS projects include surveys performed from crewed vessels and remotely operated or autonomous vehicles operated by NOS field crews, other NOAA personnel on behalf of NOS, contractors, grantees, or permit/authorization holders. NOS may use echo sounders and other active acoustic equipment and employ other equipment, including bottom samplers and conductivity, temperature, and depth instruments to collect the needed data. A project could also involve supporting activities, such as the use of divers and the installation of tide buoys. Overall, the draft NOS PEIS concluded in the cumulative effects scenario (i.e., actions described in Section 4.1, Approach to Analysis) that short- and long-term aggregate adverse cumulative impacts on habitats throughout the "action area" are negligible to moderate in magnitude, with moderate impacts occurring only in the event of widespread propagation of invasive species and are therefore expected to result in insignificant impacts to habitats.

- The NOAA Pacific Islands Regional Office Draft Programmatic Environmental Impact Statement for the Pacific Islands Aquaculture Management Program (PIAMP) (NOAA 2021c), cited hereafter as the PIAMP DPEIS, analyzes the potential direct, indirect, and cumulative effects of several management alternatives on the human, physical, and biological environment. The document is relevant to this PEIS because of the similarity in activities and resulting impacts on resources, particularly aquaculture-related research and development projects. The PIAMP DPEIS assesses the cumulative impacts of actions that include but are not limited to commercial and non-commercial fishing, installation of undersea cables, tourism and recreation, marine managed areas, natural events, shipping, scientific research, exploitation of resources, and predation. Overall, the draft PIAMP DPEIS concluded that the assessed actions may have potential impacts from effluent from marine aquaculture facilities, including impacts on habitat and ecosystem functioning, local wild fish stocks and other marine wildlife and protected species, and socioeconomics.

- The Office of National Marine Sanctuaries (ONMS) 2018 Draft Programmatic Environmental Assessment (PEA) for Field Operations in the Southeast and Gulf of Mexico National Marine Sanctuaries (NOAA 2018) is cited hereafter as the ONMF PEA. It is relevant to this PEIS because of the same or similar activities and resources analyzed, particularly mapping, monitoring, and research. The ONMF PEA assesses the potential impacts of survey and monitoring activities on the condition and spatial distribution of seagrass, coral, and hardbottom habitats to inform and develop management strategies. Activities included vessel and aircraft operations, non-motorized craft, SCUBA and snorkel operations, onshore fieldwork, sea floor equipment deployment, AUVs/ROVs, and other sampling activities, similar to the OCS PEA (NOAA 2013b) but in the Gulf of Mexico and Southeast Atlantic.

- The NOAA National Coastal Centers for Coastal Ocean Science Environmental Assessment (NOAA 2016) assessed hydrographic surveying and mapping activities in Puerto Rico and the U.S. Virgin Islands and addresses the collection of multibeam and split/beam acoustics echosounder data and field verification activities and tiers from the OCS PEA 2013. The document is relevant to this PEIS because it analyzed the same or similar activities and resources, particularly mapping, monitoring, and research. The subsequent Finding of No Significant Impact (FONSI) determined that proposed activities are not likely to adversely impact marine mammals, corals, seagrasses, ESA-listed species, critical habitat or EFH, cultural resources, or other aspects of the environment.

- The 2015 NOAA Restoration Center PEIS for Habitat Restoration Activities Implemented throughout the Coastal United States is cited hereafter as the NOAA RC PEIS (NOAA 2015a). The document is relevant to this PEIS because of the similarity in activities and resulting impacts on resources, particularly habitat research, monitoring, and assessment. For example, the NOAA RC PEIS evaluates the potential impacts of habitat research and monitoring, invasive species assessment, and habitat assessment. The NOAA RC PEIS assessed potential impacts of restoration

projects on various resources and concluded that the proposed activities would have no significant adverse impact on physical, biological, or socioeconomic resources under U.S. jurisdiction. Potential impacts of planning, design, permitting, fish and wildlife monitoring, public education and outreach, invasive species assessment, and restoration activities were evaluated. The NOAA RC PEIS and subsequent Record of Decision (ROD) concluded that proposed activities described in the NOAA RC PEIS would have no adverse impact on physical, biological, or cultural resources. Activities anticipated to require further analysis were identified in the NOAA RC PEIS. Many of the activities and resources analyzed in this PEIS are similar to or the same as those analyzed in the NOAA RC PEIS.

- The 2013 Office of Coast Survey's Programmatic Environmental Assessment (NOAA 2013b), cited hereafter as the OCS PEA, evaluated impacts of hydrographic surveys on various resources and concluded that the proposed activities would have no significant adverse impact on physical, biological, or socioeconomic resources in the Atlantic, Pacific Island Region, and priority international areas. The document is relevant to this PEIS because of the same or similar activities and resources analyzed, particularly mapping, monitoring, and research. The OCS PEA evaluated potential survey impacts, including risk of vessel strikes, echosounder and other sounds, light detection and ranging surveys, vessel transit operations, anchoring, bottom sample collection, tide gauge installation and operation, coast survey laboratory activities, and other potential impacts. The OCS PEA and subsequent FONSI concluded that these activities would have no significant impacts on the coast and marine environment, sea turtles, seabirds, seagrasses, mangroves, corals, EFH, T&E species and critical habitat, cultural environment, and others.

- The 2009 Gulf of Mexico Fishery Management Council and NOAA's PEIS for the Fishery Management Plan for Regulating Offshore Marine Aquaculture in the Gulf of Mexico (NOAA 2009b) is cited hereafter as the NOAA Aquaculture PEIS. This document is relevant to this PEIS because it discusses general aquaculture practices and resulting impacts on resources, particularly finfish, bivalves, and crustaceans. Activities related to aquaculture research and field studies that are funded under the S-K Program would result in similar, though lesser, impacts than those analyzed in the NOAA Aquaculture PEIS, and it is therefore incorporated by reference.

4.4 Environmental Consequences of the No Action Alternative

Under the No Action Alternative, the S-K Program would not fund projects that address the needs of fishing communities, optimize economic benefits by building and maintaining sustainable fisheries, or increase other opportunities to keep working waterfronts viable (Section 2.1, No Action Alternative).

The S-K Program would continue to exist and receive funds from permanent appropriation of a portion of import duties on marine products through the S-K Act (Section 1.3, History of the S-K Program); however, the funds would no longer be applied to S-K Program projects.

Under the No Action Alternative, the S-K Program would have no impacts on offshore, nearshore, freshwater, and water quality resources of the physical environment; submerged aquatic vegetation, algae, and macroalgae, benthic invertebrates, fish, and protected species resources of the biological environment; and recreation and tourism and cultural and historical resources of the social environment. S-K Program-funded Research and Monitoring, Gear Testing, Bycatch Reduction, and Processing Studies, and Aquaculture projects would not occur, and thus would not result in impacts, including direct, short-term, localized impacts. There would be no impact on water quality. Temporary disturbance from human presence and increased noise associated with implementation of projects within the physical environment and associated resources would not occur, and thus would not have impacts, including direct, short-term, and adverse impacts, on habitats in the area where specific projects funded under the S-K Program would

take place. Projects that target a specific organism or fishery and require the use of aquatic vessels for in-water observation or access, tagging, collection (e.g., hook and line, trawling), and sampling that requires handling (e.g., genetic tissue sampling, sexing, sizing) would not occur, and thus would not have impacts, including direct, short-term, and adverse impacts, on fish, sea turtles, and marine mammals. Shore-based or nearshore-based projects would not occur, and thus would not have impacts, including minor, localized, and temporary impacts, on land use and recreation and cultural resources. While the No Action Alternative would result in no adverse impacts on any of these environments and resources, any potential long-term beneficial impacts on any of these environments and resources resulting from S-K funded projects also would not be realized.

The absence of funding for S-K Program projects would also generally lead to no socioeconomic impacts, since projects are short-term in nature and not awarded to the same recipients, leaving them no worse or better off in the absence of funding. However, under the No Action Alternative, the S-K Program would continue to exist and receive funds from permanent appropriation of a portion of import duties on marine products through the S-K Act. Therefore, there may still be beneficial socioeconomic impacts since funding could be diverted to similar research activities under NOAA. Under the Saltonstall-Kennedy Act of 1954, the grant program is funded by a permanent appropriation of 30 percent of the previous year's custom receipts from imports of fish and fish products, which is deposited into a Promote and Develop (P&D) account (CRS 2020a). As of 2020, the majority of the P&D account funds have been Congressionally directed to the Operations, Research, and Facilities (ORF) account, which supports NMFS science and management activities, while remaining funds are allocated to the grant program. In lieu of the grant program, funds would likely be allocated into the ORF account and have similar positive economic impacts due to increases in economic activity as a result. However, any evaluation of potential alternative uses of those funds, potential effects from such uses, or the magnitude of the effects or benefits of those uses is not known and would be speculative in nature, and is not included in the analysis of the No Action Alternative.

4.5 Environmental Consequences of the Proposed Action

The following section describes the environmental consequences of the Proposed Action. Section 2.2, Proposed Action - Promotion, Marketing, Research, and Development Alternative, defines the S-K Program project types and potential environmental impacts resulting from their implementation.

For each of the project types, the potential impacts on the physical, biological, and social environments and associated resources are assessed based on the primary activities being conducted during project implementation. The nature of each project type is varied and wide-ranging; therefore, a one-size-fits-all assessment approach is not appropriate. For each project that is funded under the S-K Program, NOAA will review the proposed project to determine if it would have adverse effects that are beyond the scope of those analyzed here, including adverse effects that are significant. If so, additional NEPA analyses will be required. NOAA will not fund such projects until the required additional NEPA analysis is complete.

4.5.1 Seafood Promotion and Marketing

Seafood promotion and marketing projects may include, but are not limited to, conducting research in product and market development to create and sell more value-added seafood products into the marketplace. These projects may include desktop synthesis of market information, laboratory research to determine viability of underutilized species in the seafood market, and social science methods for performing market research, including interviews and surveys. Seafood promotion and marketing projects take place within in office or laboratory settings or outdoor field setting where interviews or surveys may be conducted such as onboard fishing vessels and at ports and harbors, seafood markets, and restaurants (Table 2-1).

The following sections analyze the effects of seafood promotion and marketing projects on socioeconomic resources of the social environment. It is not anticipated that seafood marketing and promotion projects would have measurable effects on the physical or biological environments since the primary techniques are limited to office and laboratory settings or field settings that do not include biological sampling techniques. Therefore, impacts on these resources are not discussed further for this project type. Although projects funded under this project type may recommend future actions or studies that may impact these resources, any such action would be subject to independent review under NEPA and other applicable statutes. The outcome of projects within this project type does not commit NOAA to a future action that could affect the environment. Examples of seafood promotion and marketing projects are provided in Section 2.2.2.1, Seafood Promotion and Marketing, and past projects funded by the S-K Program that fall within this project type are identified in Appendix B. The analysis of effects is based upon the techniques employed. Methods, techniques, and environments with potential impacts to associated resources for this project type are summarized in Table 4-2 below.

Table 4-2. Seafood Promotion and Marketing Projects – Methods, Techniques, and Environments with Potential Impacts to Associated Resources

Action Setting	Methods	Techniques	Physical	Biological	Social
Office or laboratory	• Desktop analysis • Interviews and surveys • Workshops, trainings, informational surveys • Laboratory research	• Conduct surveys, interviews, market research, outreach activities via in-person surveys, or phone, paper-, or web-based surveys. • Undertake routine laboratory analysis within a confined laboratory setting (e.g., analyze previously collected water, animal, plant, benthic, seafood samples to characterize environment, evaluate disease, examine genetics; develop disease or toxin assays). • Manage, analyze, and synthesize data; develop and use databases. • Develop and use computer-based tools.			X
Field (land, water, or underwater)	• Interviews and surveys • Workshops, trainings, informational surveys	• Conduct in-person social science interviews and other site-based social research in the field (on board fishing vessels, ports and harbors, seafood markets, restaurants). These activities will be limited to interviews, observations, polling, or other socially based activities.			X

4.5.1.1 Social Environment

Socioeconomics

Seafood promotion and marketing projects may have a variety of social and economic impacts, directly on grantees and the communities where projects take place as well as indirectly on other sectors of the economy or other communities. All projects funded under the program would have some positive economic impacts. The degree of economic impacts depends on the amount of grant funding and what the funds are used for over the course of the project, since different allocations to labor, equipment, and supplies will stimulate different sectors of the economy and drive different changes in final demand for goods and services, employment, and earnings. Here, NMFS estimated the degree of economic impacts by using budget information for past projects as an indicator of what impacts similar projects may have in the future. Specifically, by categorizing budgeted expenditures, we are able to quantify total direct and indirect economic impacts using a regional input-output (IO) modeling approach. Seafood promotion and marketing was identified as a secondary and tertiary project type for a number of projects (Figure 1-2); however, the

analysis in this section includes only projects for which seafood promotion and marketing was the primary project type.

On average, the mean total project budget is approximately $267,357 after accounting for inflation ($2021). Budgets for these projects show that the largest share of funds are generally allocated to salaries and fringe benefits, followed by overhead (facilities and administrative costs), and subcontracts. The remainder of funds goes to tuition and fees, supplies, equipment (capitalized costs in excess of $5,000), construction costs, other goods and services (like shipping), travel costs, or construction costs. More detailed information can be found in Appendix D. Grantees for projects in this category are primarily universities, state government agencies, non-governmental organizations, and private research institutions. Subcontracts are primarily for private and university researchers, graphic designers, and marketing consultants.

After adjusting for inflation, the average total output effect of seafood marketing and promotion projects was $401,743. Output, or total business sales, is the total value of production, including the direct, indirect, and induced value of production. The total output effect for seafood promotion and marketing projects was $1.50 for each dollar of the total budget, where the average budget amount was $267,357, of which $10,238 was brought by grantees as matching funds. The average employment effect was 3.7, meaning that 3.7 total jobs are supported, on average, by each grant. This includes the number of jobs supported directly by the project in terms of annual salary (e.g., consultants or researchers), indirectly (e.g., jobs needed to produce supplies), and induced (e.g., jobs supported by how wages are spent on goods and services such as groceries and rent). Employment estimates are generated by the model, are based on regional estimates by industry, and do not represent the number of unique jobs affected by any given grant. Labor income effects include the total amount paid in salaries to the direct, indirect, and induced workers. The total labor income effect across all seafood promotion and marketing projects was $0.74 per dollar of the budget (Table 4-3).

Table 4-3. Seafood Promotion and Marketing Project Type Summary and Aggregate IO Analysis Results for Each NMFS Region ($2021)

Summary Category	Measure	Units	Amount
Total grant amount	Average per project	$ (2021)	$257,119
Total in applicant match	Average per project	$ (2021)	$10,238
Total project amount	Average per project	$ (2021)	$267,357
Economic output effects	Average per project	$ (2021)	$401,743
Economic output effects	Dollars per project budget amount	$ (2021)	$1.50
Labor income effects	Average per project	$ (2021)	$197,855
Labor income effects	Dollars per project budget amount	$ (2021)	$0.74
Employment effects	Average per project	Number of jobs	3.70

The timing of socioeconomic impacts for seafood promotion and marketing projects is likely to be consistent with the project timeline of 1 to 2 years, since most, if not all, project expenses will be incurred during the project period. Some indirect, longer-term socioeconomic beneficial impacts may occur, in particular if grant funds are used to purchase equipment or used for construction. For past seafood promotion and marketing projects, a few projects reported equipment costs, but no projects reported construction costs. Example equipment costs include specialized booths for events and a sprinter van with customized paint.

The geographic extent of impacts may vary between being primarily localized to the site and extending beyond the project site, due largely to the number and nature of subcontracts on the project as well as other project expenses. Some projects have large, specialized supply or equipment costs, which may mean that

economic benefits flow to companies far away from the project site where the product is produced. In addition, grantees may subcontract with specialized firms to conduct market research, conduct interviews, produce videos and marketing materials, and provide other support, and the firms may not necessarily be geographically located with the other grantees or at the project site (e.g., if there is a field component of the work).

Overall, the magnitude of beneficial socioeconomic impacts is expected to be minor to moderate, as it is expected that projects of this type will induce a change in social or economic conditions for some individuals, groups, or businesses—largely the grantees themselves—but indirect benefits from grant funds will flow to a much larger network of businesses and the overall economy as a whole. Moderate impacts may be more likely to occur when grant funding flows to a small number of highly dependent recipients, as opposed to grants where there are broad, cross-organizational teams. The magnitude of these benefits may be more minor than estimated, however, since they must be compared to the benefits from what the funds would otherwise be used for. Under the S-K Act of 1954, the grant program is funded by a permanent appropriation of 30 percent of the previous year's custom receipts from imports of fish and fish products, which is deposited into a P&D account (CRS 2020a). As of 2020, the majority of the P&D account funds have been Congressionally directed to the ORF account, which supports NMFS science and management activities, while remaining funds are allocated to the grant program. In lieu of the grant program, funds would likely be allocated into the ORF account and have similar positive economic impacts due to increases in economic activity as a result; however, the magnitude of these benefits is not known.

4.5.1.2 Summary of Impacts on All Resources

A majority of seafood promotion and marketing projects funded under the S-K Program are expected to fall within the scope of the analysis of this PEIS; however, projects (or portions of projects) may be excluded from complete NEPA coverage under this PEIS when their impacts exceed levels described in Section 4.5, Environmental Consequences of the Proposed Action, or are not commensurate with the effects described herein. Projects may also be excluded based on criteria for exclusion (Table 1-1). For most socioeconomic resources, the S-K Program projects within the seafood promotion and marketing project type would result in minor to moderate beneficial effects (Table 4-4).

Table 4-4. Summary of Impacts on all Resources from Seafood Promotion and Marketing Projects

Environment	Resource	Type	Duration	Geographic Extent	Magnitude	Quality
Social	Socioeconomic	Direct	Short-term	Localized	Minor to Moderate	Beneficial
Social	Socioeconomic	Indirect	Long-term	Beyond the Project Site	Minor to Moderate	Beneficial

4.5.2 Research and Monitoring

Research and monitoring projects may include, but are not limited to, stock assessments, fish and shellfish distribution studies, and ecosystem studies (see Section 2.2.2.2, Research and Monitoring). Research and monitoring projects funded under the S-K Program, or projects consistent with the scope of the S-K Program, have the potential to directly impact resources within the physical, biological, and social environments. The duration of direct and indirect impacts on most resources is short-term. The geographic extent and magnitude of direct and indirect impacts on most resources are localized and minor in nature.

The following sections analyze the effects of research and monitoring projects on physical, biological, and social environments and associated resources. Examples of research and monitoring projects are provided in Section 2.2.2.2, Research and Monitoring, and past projects funded by the S-K Program that are

categorized within this project type are identified in Appendix B. The analysis of effects is based upon the typical methods and techniques employed. Methods, techniques, and environments with potential impacts to associated resources for this project type are summarized in Table 4-5.

Table 4-5. Research and Monitoring Projects – Methods, Techniques, and Environments with Potential Impacts to Associated Resources

Action Setting	Methods	Techniques	Physical	Biological	Social
Office or laboratory	• Biological lab research • Desktop analysis • Interviews and surveys • Workshops, trainings, informational surveys	• Undertake routine analysis within a controlled/semi-controlled indoor or outdoor setting (e.g., analyze previously collected water, animal, plant, benthic, seafood samples to characterize environment, evaluate disease, examine genetics; develop disease or toxin assays). • Manage, analyze, and synthesize data; develop and use databases. • Conduct computer modeling, GIS. • Develop and use computer-based tools.	X	X	X
Field (land, water, or underwater)	• Biological field research • Interviews and surveys	• Collect field data at ports and harbors directly from fishermen and processors. • Collect data or samples using the following methods: o Mark or otherwise tag finfishes or invertebrates using standard procedures and safeguards; collect fin clips or seaweed samples for genetic or laboratory analyses. o Undertake field surveys and monitoring to take benthic samples to study organisms in the seafloor or lake beds. o SCUBA or video survey. o Install short-term moored or shored based instrumentation for observational purposes (e.g., cameras). o Use benthic devices for anchoring of moored instrumentation. o Collect information from new or existing buoys, or other floating instrumentation. o Operation of vessels for research and monitoring. o Use remotely operated vehicles or autonomous underwater vehicles. • Use echosounders, which use sonar technology for the measurement of underwater physical and biological components.	X	X	X

4.5.2.1 Physical Environment

Expected impacts on the physical environment and associated resources from research and monitoring projects conducted under the S-K Program, or projects consistent with the scope of the S-K Program, are discussed below.

Offshore, Nearshore, and Freshwater

Temporary disturbance from human presence, and increased noise associated with implementation of research and monitoring projects that include field research methods and techniques such as the use of sampling devices, boats, buoys, or other appurtenances, have the potential to cause direct, short-term, minor to moderate adverse impacts on the physical environment in the localized area where specific S-K Program funded projects would take place. These impacts would occur primarily within seafloor, riverbed, or lakebed areas. Depending on the nature of such projects, however, if a project leads to future management decisions that improve resource conditions, it could result in long-term indirect benefits to resources of the physical environment that extend beyond the local area where the initial S-K Program funded project took place. Considering the relatively small scale, short duration, and limited footprint of each S-K Program funded project, indirect, long-term adverse impacts on these resources are not expected to occur. Specific research and monitoring techniques, and their associated impacts on resources of the physical environment, are discussed in detail below.

Research and monitoring projects that involve the use of temporary buoy weights or moorings, or small buoys (e.g., those used for diving safety) could impact benthic resources of the physical environment through direct contact resulting in a potential disturbance. The quantity of benthic resources directly affected by such deployment would be limited to the size of each buoy that is used (typically no more than 10 square feet in area) and, as practical, researchers would place devices on bare bottom to limit the area of disturbance. Because these research devices are placed temporarily and affect a small area, the direct adverse effects on the physical environment would be minor, localized, and short-term. Potential effects on benthic species are discussed further in Section 4.5.2.2, Biological Environment.

Deployment of remote sensing equipment for research and monitoring—including AUVs, ROVs, and echosounders (i.e., sonar technology) from remote vehicles or tethered devices—could directly impact pelagic and benthic resources from direct contact and related disturbances in the water column that may suspend sediment in the immediate area. Because these devices are placed temporarily and affect benthic or pelagic resources in the immediate localized area where the device is deployed, the direct adverse effects on the physical environment would be minor, localized, and short-term.

The operation of vessels for research and monitoring would directly affect benthic resources of the physical environment during anchoring and unintentional striking or vessel groundings. Because vessel operations associated with projects funded under the S-K Program are low-intensity in nature (e.g., lowering and lifting anchors), the duration of direct impacts on most resources is short-term, and impacts are localized and minor in nature.

For projects funded under the S-K Program, NOAA recommends that fixed moorings, drifting, or live boating (maintaining a stationary location using the vessel engine) are used whenever possible to minimize impacts on benthic habitats from anchoring. NOAA expects that all vessel operators are licensed and highly trained, with an appropriate USCG license or equivalent NOAA Corps experience for the vessel size. These measures would minimize direct impacts on habitat resources and sessile benthic infauna.

Water Quality

Research and monitoring projects funded under the S-K Program may directly impact water quality during project implementation. Depending on the water body's substrate, localized increases in turbidity may result from the use and movement of researchers, equipment, and vessels throughout a project site. Specific research and monitoring techniques, and their associated impacts on water quality, are discussed in detail below.

The normal deployment and use of equipment on the seafloor, riverbed, or lakebed associated with research and monitoring equipment such as remote sensing devices, including AUVs and ROVs, generally has no

associated discharge of harmful pollutants into the water column and, with the exception of temporary and localized turbidity, is expected to have no impact on water quality. Considering the relatively small scale, short duration, and limited footprint of each S-K Program funded project, indirect, long-term adverse impacts on these resources are not expected to occur.

The use of other sampling technologies and operations—such as deploying anchors or other instruments to measure oceanographic, bathymetric, and water quality conditions, or tagging fish to better understand their distributions and behavior—generally has minor effects on the physical environment and associated resources. Normal operations cause no discharge of harmful substances into the water column or the atmosphere or onto the seafloor. However, the deployment of anchors, including drilling installation, may result in short-term, direct, slightly adverse effects from elevated turbidity on water quality on a localized scale.

The general operation of research vessels has the potential to have adverse, minor direct impacts on water quality from unintended fuel, lubricant, sewage, and garbage spills from such vessels. However, as stated above, NOAA expects that all vessel operators conducting research under the S-K Program are licensed, highly trained, and knowledgeable regarding BMPs to avoid accidental discharges of pollutants to the aquatic environment. Therefore, direct, adverse impacts that extend beyond the local area or result in more than minor, short-term impacts on water quality are not anticipated.

The operation of unmanned aerial systems (UAS) and other remote aerial systems may require a water landing, in which the operator lands and retrieves the aerial system in the ocean. In such instances, no effects on water quality are anticipated because the systems are battery operated and sealed to ensure that water does not enter the system, even when submerged, thereby minimizing the threat of a discharge during retrieval. In the unlikely event a remote aerial system unintentionally lands in the ocean and sustains damage, the damage to the surrounding environment is expected to be minimal because the systems typically must be within eyesight of the remote operator, resulting in an immediate retrieval following an emergency landing. Based upon S-K Program funded research from 2010 to 2021, the use of UAS flights is limited; however, this technology is expected to continue to be used at higher frequencies in the future. SCUBA/snorkel operations are expected to result in little to minor effects on water quality, primarily related to localized increases in turbidity if operations are conducted near the seafloor.

4.5.2.2 Biological Environment

Expected impacts on the biological environment and associated resources from research and monitoring projects conducted under the S-K Program, or projects consistent with the scope of the S-K Program, are discussed below. For all research and monitoring project activities, researchers would avoid sensitive areas that are not the direct subject of primary research activities (e.g., eelgrass beds would be avoided during clam surveys). This measure would avoid unnecessary or potentially harmful contact on resources of the biological environment in such areas. Specific research and monitoring techniques—and their associated impacts on submerged aquatic vegetation, algae, macroalgae, and benthic invertebrates—are discussed below.

Submerged Aquatic Vegetation, Algae, Macroalgae, and Benthic Invertebrates

S-K Program funded projects that require research or monitoring from the shore or within nearshore areas (e.g., intertidal surveys, research at existing shellfish aquaculture facilities) are expected to have minor direct impacts on the surrounding ecosystem, including habitat for invertebrates and macroalgae. Short-term direct disturbance to affected habitats and sessile invertebrates and macroalgae could occur during fieldwork activities via incidental and unavoidable contact within the beach or intertidal area. Invertebrates would be temporarily displaced, and behaviors may be temporarily altered (e.g., feeding) due to the presence of researchers or shore-based equipment.

The operation of vessels has the potential to have direct impacts on invertebrates and macroalgae from anchoring and vessel movement. Mobile invertebrates could be temporarily displaced from areas temporarily occupied by vessel anchoring systems, and macroalgae could be damaged during anchor deployment. Similarly, research equipment deployed on the seafloor, riverbed, or lakebed—such as diving buoys, weighted research buoys, anchors, or instrumentation that focuses on biological data collection or monitoring (e.g., video cameras or benthic fauna trapping devices)—could directly impact biological resources that may occur in the area of deployment. Because vessel operation and associated research equipment deployment for projects funded under the S-K Program are low-intensity in nature (e.g., lowering and lifting equipment), affecting biological resources within discrete areas, the duration of direct impacts on most resources is short-term, and impacts are localized and minor in nature. However, such activities may result in the injury or mortality of sessile infauna and macroalgae if anchoring systems drag or are placed in areas where a high density of invertebrates and macroalgae occur. The small footprint of most instruments would limit direct impacts to minor levels. However, the physical placement of equipment on the seafloor, the direct contact with sessile benthic organisms by the gear itself, and the possible deterioration of research materials that subsequently land on the bottom may lead to the smothering and mortality of some invertebrates and macroalgae. The transitory nature of most of these devices associated with S-K Program funded projects, as well as the limited scope of each study with regards to the size of the region, is expected to result in minor effects on benthic species and resources of the biological environment. Under most circumstances, the use of such research and monitoring equipment is intended to provide information that would be used to inform the conservation and management of species and habitats. Thus, equipment use may provide long-term, indirect beneficial effects on biological resources beyond the initial area where the S-K Program funded project occurs.

The use of equipment to install research equipment (e.g., drilling for anchors) could disturb invertebrates if they are sensitive to noise, resulting in temporary behavior modifications and predator responses. Similarly, the use of ROVs or AUVs for exploration and mapping of seafloor and freshwater benthic habitats could impact local fauna and temporarily alter or initiate behaviors, including feeding behaviors and escape responses. Ehud et al. (1994) observed diminished feeding of American lobsters (*Homarus americanus*) in the presence of operational ROVs in the marine environment. The alteration in feeding behavior was attributed to disturbance from both light and sound emission from the ROV. Similar behavioral responses would be expected to other marine and freshwater species, particularly in areas that have limited human presence.

Data for underwater sound levels from ROVs are limited and highly variable. Estimates from one study indicated levels with thrusters off were greater than 130 decibels (dB), and levels with all thrusters on were greater than 160 dB (Roundtree et al. 2002). These noise levels are not expected to cause injury to invertebrates, but they could cause temporary behavioral modifications, with a return to normal behavioral patterns after the research activity is completed. As reported by NMFS (2018a), the current scientific understanding of acoustic sensitivity and sound production by invertebrate species remains limited. Invertebrates such as crabs, lobsters, urchins, and corals are known to either produce sounds in intraspecific interactions or use acoustic cues in settlement phases. For these species, therefore, the highest risk associated with equipment that emits underwater noise would be associated with continuous sound sources that could lead to reduced ability to detect important acoustic cues. The highly localized, relatively rare, and impulsive nature of echosounders for projects funded under the S-K Program suggests that no impacts on settlement cueing and communication by species such as crabs, lobsters, urchins, and other known acoustically active species are expected. Further, the transitory nature of these devices, as well as the limited scope of each S-K Program funded project with regards to the size of the region, is expected to keep these effects minor.

Other sampling activities associated with S-K Program funded projects may include the placement of recruitment lines, species collection (e.g., trap deployment) or tagging, or placement of transect lines, tape,

and other markers. Use of such equipment and sampling methods could result in direct adverse effects on affected resources of the biological environment. Both macroalgae and invertebrates could be disturbed and therefore may be adversely affected by such actions. Sampling activities may indirectly adversely affect invertebrates through behavioral disturbances caused by the instruments themselves, or more directly through contact of sessile benthic organisms (including some invertebrates) by the gear itself. In addition, research, monitoring, and sampling equipment could become marine debris, which could entangle or be ingested by benthic invertebrates resulting in injury or mortality (Giordano et al. 2010, Richardson et al. 2019, CRS 2020b). The transitory nature of these devices, as well as the limited scope of each project funded under the S-K Program regarding the size of the study area and study duration, is expected to result in minor, direct, adverse effects on a localized scale.

The use of SCUBA/snorkel operations for research and monitoring could result in minor adverse effects on resources of the biological environment including sessile invertebrates and macroalgae due to the minor and limited disturbance of the water column and bottom substrate. Intentional or accidental improper techniques during work along the bottom substrates can result in damage to these biological resources. NOAA expects that all divers and snorkelers employed during studies funded under the S-K Program are highly trained and knowledgeable about standard BMPs to avoid or minimize damage to marine and freshwater substrates. Thus, these operations are expected to result in minor effects on SAV, algae, macroalgae, and benthic invertebrates.

The use of other sampling activities may have indirect benefits on biological resources, including data collection for future study; increased understanding of individual species, biodiversity, and habitats, which may lead to improved management of resources; and indirect benefits of increased awareness and the development of education and outreach materials for public education. These indirect beneficial effects could be minor over the long term.

Fish (T&E Species, Critical Habitat, EFH)

S-K Program funded projects that include shore-based or nearshore fieldwork (e.g., intertidal surveys, research at existing shellfish aquaculture facilities) are expected to have minor direct impacts on fish resources, including T&E species, critical habitats, and EFH. If researchers enter the intertidal area, short-term and direct effects on fish could include displacement and behavioral modification due to the presence of researchers or shore-based equipment. Specific impacts on fish resources are discussed below.

The operation of vessels for research and monitoring may result in direct impacts to fish from disturbance associated with noise and anchoring, and from unintentional striking or groundings. Individuals or groups of fish could be displaced or disturbed by elevated underwater noise levels associated with vessel use. The use of anchored research or monitoring equipment could disturb mobile fish, including T&E species, and temporarily degrade critical habitats and EFH if the equipment emits noise (e.g., sonar echosounder, video camera), if anchors interact with critical habitats or EFH, or if small-scale drilling is required for anchor installation. Although impacts on critical habitat and EFH would be minor in nature, due to the relatively small scale, limited footprint, and temporary duration of the projects, such actions could alter individual fish behaviors (e.g., foraging, predator avoidance, migration) for the duration of the activity and temporarily displace fish from occupied critical habitat and EFH. Generally, in-water drilling produces continuous noise that may exceed hydroacoustic disturbance thresholds for fish (FHWG 2008). However, such operations do not involve impact methods (e.g., hammers) and therefore do not produce levels of underwater noise that exceed thresholds for harm and would not expose critical habitats and EFH to noise levels that are unsuitable for rearing and migration. Although the use of anchors or monitoring equipment could have direct adverse impacts on fish resources, effects would be minor in intensity over the short term because activities would be localized to the general area of specific research activities and confined to the period of the project activities. The mobility of most life stages of fish, including T&E species, also limits impacts.

The deployment of remote sensing equipment for research and monitoring—including AUVs, ROVs and echosounders from remote vehicles or tethered devices for exploration and mapping of seafloor and freshwater substrates—may temporarily alter or initiate startle behaviors in fish, including those related to feeding and predator avoidance. Because this equipment is placed temporarily and effects are limited to the localized area where the equipment is deployed, the direct adverse effects on fish would be minor, localized, and short-term. Data for underwater sound levels from ROVs are limited and highly variable (Roundtree et al. 2002). These noise levels would not exceed typical injurious levels for fish (Popper et al. 2014), but they could temporarily modify behaviors, with a return to normal behavioral patterns after the research activity is completed. Therefore, combined with the relatively low number of annual deployments of such equipment under the S-K Program (e.g., four S-K Program projects 2010–2021), the short-term use of such equipment, and the highly mobile nature of fish, these activities would result in minor, short-term, direct adverse impacts on fish in a localized area.

Information on the movements of commercially and recreationally important fish species gained from remote sensing operations subsequently could be used to better manage species and protect critical habitats and EFH, which could result in potential long-term, beneficial impacts on fish, including T&E species. However, long-term benefits to target species from implementation of these projects are speculative in nature and are not included in the analysis of effects of the S-K Program. Indirect benefits may be localized or extend beyond the immediate area where the S-K Program funded project is implemented and could range from no effect to moderate in nature depending on the findings and potential implementation of improved management or conservation strategies.

Research and monitoring projects that target a specific organism or fishery and require the use of aquatic vessels for in-water observation or access, tagging, collection (e.g., hook and line, trawling), and sampling that requires handling (e.g., genetic tissue sampling, sexing, sizing) have the potential for direct, short-term, adverse impacts on fish. Other sampling activities may indirectly adversely affect fish through behavioral disturbances caused by the instruments, or more directly through contact of fish by the gear. During research that requires sampling gear deployment or capture, collection, and tagging, individual fish could be subject to behavioral modifications and harmed or killed. In addition, research, monitoring, and sampling equipment could become marine debris, which could entangle or be ingested by fish resulting in injury or mortality (Giordano et al. 2010, Richardson et al. 2019, CRS 2020b). The transitory nature of these devices, as well as the limited scope of each study with regards to the size of the region subject to study and the number of individual fish involved, is expected to result in minor effects on local fish resources, including T&E species, critical habitats, and EFH.

Remote aerial systems or piloted aircraft may be used for research activities, particularly as related to stock assessments and fish population monitoring or predation studies. Operation of UAS (e.g., drones) and other remote aerial systems is expected to have no impacts on fish due to the small size and remote aerial operation of such aircraft, and the high mobility of most fish. Operation of research airplanes or helicopters above an ocean or lake surface may produce noise that is perceptible to fish near the surface; however, impacts would be limited to temporary, minor disturbance. Impacts from piloted aircraft would be further minimized by the infrequent use of such equipment on an annual basis associated with projects funded under the S-K Program.

In the unlikely event a remotely operated aerial system requires an unintentional or emergency landing, trained operators would use care during landing operations and utilize the surrounding environment and coast to a soft landing, targeting an unpopulated area, and all efforts would be taken to ensure minimal impact on the surrounding physical environment (NOAA 2017a). In compliance with Federal Aviation Administration regulations and NOAA standing orders, all remote aerial system operators are required to successfully complete training certifications specific to the UAS system being used, complete a health screening, and be licensed to operate such systems. Therefore, aircraft (UAS) operations conducted under the S-K Program are expected to have no effects on fish, including T&E species, critical habitats, and EFH.

The use of SCUBA/snorkel operations for research and monitoring would result in minor adverse effects on fish due to the minor and limited disturbance of the water column and bottom habitats for each project's area of study (within the overall action area) and the high mobility of most fish species.

Protected Species (Sea Turtles, Marine Mammals, and Marine Birds)

Impacts on sea turtles, marine mammals, and marine birds from research and monitoring are presented collectively for these protected resources in the following section. Research and monitoring projects that target a specific organism or fishery and require the use of aquatic vessels for in-water observation or access, tagging, collection (e.g., hook and line, trawling), and sampling that requires handling (e.g., genetic tissue sampling, sexing, sizing) have the potential for direct, short-term, adverse impacts on sea turtles, marine mammals, and marine birds. Specific impacts on submerged protected species, including sea turtles, marine mammals, and marine birds, are discussed below.

S-K Program funded projects that include shore-based or nearshore fieldwork (e.g., intertidal surveys, research at existing shellfish aquaculture facilities) may have direct, adverse impacts on hauled-out marine mammals or nesting sea turtles and marine birds. If researchers enter the intertidal area when marine mammals, sea turtles, or marine birds are present, short-term direct disturbance of these protected resources could result from the presence of personnel or use of equipment. Individuals in the affected areas would be temporarily displaced, and behaviors may be temporarily altered (e.g., feeding, nesting). However, the effects of this disturbance are expected to be minimal, as any contact with the environment from project activities would be localized and short-term in nature. Further, NOAA would recommend that research-based activities avoid sensitive timing periods for areas known to support sea turtle or marine bird nesting, or sensitive life histories for marine mammals (e.g., haulouts, rookeries) unless those areas are the direct subject of specific research activities. This measure would avoid unnecessary or potentially harmful contact with these protected resources. If sensitive areas or time periods cannot be avoided, researchers would have to comply with any additional measures required under the ESA, the MMPA, and any other applicable laws.

Anchors or equipment anchored to the seafloor could cause minor disturbance of sea turtles and diving marine birds. If sea turtles are resting on the seafloor near the area of deployment, they could be displaced and temporarily disturbed by the presence of equipment and potential noise emission from the device. Limited data are available for sea turtles and noise from sonar-based devices (e.g., echosounders) that may be employed for research; however, because turtles detect sound at less than 1,000 Hertz, any effect would only be in response to low-frequency sonar (Popper et al. 2014). Thus, these activities are expected to result in direct adverse effects that are minor in intensity and limited to a localized area. Effects are also expected to be short-term, given the limited duration of activities implemented for projects funded under the S-K Program, and that direct effects are generally expected to occur only during project activities.

Anchor placement, including use of drilled anchors, could also directly impact marine mammals in the general vicinity of the activity. The use of anchors or other devices and potential installation using in-water drilling methods could displace individuals from the local area, causing them to abandon foraging or migratory activities. Under such circumstances, compliance with the MMPA would be required. If seafloor-deployed equipment uses active sonar or other noise-generating technology as part of its normal operations, marine mammals may be adversely affected, potentially exhibiting behavioral changes such as altering their foraging, diving, or vocalization patterns. Another possible adverse impact to marine mammals, sea turtles, or diving marine birds includes the potential for entanglement with a mooring cable for research equipment and trapping devices or fishing lines. These direct, adverse impacts are expected to be short-term and localized, due to the limited scale, area, and duration of the projects, and are therefore considered to be minor. NOAA expects that research-based actions with the potential for entanglement are rare (e.g., one S-K Program project 2010–2021), and that all such research would include monitoring for and rectification of such impacts.

The use of remote sensing equipment including, AUVs and ROVs for research and monitoring, could result in minor effects on the behavior of mobile marine mammals, sea turtles, and diving marine birds due to the generally minor, limited, and short-term impact caused by these tools. Underwater sound levels from ROVs may range from 130 dB to levels greater than 160 dB (Roundtree et al. 2002). Although not expected to cause injury to sea turtles, diving birds, or marine mammals, these levels exceed marine mammal behavioral disturbance thresholds established by NOAA for continuous sound sources (NMFS 2018a). Thus, the use of such equipment may lead to temporary, minor to moderate direct adverse effects on marine mammals in the form of temporary behavioral modifications, with a return to normal behavioral patterns after the research activity is completed. Therefore, combined with the relatively low number of annual deployments of such equipment under the S-K Program, the short-term use of such equipment, and the highly mobile nature of marine mammals, these activities would result in minor, short-term, direct adverse impacts in a localized area. If required, the use of ROVs may trigger the need for an Incidental Harassment Authorization under the MMPA, which would be the responsibility of the researcher to obtain.

The response of sea turtles to elevated underwater sound is less understood than that of marine mammals. As reported in Popper et al. (2014), because of their rigid external anatomy, it is possible that sea turtles are highly protected from impulsive sound effects, at least regarding pile driving and seismic airguns. Weir (2007), as cited by Popper et al. (2014), observed fewer sea turtles near airguns as they were firing; however, the source of agitation could not be identified, and the turtles may have reacted to the ship and equipment as opposed to the airgun noise. Although no research activity funded under the S-K Program has used equipment that produces noise equivalent to airguns, the production of any noise may elicit no response, or a temporary, minor, adverse response from sea turtles and diving birds in the local vicinity of the action.

In addition to disturbance and noise from AUV or ROV presence and use, marine mammals, sea turtles, and diving birds may become entangled in equipment cables. The potential for this impact would be minimized by the limited duration of operations and the fact that this equipment is always attended. Should an animal be observed in the vicinity, the ROV can be quickly retrieved to avoid such impact. In summary, although the use of AUVs and ROVs could result in direct, adverse effects on marine mammals, sea turtles, and diving birds, with a greater intensity of effects for marine mammals, given the limited use of these tools at any specific location for projects funded under the S-K Program and the precision with which these types of equipment are operated, effects would be short-term and localized.

In addition to AUV/ROV use, although uncommon, remote sensing operations may include the use of echolocators that use active sonar. Such use may adversely impact protected species, particularly marine mammals, by introducing noise to the underwater environment. This and other anthropogenic underwater noise may adversely affect marine mammals in several ways, including causing some behavioral changes such as altering their foraging, diving, or vocalization patterns. However, they would not likely result in injury to the marine mammals because noise levels do not typically exceed those that cause permanent or temporary hearing damage, as discussed in detail in NMFS (2018a) and incorporated herein by reference. In general, when considering the typical sonar deployment strategies and types, the mobility of marine mammals in the water column, and the propensity for marine mammals to avoid obtrusive sounds, minor alert and startle responses, avoidance of the survey vessel, and brief or minor modification of vocal behaviors are the most probable responses to elevated hydroacoustic noise exposure. In addition, the relatively rare, impulsive, and highly localized implications of these source types result in nonexistent (for humpback whales) to minimal (for toothed whales) implications for acoustic masking of communication signals or other important biological signals within mid-higher frequency hearing ranges. No measurable impacts are expected on the ability of exposed cetaceans to forage, shelter, navigate, reproduce, and avoid predators and other threats such as vessels. Therefore, exposure of marine mammals to noise from active acoustic research sources would be minor, localized, and temporary.

To further minimize the potential for significant impacts on marine mammals from use of sonar technologies, NOAA expects that all researchers on board vessels conducting S-K Program funded research

monitor and report locations of marine mammal and sea turtle sightings as part of their regular operational protocol (BOEM 2018). Observation reports should be filed to record the species, number of animals, behavior, time, and location of the sighting. Therefore, with implementation of these measures, although the use of sonar sensing equipment is expected to result in direct, adverse effects on marine mammals, these effects are expected to be short-term and localized and are therefore considered to be minor.

Projects funded under the S-K Program may include various sampling operations associated with non-target species that may directly or indirectly impact marine mammals, sea turtles, and marine birds. Sampling activities targeting fish, invertebrates, or macroalgae include but are not limited to the placement of transect lines and quadrats, placement of anchors or cables, trawling for data collection, collection and tagging of fish, research at existing mariculture sites, and water quality sampling (e.g., temperature probe deployment). If present during such sampling activities, individuals could be displaced from occupied areas, resulting in direct adverse impacts on these protected species. If the organisms subject to study provide prey for protected resources, such activities could temporarily alter foraging behaviors for the duration of the sampling exercise. In addition, research, monitoring, and sampling equipment could become marine debris, which could entangle or be ingested by protected species resulting in injury or mortality (Giordano et al. 2010, Richardson et al. 2019, CRS 2020b). These adverse impacts are expected to be short-term and localized and are therefore considered to be minor.

The operation of vessels has the potential to have adverse, but minor to moderate direct and indirect impacts on marine mammals, sea turtles, and marine birds. Minor effects would result if individuals are temporarily displaced or modify behaviors in response to vessel movement and underwater sound produced by engines. Moderate impacts, while unlikely, would primarily be attributed to vessel strikes. As reported by OCM (2019), smaller vessels are typically faster, but have higher maneuverability and shallow draft compared to larger vessels. Therefore, smaller research vessels are less likely to collide with and injure protected species because they can change direction to avoid collisions and do not ride as low in the water. Therefore, operating a research vessel near protected species during other sampling activities can have short-term temporary effects on their behavior and presents a remote risk of the vessel striking the animal.

Regardless of boat size, operators of vessels for projects funded under the S-K Program are required to be knowledgeable about ESA and MMPA regulations to avoid impacts on protected sea turtles and marine mammals (BOEM 2018). Further, NOAA expects that all research vessels operated under S-K Program grants implement BMPs to avoid harm to protected species. Examples of best practices include maintaining lookouts for protected species, interacting with other vessel operators (e.g., whale watch boats), receiving real-time survey information on the locations and concentration of marine mammals, reducing speeds, and maintaining safe distances. Further, NOAA requires that all researchers attempt to maintain a safe distance between marine mammals and their vessel (BOEM 2018). These measures, combined with the relatively limited total number of days at sea for S-K Program funded research vessels, further decreases the likelihood of impacts on protected species residing in the affected environments.

Regarding sea turtle vessel strikes, because individuals are submerged, partially submerged, and regularly coming up for air, sea turtle strikes may occur regardless of vessel size, speed, or BMPs implemented for marine mammals. To avoid or minimize sea turtle vessel strikes, NOAA recommends that all vessels operated under S-K Program grants avoid murky waters as best as possible; transit live bottom/artificial habitats at slower speeds; and avoid transiting near tide lines where turtles may be foraging (BOEM 2018). Considering these measures, vessel operations for projects funded under the S-K Program would have minor to moderate impacts on protected species in localized areas over the short-term duration of each project.

Research and monitoring projects conducted via piloted and remote aerial devices would disturb hauled-out marine mammals or individual marine mammals, sea turtles, or marine birds near the ocean surface. Although UAS (e.g., drones) may be used with some frequency in projects, the use of piloted aircraft (e.g.,

airplanes or helicopters) for research activities funded under the S-K Program is typically infrequent on an annual basis. The use of UAS or aircraft would produce noise and visual disturbance that may startle marine mammals and alter ongoing foraging, resting (for hauled-out individuals), or migratory behaviors. These direct, adverse effects would be short-term and localized but, depending on the noise level and duration of aircraft use, could result in moderate impacts on marine mammals.

To minimize the likelihood of interactions with hauled-out marine mammals, aircraft operations would not generally occur below 200 feet in elevation. Aircraft operations funded previously under the S-K Program are also very limited in number, scope, and duration. Therefore, they are expected to result in minor adverse effects on these resources, because these effects are short-term and localized. Over the long term, the use of aircraft operations to characterize habitats and collect data would result in minor beneficial, indirect, and long-term effects on these protected resources.

The use of SCUBA/snorkel operations for research and monitoring would result in minor adverse effects on marine mammals and sea turtles due to the limited disturbance of the occupied habitats and the high mobility of most protected species. However, long-term benefits to target species from implementation of these projects are speculative in nature and are not included in the analysis of effects of the S-K Program.

In-Flight Marine Birds

Research and monitoring projects conducted via piloted and remote aerial devices can provide valuable data on habitat and species and reduce the need for a physical presence in remote areas, which may cause a disturbance to the areas' physical and biological surroundings. Although UAS (e.g., drones) may be used with some frequency in projects, the use of piloted aircraft (e.g., airplanes or helicopters) for research activities funded under the S-K Program is typically an infrequent occurrence. The use of UAS or aircraft would result in adverse direct effects on habitats, including terrestrial at-sea habitats in the form of potential seabird strikes and behavioral disturbance from UAS noise to in-flight seabirds. UAS operating at low altitudes conducting remote sensing surveys may have indirect effects on biological resources via seabird disturbances (i.e., low overflights could result in seabird flushing).

Aircraft operations funded previously under the S-K Program are also very limited in number, scope, and duration. Therefore, they are expected to result in minor adverse effects on biological resources, because these effects are short-term and localized. Over the long term, the use of aircraft operations to characterize habitats and collect data would result in minor adverse direct effects on in-flight marine birds.

4.5.2.3 Social Environment

Expected impacts on the social environment and associated resources from research and monitoring projects conducted under the S-K Program, and projects consistent with the scope of the S-K Program, are discussed below. In general, direct impacts on social resources would be minor, and long-term benefits may be realized from research and monitoring funded under the S-K Program.

Recreation and Tourism

Shore-based or nearshore-based research (e.g., intertidal surveys, research at existing shellfish aquaculture facilities) conducted in heavily visited recreational coastal or freshwater sites during peak recreational boating seasons may occasionally interfere with recreational uses. These activities would result in minor, localized, and temporary impacts. Specific impacts on recreation and tourism resources are discussed below.

Recreational uses may be adversely impacted by seafloor, riverbed, or lakebed deployed equipment if the instrument becomes entangled in recreational fishing or mooring lines. The potential for this direct, adverse

impact on recreational or commercial fishing and recreation and tourism is considered minor, localized, and short-term. Research and monitoring activities such as transect surveys or deployment of remote sensing equipment in well-visited marine or freshwater areas may temporarily interfere with the conduct of commercial or recreational activities, resulting in minor effects. Information on the movements of commercially and recreationally important fish species from seafloor, riverbed, or lakebed deployed research and monitoring equipment may be used to better manage species and protect their habitat. This may result in minor, long-term benefits to recreational and tribal fishermen and those associated with the commercial fishing industry.

Occasionally, sampling operations conducted by researchers operating under an S-K Program funded research grant may temporarily interfere with the conduct of commercial or recreational activities, resulting in short-term, minor effects for the duration of the research project. The collection of samples for genetic or biological research and monitoring would take a fraction of a percent of the total population of species and plants being studied and would not be expected to interfere with other users' ability to legally harvest and/or collect marine species for subsistence or commercial purposes.

Research vessels launched from and used in heavily visited recreational coastal or freshwater sites during peak recreational boating seasons may occasionally interfere with recreational and commercial boaters. However, these activities would result in minor, localized, and temporary impacts. Aircraft operations are not expected to impact maritime users, as no piloted aircraft operations occur on or near the ocean. Because most remote aerial systems are operated from a vessel and the system remains within eyesight and under the control of the operator at all times, adverse impacts on interactions with human use activities such as fishing (recreational or commercial) and tourism are not expected.

SCUBA/snorkel operations associated with research and monitoring projects would have minor adverse effects on recreational users due to the potential for temporary displacement of fishing activity when research divers or snorkelers are present. These effects would be minor because the research associated with S-K Program funded projects would be short-term and localized.

Cultural and Historic Resources

As described in Chapter 3, Affected Environment, cultural and historic resources generally include "historic properties, other culturally valued pieces of real property, cultural use of the biophysical environment, and such 'intangible' sociocultural attributes as social cohesion, social institutions, lifeways, religious practices, and other cultural institutions" (National Preservation Institute 2020). Research and monitoring projects funded under the S-K Program may result in direct impacts on cultural and historic resources. The duration of these impacts on most resources would be short-term, and impacts would be localized and minor in nature. Depending on the resource targeted for research or monitoring, long-term effects on cultural and historic resources could also be beneficial. For example, if research to study a specific fishery, results in the implementation of new data collection or management methods in areas that could benefit traditional tribal fishing grounds, long-term implications could be beneficial. Or if research results in the use of new, locally sourced feed materials, local areas may benefit from increased demand for near-sourced products. Alternatively, if actions take place within culturally important areas to local tribes, direct, short-term, and adverse impacts could occur. Specific impacts on cultural and historic resources are discussed below.

NOAA will follow Administrative Order 218-8 (NOAA Policy on Government-to-Government Consultation with Federally Recognized Indian Tribes and Alaska Native Corporations) and utilize the NOAA tribal consultation handbook (NOAA 2013c) to coordinate with Indian Tribes, Alaska Native Corporations, and Native Hawaiian Organizations to minimize and reduce impacts to cultural and historic resources that are important to these groups. NOAA shall also utilize these same principles for coordinating with other non-U.S. local communities and traditional groups to minimize and reduce impacts to cultural and historical resources that are important to these groups.

Shore-based or nearshore-based research projects (e.g., intertidal surveys, research at existing shellfish aquaculture facilities) are typically of short duration and limited in scope and are not expected to interfere with cultural and historic resources. During routine fieldwork, NOAA requires all S-K Program grant recipients to take precautions to avoid all known cultural resources to avoid unnecessary harm to the surrounding environment. In addition, if onshore fieldwork is conducted in areas near known or newly encountered cultural or historic resources, appropriate experts (e.g., cultural or archeological) would be consulted prior to fieldwork initiation. As a result, no effects on cultural or historic resources are expected from these activities.

The use of AUVs or ROVs would have no effects on cultural resources, as they would not typically come in contact with these resources. The deployment of research equipment on the seafloor, riverbed, or lakebed (e.g., anchors, other monitoring equipment) is expected to have minor adverse effects on cultural and historic resources. Over the course of human occupation, sea levels have risen dramatically and, as demonstrated by several studies, archaeological evidence of past human occupation may be located underwater (Hale et al. 2021) as well as shipwrecks, which are protected under the Abandoned Shipwreck Act of 1987. While intentional or accidental improper operator techniques are possible, NOAA expects that equipment will be deployed by trained operators using BMPs. Thus, these operations are not expected to result in adverse effects. In addition, if research and monitoring equipment is deployed in areas near known or newly encountered cultural and historic resources, appropriate experts (e.g., cultural or archeological) would be consulted prior to deployment. As a result, expected effects to cultural and historic resources from these activities may be direct, short-term, localized, and minor adverse effects.

Vessel operations are also anticipated to have minimal effects on cultural and historic resources. Anchoring and unintentional striking or groundings are rare but may occur. Vessel operations are low intensity in nature (e.g., lowering and lifting anchors), and few vessels are used to operate in a large area, so the risk of impact would not be concentrated in a small area. To mitigate potential impacts from anchoring a vessel, NOAA recommends that fixed moorings are used whenever possible. In addition, if vessels would be operated in areas near known or newly encountered cultural and historic resources, appropriate experts (e.g., cultural or archeological) would be consulted before project initiation. As a result, the duration of direct impacts on most cultural and historic resources would be short-term, and impacts would be localized and minor in nature. The use of aircraft, including drones, may affect the use of traditional cultural places through disturbance via sound and visual presence. However, because most research-based aircraft operations would occur over water, effects on cultural and historic resources are expected to be minor, short-term, and localized.

SCUBA/snorkel operations are not expected to adversely affect cultural and historic resources. While intentional or accidental improper diving or snorkeling techniques and overuse of specific locations can result in damage to these resources, NOAA expects that all research divers and snorkelers are highly trained and will employ best management practices to avoid improper actions that can cause harm to known or newly encountered cultural and historic resources. Thus, these operations are expected to have no effect on cultural and historic resources.

In addition to the general BMPs described above that will be used to avoid and/or minimize effects to cultural and historic resources during research and monitoring activities, S-K funded projects would have to meet any applicable requirements under the NHPA.

Socioeconomics

Research and monitoring projects may have a variety of social and economic impacts, directly on grantees and the communities where projects take place as well as indirectly on other sectors of the economy or other communities. All projects funded under the program would have some positive economic impacts. The degree of economic impacts depends on the amount of grant funding and what the funds are used for

over the course of the project, since different allocations to labor, equipment, and supplies will stimulate different sectors of the economy and drive different changes in final demand for goods and services, employment, and earnings. Below, the degree of economic impact is estimated by using budget information for past projects as an indicator of what impacts similar projects may have in the future. Specifically, by categorizing budgeted expenditures, the analysis is able to quantify total direct and indirect economic impacts using a regional input-output modeling approach. Research and monitoring was identified as a secondary and tertiary project type for a number of projects (Figure 1-2); however, the analysis in this section includes only projects for which research and monitoring was the primary project type. Specific impacts on socioeconomic resources are discussed below.

On average, the mean total project budget was approximately $305,616 after accounting for inflation ($2021). Budget analysis of these types of projects found that overall, the largest share of funding was allocated to salaries and fringe benefits, followed by subcontracts, and overhead (facilities and administrative costs). The remainder of costs went to "other" costs, including equipment (capitalized costs in excess of $5,000), construction costs, tuition and fees, and other goods and services (including shipping), as well as supplies and travel costs. More detailed information can be found in Appendix D. Grantees for projects in this category were primarily universities, non-governmental organizations, private research institutions, and state government agencies. Some other notable grantee types include tribal organizations, seafood companies, consulting firms, and aquaculture companies. Subcontracts were primarily for private and university researchers; research, charter, or fishing vessels; fishermen or fishing associations; and non-governmental organizations.

After adjusting for inflation, the average total output effect of research and monitoring projects was $470,326. Output, or total business sales, is the total value of production, including the direct, indirect, and induced value of production. The total output effect for research and monitoring projects was $1.54 for each dollar of the total budget, where the average budget amount was $305,616, of which $18,893 was brought by grantees as matching funds. The average employment effect was 4.1, meaning 4.1 total jobs are supported on average by each grant. This includes the number of jobs directly supported by the project in terms of annual salary (e.g., consultants or researchers), indirectly (e.g., jobs needed to produce supplies), and induced (such as jobs supported by how wages are spent on goods and services like groceries and rent). Employment estimates are generated by the model and are based on regional estimates by industry and do not represent the number of unique jobs affected by any given grant. Labor income effects include the total amount paid in salaries to the direct, indirect, and induced workers. The total labor income effect across all research and monitoring projects was $0.71 per dollar of the budget (Table 4-6).

Table 4-6. Research and Monitoring Project Type Summary IO Analysis Results ($2021)

Summary Category	Measure	Units	Amount
Total grant amount	Average per project	$ (2021)	$286,723
Total in applicant match	Average per project	$ (2021)	$18,893
Total project amount	Average per project	$ (2021)	$305,616
Economic output effects	Average per project	$ (2021)	$470,326
Economic output effects	Dollars per project budget amount	$ (2021)	$1.54
Labor income effects	Average per project	$ (2021)	$216,670
Labor income effects	Dollars per project budget amount	$ (2021)	$0.71
Employment effects	Average per project	Number of jobs	4.12

The timing of socioeconomic impacts for these types of projects is likely to be consistent with the project timeline of 1 to 2 years, since most, if not all, project expenses will be incurred during the project period.

Some indirect, longer-term socioeconomic beneficial impacts may occur, in particular where grant funds are used to purchase equipment or used for construction. Approximately 13 percent of research and monitoring projects reported equipment costs, and no projects reported construction costs.

The geographical extent of impacts may vary between primarily localized to the site and extending beyond the project site, due largely to the number and nature of subcontracts on the project, as well as other project expenses. Some projects have large, specialized supply or equipment costs that may mean economic benefits flow to companies far away from the project site, where the product is manufactured. In addition, grantees may subcontract with specialized firms, and the firms may not necessarily be geographically located with the other grantees or at the project site (e.g., if there is a field or lab component of the work).

Overall, the magnitude of beneficial socioeconomic impacts is expected to be minor to moderate, as it is expected that projects of this type will induce a change in social or economic conditions for some individuals, groups, or businesses—largely the grantees themselves—but indirect benefits from grant funds will flow to a much larger network of businesses and the overall economy as a whole. Moderate impacts may be more likely to occur when grant funding flows to a small number of highly dependent recipients in contrast to projects where funds flow to a larger cross-disciplinary team. The magnitude of these benefits may be more minor than estimated, however, since they must be compared to the benefits from what the funds would otherwise be used for (see discussion in Section 4.5.1.1, Social Environment).

4.5.2.4 Summary of Impacts on All Resources

A majority of research and monitoring projects funded under the S-K Program are expected to fall within the scope of the analysis of this PEIS; however, projects (or portions of projects) may be excluded from complete NEPA coverage under this PEIS when their impacts exceed levels described in Section 4.5, Environmental Consequences of the Proposed Action, or are not commensurate with the effects described herein. Projects may also be excluded based on criteria for exclusion (Table 1-1). For most resources, the S-K Program projects within the research and monitoring project type would result in minor effects (Table 4-7).

Table 4-7. Summary of Impacts from Research and Monitoring Projects

Environment	Resource	Type	Duration	Geographic Extent	Magnitude	Quality
Physical	Offshore, Nearshore, and Freshwater	Direct	Short-term	Localized	Minor	Adverse
Physical	Offshore, Nearshore, and Freshwater	Indirect	Long-term	Beyond the Project Site	Minor	Beneficial
Physical	Water Quality	Direct	Short-term	Localized	Minor	Adverse
Physical	Water Quality	Indirect	Long-term	Beyond the Project Site	Minor	Beneficial
Biological	Benthic Organisms	Direct	Short-term	Localized	Minor	Adverse
Biological	Benthic Organisms	Indirect	Long-term	Beyond the Project Site	Minor	Beneficial
Biological	Fish	Direct	Short-term	Localized	Minor	Adverse
Biological	Fish	Indirect	Long-term	Beyond the Project Site	Minor	Beneficial
Biological	Protected Species and Habitat	Direct	Short-term	Localized	Minor	Adverse
Biological	Protected Species and Habitat	Indirect	Long-term	Beyond the Project Site	Minor	Beneficial

Environment	Resource	Type	Duration	Geographic Extent	Magnitude	Quality
Social	Recreation and Tourism	Direct	Short-term	Localized	Minor	Adverse
Social	Recreation and Tourism	Indirect	Long-term	Beyond the Project Site	Minor	Beneficial
Social	Cultural and Historic Resources	Direct	Short-term	Localized	Minor	Adverse
Social	Cultural and Historic Resources	Indirect	Long-term	Beyond the Project Site	Minor	Beneficial
Social	Socioeconomic	Direct	Short-term	Localized	Minor to moderate	Beneficial
Social	Socioeconomic	Indirect	Long-term	Beyond the Project Site	Minor to moderate	Beneficial

4.5.3 Gear Testing, Bycatch Reduction, and Processing Studies

Gear testing, bycatch reduction, and processing studies projects may include, but are not limited to, testing of exclusion devices, alternate bottom trawls, alternative/decoy baits, lights, acoustic devices, and other deterrent devices. These projects may install anchors and test line rigidity for turtle and marine mammal exclusion from aquaculture facilities and deploy and retrieve experimental traps. Research associated with gear testing, bycatch reduction, and processing projects may also include the analysis of data via computer-based programs and reporting within controlled and semi-controlled settings.

Many of the technologies and methods associated with the implementation of gear testing, bycatch reduction, and processing projects in a field setting are identical to those under Research and Monitoring projects (Section 4.5.2, Research and Monitoring). Therefore, similar impacts are expected for this project type. The following sections analyze the effects of gear testing, bycatch reduction, and processing studies projects on physical, biological, and social environments and associated resources. Examples of gear testing, bycatch reduction, and processing studies projects are provided in Section 2.2.2.3, Gear Testing, Bycatch Reduction, and Processing Studies and past projects funded by the S-K Program that are categorized within this project type are identified in Appendix B. The analysis of effects is based upon the typical methods and techniques employed. Methods, techniques, and environments with potential impacts to associated resources for this project type are summarized in Table 4-8.

Table 4-8. Gear Testing, Bycatch Reduction, and Processing Studies Projects – Methods, Techniques, and Environments with Potential Impacts to Associated Resources

Action Setting	Methods	Techniques	Physical	Biological	Social
Office or laboratory	• Biological lab research • Desktop analysis • Interviews and surveys • Workshops, trainings, informational surveys	• Conduct gear testing. • Undertake routine laboratory analysis within a confined laboratory setting (e.g., analyze alternative baits/feed). • Manage, analyze, and synthesize data; develop and use databases. • Conduct computer modeling, GIS. • Develop and use computer-based tools.	X	X	X
Field (land, water, or underwater)	• Biological field research • Interviews and surveys	• Conduct hook and line surveys. • Operation of vessels for research and monitoring. • Use exclusion devices within the pelagic environment and benthic habitats:	X	X	X

Action Setting	Methods	Techniques	Physical	Biological	Social
		• Testing and use of alternate bottom trawls, alternative/decoy baits, lights, acoustic devices, other deterrent devices. • Use of turtle exclusion devices during non-target species harvest. • Use of underwater drilling machine to install anchors and testing of line rigidity for turtle exclusion from aquaculture facilities. • Deploy and retrieve control and experimental traps. • Conduct routine monitoring and evaluation related to bycatch assessments, fish/shellfish handling methods, and prototype grid systems.			

4.5.3.1 Physical Environment

Offshore, Nearshore and Freshwater

Temporary disturbance from human presence and increased noise associated with implementation of gear testing, bycatch reduction, and processing projects have the potential to cause direct, short-term, and adverse impacts on the physical environment and associated resources in the localized area where specific S-K funded projects would take place. Depending on the nature of such projects, however, if a project leads to future management decisions that improve resource conditions, it could result in long-term indirect benefits to resources of the physical habitat that extend beyond the local area where the initial S-K Program funded project took place. Considering the short duration and limited footprint of each project, indirect, long-term adverse impacts on these resources are not expected to occur. Specific research and monitoring techniques—and their associated impacts on offshore, nearshore, and freshwater locations—are discussed in detail below.

Gear testing and bycatch reduction equipment deployed on the seafloor, riverbed, or lakebed—such as anchors or instrumentation that focuses on biological data collection, monitoring (e.g., video cameras or experimental trapping devices), and testing exclusion devices within pelagic and benthic resources (e.g., underwater drilling machine to install anchors and testing of line rigidity for turtle exclusion from aquaculture facilities)—can improve the conservation and management of species and habitats. Thus, the use of such devices may provide long-term, indirect beneficial effects on habitats in the area subject to study.

However, similar to the Research and Monitoring project type (Section 4.5.2, Research and Monitoring), deployment of gear testing and bycatch reduction equipment would directly impact benthic resources from direct contact and related disturbances in the water column that may suspend sediment in the immediate area where devices may be deployed. Because these devices are placed temporarily and affect the immediate area where deployed, the direct adverse effects on the physical environment and associated resources would be minor, localized, and short-term.

Other sampling activities associated with the S-K Program may include the placement of recruitment lines, species collection (e.g., trap deployment) or tagging, placement of transect lines and tape, and other markers. Similar to the Research and Monitoring project type (Section 4.5.2, Research and Monitoring), use of such equipment and sampling methods could result in direct adverse effects on resources of the physical environment. In addition, sampling equipment could become marine debris, which could entangle or be ingested by benthic resources resulting in injury or mortality. The transitory nature of these devices,

as well as the limited scope of each project funded under the S-K Program, with regard to the size of the individual S-K Program funded project area and duration, is expected to result in minor, direct, adverse effects on a localized scale.

Water Quality

Gear testing, bycatch reduction, and processing projects funded under the S-K Program may directly impact water quality during project implementation similar to the Research and Monitoring project type (Section 4.5.2, Research and Monitoring). Depending on the water body's substrate, localized increases in turbidity may result from the use and movement of researchers, equipment, and vessels throughout a project site. However, long-term, beneficial impacts on water quality could be realized if S-K Program gear testing, bycatch reduction, and processing projects determine that improvements can be made to ongoing practices that may benefit water quality (e.g., improved shellfish harvest collection methods or waste reduction from improved seafood processing). Specific research and monitoring techniques, and their associated impacts on water quality, are discussed in detail below.

The normal deployment and use of equipment on the seafloor, riverbed, or lakebed generally has no associated discharge of harmful pollutants into the water column and thus is expected to have no impact on water quality. The use of other sampling technologies and operations—such as deploying anchors, retrieving experimental traps, or tagging fish to better understand their distributions and behavior—generally has no effect on the physical environment. Normal operations cause no discharge of harmful substances into the water column, into the atmosphere, or onto the seafloor. However, the deployment of anchors and experimental traps may have a short-term, direct, minor adverse effect on a small area and associated resources of the seafloor. Localized turbidity would result from anchor installation and trap deployment. Considering the relatively small scale, short duration, and limited footprint of each S-K Program funded project, indirect, long-term adverse impacts on these resources are not expected to occur.

Similar to the Research and Monitoring project type (Section 4.5.2, Research and Monitoring), the general operation of research vessels has the potential to have adverse, minor direct impacts on water quality (e.g., from unintended fuel spills). However, as stated above, NOAA expects that all vessel operators conducting research under the S-K Program use BMPs to avoid accidental discharges of pollutants to the aquatic environment. Therefore, direct, adverse impacts that extend beyond the local area or result in more than minor, short-term impacts on water quality are not anticipated.

4.5.3.2 Biological Environment

Submerged Aquatic Vegetation, Algae, Macroalgae, and Benthic Invertebrates

S-K Program funded projects that require gear testing, bycatch reduction, and processing projects (e.g., conduct routine monitoring and evaluation related to bycatch assessments, fish/shellfish handling methods) are expected to have minor impacts to SAV, algae, macroalgae, and benthic invertebrates. Short-term direct disturbance to affected habitats and sessile invertebrates and macroalgae would occur during fieldwork activities via incidental and unavoidable contact with the seafloor, riverbed, or lakebed. Invertebrates would be temporarily displaced, and behaviors may be temporarily altered due to the presence of researchers or equipment.

Similar to the Research and Monitoring project type (Section 4.5.2, Research and Monitoring), the deployment of equipment for gear testing and bycatch studies would result in minor direct adverse effects on habitat, including habitat for sessile invertebrates and macroalgae. Effects are expected to be minor because each project funded under the S-K Program would be limited in footprint and temporary in duration. Intentional or accidental improper techniques can result in damage to these biological resources. However, NOAA expects that all equipment deployment would implement standard BMPs to avoid or

minimize damage to marine and freshwater substrates. Thus, these studies are expected to result in minor effects on benthic and open water habitats, benthic infauna, and macroalgae.

Similar to the Research and Monitoring project type (Section 4.5.2, Research and Monitoring), the operation of vessels has the potential to have direct impacts on invertebrates and macroalgae from anchoring and vessel movement. Mobile invertebrates could be temporarily displaced from areas temporarily occupied by vessel anchoring systems, and macroalgae could be damaged during anchor deployment. Similarly, equipment deployed on the seafloor, riverbed, or lakebed (e.g., video cameras or benthic fauna trapping devices) would directly impact biological resources that may occur in the area of deployment. Because vessel operation and associated research equipment deployment for projects funded under the S-K Program are low-intensity in nature (e.g., lowering and lifting equipment), affecting biological resources within discrete areas, the duration of direct impacts on most resources would be short-term, and impacts would be localized and minor in nature. Such activities may result in the injury or mortality of sessile infauna and macroalgae if anchoring systems damage biological resources. The small footprint of most instruments would limit direct impacts to minor levels. However, the physical placement of equipment on the seafloor, the direct contact with sessile benthic organisms by the gear itself, and the possible deterioration of research materials that subsequently land on the bottom may lead to the smothering and mortality of some invertebrates and macroalgae. The transitory nature of most of these devices associated with the S-K Program, as well as the limited scope of each study with regards to the size of the region, is expected to result in minor effects on benthic resources. Under most circumstances, the use of gear testing and bycatch study equipment is intended to provide information that would be used to inform the conservation and management of species and habitats. Thus, equipment use may provide long-term, indirect beneficial effects on biological resources in the area subject to study.

Other sampling activities associated with the S-K Program may include the placement of recruitment lines, species collection (e.g., trap deployment) or tagging, or placement of transect lines, tape, and other markers. Use of such equipment and sampling methods would result in direct adverse effects on affected habitats. Most affected habitats would be occupied by invertebrates in the water column or both macroalgae and invertebrates in the benthic zone, and disturbance to these areas therefore may adversely affect these biological resources. Sampling activities may indirectly adversely affect invertebrates through behavioral disturbances caused by the instruments themselves, or more directly through contact of sessile benthic organisms (including some invertebrates) by the gear itself. In addition, sampling equipment could become marine debris, which could entangle or be ingested by benthic invertebrates resulting in injury or mortality. The transitory nature of these devices, as well as the limited scope of each project funded under the S-K Program regarding the size of the project area and duration, is expected to result in minor, direct, adverse effects on a localized scale.

Fish (T&E Species, Critical Habitats, and EFH)

Gear testing, bycatch reduction, and processing projects that target a specific organism or fishery and require the use of aquatic vessels for in-water observation or access, tagging, collection (e.g., hook and line, trawling), and sampling that requires handling (e.g., genetic tissue sampling, sexing, sizing) have the potential for direct, short-term, adverse impacts on fish resources, including T&E species, critical habitats, and EFH similar to the Research and Monitoring project type (Section 4.5.2, Research and Monitoring). Fish resources in the affected areas would be temporarily displaced, and behaviors may be temporarily altered due to the presence of researchers or equipment. Specific impacts on fish resources are discussed below.

The use of gear testing and bycatch equipment that is anchored to the benthic environment would cause no disturbance to mobile fish, including T&E species. However, if the equipment emits noise (e.g., video camera, small-scale drilling for anchor installation), it could alter behaviors (foraging, predator avoidance, migration) for the duration of the activity and temporarily displace fish from occupied habitats. Because

this equipment is placed temporarily and affects a small area (typically no more than 10 square feet), such activities are expected to result in direct adverse effects that are minor in intensity, in a localized area. Effects are also expected to be similar to those previously described for research and monitoring projects (Section 4.5.2, Research and Monitoring) and would be short-term, given the limited duration of projects funded under the S-K Program, and direct effects are generally expected to occur only during project activities.

Other sampling activities may indirectly, adversely affect fish through behavioral disturbances caused by the instruments themselves, or more directly through contact of fish by the gear. Research activities that involve sampling gear deployment or capture, collection, and tagging, individual fish could be subject to behavioral modifications and harmed or killed. In addition, sampling equipment could become marine debris, which could entangle or be ingested by fish resulting in injury or mortality. For non-target species or fisheries, many of the gear testing and bycatch reduction projects are designed to evaluate deterrence methods (e.g., alternative/decoy baits, lights, acoustic devices, other deterrent devices), which would benefit non-target fish species in the long term. However, long-term benefits to target species from implementation of these projects are speculative in nature and are not included in the analysis of effects of the S-K Program. Overall, the transitory nature of these devices, as well as the limited scope of each study with regards to the size of the region, is expected to result in minor, adverse direct and indirect effects.

Similar to the Research and Monitoring project type (Section 4.5.2, Research and Monitoring), the operation of vessels for gear testing and bycatch reduction may result in minor, adverse, and direct impacts on fish from disturbance associated with noise and anchoring, and from unintentional striking or groundings, depending on the location and presence of fish resources in proximity to the vessel,. In addition, individuals or groups of fish could be displaced or disturbed by elevated underwater noise levels associated with vessel use. Although the use of anchors, monitoring equipment, or unintentional striking would have direct adverse impacts on fish resources, effects would be minor in intensity over the short term because activities would be localized to the general area of specific research activities and confined to the period of the project activities under the S-K Program. The mobility of most life stages of fish, including T&E species, also limits impacts.

Protected Species (Sea Turtles, Marine Mammals, and Marine Birds)

Gear testing, bycatch reduction, and processing projects that target a specific organism or fishery and require the use of aquatic vessels for in-water observation or access, tagging, collection (e.g., hook and line, trawling), and sampling that requires handling (e.g., genetic tissue sampling, sexing, sizing) have the potential for direct, short-term, adverse impacts on sea turtles and marine mammals. Sampling activities targeting fish or shellfish (e.g., routine monitoring and evaluation related to bycatch assessments, fish/shellfish handling methods) include but are not limited to the placement of transect lines and quadrats, placement of anchors or cables, trawling for data collection, and collection and tagging of fish. S-K Program funded projects may include various sampling operations associated with non-target species that may directly or indirectly impact marine mammals and sea turtles (e.g., testing exclusion devices, alternate bottom trawls). These activities would have impacts similar to those described in the Research and Monitoring project type (Section 4.5.2, Research and Monitoring). These projects could also improve deterrence, exclusion, and avoidance methods and equipment for protected species (e.g., development of specialized turtle excluder devices), resulting in long-term benefits. Specific impacts on protected species—including sea turtles, marine mammals, and marine birds—are discussed below.

S-K Program funded projects that include shore-based or nearshore fieldwork (e.g., intertidal surveys, research at existing shellfish aquaculture facilities) may have direct, adverse impacts on hauled-out marine mammals or nesting sea turtles and marine birds. If researchers enter the intertidal area when marine mammals, sea turtles, or marine birds are present, short-term direct disturbance of these protected resources is possible via incidental displacement from the presence of personnel or use of equipment. Individuals in

the affected areas would be temporarily displaced, and behaviors may be temporarily altered (e.g., feeding, nesting) due to the presence of researchers or shore- or nearshore-based equipment. However, the effects of this disturbance are expected to be minimal, as any contact with the environment is localized and short-term in nature. Impacts and mitigation measures for shore-based or nearshore fieldwork related to gear testing and bycatch reduction projects would be similar to those described in Section 4.5.2, Research and Monitoring.

If anchors or other devices are installed using in-water drilling methods, compliance with the MMPA would be required. Impacts and mitigation measures for in-water drilling related to gear testing and bycatch reduction projects (e.g., underwater drilling machine to install anchors and testing of line rigidity for turtle exclusion from aquaculture facilities) would be similar to those described in Section 4.5.2, Research and Monitoring. Anchors or equipment anchored to the seafloor could cause minor disturbance of sea turtles and diving marine birds. If sea turtles are resting on the seafloor in the area of deployment, they would be displaced and temporarily disturbed by the presence of equipment and potential noise emission from the device.

Anchor placement could also directly impact marine mammals in the general vicinity of the activity. The use of anchors or other devices, and potential installation using in-water drilling methods, could displace individuals from the local area, causing them to abandon foraging or migratory activities. Under such circumstances, compliance with the MMPA would be required.

If gear testing and bycatch studies employ the use of nets, lines, or cables, marine mammals, sea turtles, and diving birds may become entangled. The use of anchors or gear testing/bycatch reduction survey equipment anchored to the seafloor could cause minor disturbance of sea turtles, diving marine birds, and marine mammals in the local area. In addition, research, monitoring, and sampling equipment could become marine debris, which could entangle or be ingested by protected species resulting in injury or mortality. The potential for this impact would be minimized by the limited duration of operations and the fact that equipment would be attended by researchers during S-K Program funded projects. These direct, adverse impacts are expected to be short-term and localized and are therefore considered to be minor. NOAA expects that actions with the potential for entanglement are rare and that all such research would include monitoring for and rectification of such impacts.

Projects funded under the S-K Program may include various sampling operations associated with non-target species that may directly or indirectly impact marine mammals, sea turtles, and marine birds. Impacts and mitigation measures would be similar to those described in Section 4.5.2, Research and Monitoring. These adverse impacts are expected to be short-term and localized and are therefore considered to be minor.

The operation of vessels has the potential to result in adverse, minor to moderate direct and indirect impacts on marine mammals, sea turtles, and marine birds similar to those described in Section 4.5.2, Research and Monitoring. Minor effects would occur if individuals are temporarily displaced or modify behaviors in response to vessel movement and underwater sound produced by engines. Moderate impacts, while unlikely, would primarily be attributed to vessel strikes. As reported by NMFS (2018), smaller vessels are typically faster, but have higher maneuverability and shallow draft compared to larger vessels. Smaller research vessels are less likely to collide with and injure protected species because they can change direction to avoid collisions and do not ride as low in the water. Therefore, operating a research vessel near protected species during other sampling activities can have short-term temporary effects on their behavior and presents a remote risk of the vessel striking the animal.

4.5.3.3 Social Environment

Recreation and Tourism

Similar to the Research and Monitoring project type (Section 4.5.2, Research and Monitoring), recreational uses may be adversely impacted by gear testing, bycatch reduction, and processing projects (e.g. seafloor, riverbed, or lakebed deployed equipment) if the equipment becomes entangled in recreational fishing or mooring lines. The potential for this direct, adverse impact on recreational or commercial fishing and recreation and tourism is expected to be short-term and localized and is therefore considered to be minor. Like the Research and Monitoring project type (Section 4.5.2, Research and Monitoring), gear testing and bycatch studies that occur in well-visited marine or freshwater areas may temporarily interfere with the conduct of commercial or recreational activities, but minor effects are expected because of the short-term and localized nature of activities.

Research vessels launched from and used in heavily visited recreational coastal or freshwater sites during peak recreational boating seasons may occasionally interfere with recreational and commercial boaters. However, these activities would result in minor impacts because of the short-term and localized nature of activities.

Cultural and Historic Resources

Similar to the Research and Monitoring project type (Section 4.5.2, Research and Monitoring), vessel operations, shore-based or nearshore-based research projects, the use of AUVs, ROVs, or aircraft, including drones, and SCUBA/snorkel operations, are unlikely to have a detectable effect on cultural resources due to the limited scope and short duration of these activities. As described in Section 4.5.2, Research and Monitoring, NOAA will follow Administrative Order 218-8 and utilize the NOAA tribal consultation handbook (NOAA 2013c) to coordinate with Indian Tribes, Alaska Native Corporations, and Native Hawaiian Organizations to minimize and reduce impacts to cultural and historic resources that are important to these groups. NOAA shall also utilize these same principles for coordinating with other non-U.S. local communities and traditional groups to minimize and reduce impacts to cultural and historical resources that are important to these groups. In addition to the general BMPs described in Section 4.5.2, Research and Monitoring, that will be used to avoid and/or minimize effects to cultural and historic resources during gear testing, bycatch reduction, and processing study activities, S-K funded projects would have to meet any applicable requirements under the NHPA. Overall, gear testing, bycatch reduction, and processing study projects funded under the S-K Program could result in minor, direct, adverse impacts on cultural and historic resources. The duration of impacts on most resources would be short-term, and impacts would be localized, and minor in nature.

Socioeconomics

Gear testing, bycatch reduction, and processing projects may have a variety of social and economic impacts, directly on grantees and the communities where projects take place as well as indirectly on other sectors of the economy or other communities. All projects funded under the program would have some positive economic impacts. The degree of economic impacts depends on the amount of grant funding and what the funds are used for over the course of the project, since different allocations to labor, equipment, and supplies will stimulate different sectors of the economy and drive different changes in final demand for goods and services, employment, and earnings. Here, we estimate the degree of economic impacts by using budget information for past projects as an indicator of what impacts similar projects may have in the future. Specifically, by categorizing budgeted expenditures, we are able to quantify total direct and indirect economic impacts using a regional input-output modeling approach. Gear testing, bycatch reduction, and processing studies was identified as a secondary and tertiary project type for a number of projects (Figure

1-2); however, the analysis in this section includes only projects for which gear testing, bycatch reduction, and processing studies was the primary project type.

On average, the total project budget was approximately $299,649 after accounting for inflation ($2021). Budget analysis of these types of projects found that, overall, the largest share of the project budget (including any in-kind contributions, or match) was allocated to subcontracts, followed by salaries and fringe benefits, and "other" costs, including tuition and fees, equipment (capitalized costs in excess of $5,000), other goods and services (like shipping), and construction costs (Figure D-5). Equipment costs account for the majority of these costs; some projects reported costs of up to $360,000 or 90 percent of the total budget for equipment such as specialized harvesting gear and lab or processing machinery. The remainder of costs went to overhead costs (facilities and administrative costs), travel costs, and supplies. Grantees for projects in this category were primarily universities, non-governmental organizations, private research institutions, and seafood and aquaculture companies. Subcontracts were primarily for private and university researchers; fishing, charter, or research vessels; and equipment engineers or gear construction. For more information see Appendix D.

After adjusting for inflation, the average total output effect of gear testing, bycatch reduction, and processing studies was $449,673. Output, or total business sales, is the total value of production, including the direct, indirect, and induced value of production. The total output effect for gear testing, bycatch reduction, and processing studies was $1.50 for each dollar of the total budget, where the average budget amount was $299,649, of which $42,354 was brought by grantees as matching funds. The average employment effect was 3.3, meaning that 3.3 total jobs are supported on average by each grant. This includes the number of jobs directly supported by the project in terms of annual salary (e.g., consultants or researchers), indirectly (e.g., jobs needed to produce supplies), and induced (such as jobs supported by how wages are spent on goods and services like groceries and rent). Employment estimates are generated by the model and are based on regional estimates by industry and do not represent the number of unique jobs affected by any given grant. Labor income effects include the total amount paid in salaries to the direct, indirect, and induced workers. The total labor income effect across all gear testing, bycatch reduction, and processing studies was $0.67 per dollar of the budget (Table 4-9).

Table 4-9. Gear Testing, Bycatch Reduction, and Processing Studies Project Type Summary IO Analysis Results ($2021)

Summary Category	Measure	Units	Amount
Total grant amount	Average per project	$ (2021)	$257,295
Total in applicant match	Average per Project	$ (2021)	$42,354
Total project amount	Average per project	$ (2021)	$299,649
Economic output effects	Average per project	$ (2021)	$449,673
Economic output effects	Dollars per project budget amount	$ (2021)	$1.50
Labor income effects	Average per project	$ (2021)	$199,301
Labor income effects	Dollars per project budget amount	$ (2021)	$0.67
Employment effects	Average per project	Number of jobs	3.28

The timing of socioeconomic impacts for these types of projects is likely to be consistent with the project timeline of 1 to 2 years, since most, if not all, project expenses will be incurred during the project period. Some indirect, longer-term socioeconomic beneficial impacts may occur, in particular where grant funds are used to purchase equipment or used for construction. Approximately one-third of gear testing, bycatch reduction, and processing projects reported equipment costs, and one project reported construction costs.

The geographical extent of impacts may vary between primarily localized to the site and extending beyond the project site, due largely to the number and nature of subcontracts on the project, as well as other project expenses. Some projects have large, specialized supply or equipment costs that may mean economic benefits flow to companies far away from the project site, where the product is manufactured. In addition, grantees may subcontract with specialized firms to assist with the project, and the firms may not necessarily be geographically located with the other grantees or at the project site (e.g., if there is a field or laboratory component of the work).

Overall, the magnitude of beneficial socioeconomic impacts is expected to be minor to moderate, as it is expected that projects of this type will induce a change in social or economic conditions for some individuals, groups, or businesses—largely the grantees themselves—but indirect benefits from grant funds will flow to a much larger network of businesses and the overall economy as a whole. Moderate impacts may be more likely to occur when grant funding flows to a small number of highly dependent recipients, in contrast to large cross-organizational teams. The magnitude of these benefits may be more minor than estimated, however, since they must be compared to the benefits from what the funds would otherwise be used for (see discussion in Section 4.5.1.1, Social Environment).

4.5.3.4 Summary of Impacts on All Resources

A majority of gear testing, bycatch reduction, and processing projects funded under the S-K Program are expected to fall within the scope of the analysis of this PEIS; however, projects (or portions of projects) may be excluded from complete NEPA coverage under this PEIS when their impacts exceed levels greater than described in Section 4.5, Environmental Consequences of the Proposed Action, or are not commensurate with the effects described herein. Projects may also be excluded based on criteria for exclusion (Table 1-1). For most resources, the S-K Program projects within the gear testing, bycatch reduction, and processing project type may result in minor effects (Table 4-10).

Table 4-10. Summary of Impacts from Gear Testing, Bycatch Reduction, and Processing Projects

Environment	Resource	Type	Duration	Geographic Extent	Magnitude	Quality
Physical	Offshore, Nearshore, and Freshwater	Direct	Short-term	Localized	Minor	Adverse
Physical	Offshore, Nearshore, and Freshwater	Indirect	Long-term	Beyond the Project Site	Minor	Beneficial
Physical	Water Quality	Direct	Short-term	Localized	Minor	Adverse
Physical	Water Quality	Indirect	Long-term	Beyond the Project Site	Minor	Beneficial
Biological	Benthic Organisms	Direct	Short-term	Localized	Minor	Adverse
Biological	Benthic Organisms	Indirect	Long-term	Beyond the Project Site	Minor	Beneficial
Biological	Fish	Direct	Short-term	Localized	Minor	Adverse
Biological	Fish	Indirect	Long-term	Beyond the Project Site	Minor	Beneficial
Biological	Protected Species	Direct	Short-term	Localized	Minor	Adverse
Biological	Protected Species	Indirect	Long-term	Beyond the Project Site	Minor	Beneficial
Social	Recreation and Tourism	Direct	Short-term	Localized	Minor	Adverse
Social	Recreation and Tourism	Indirect	Long-term	Beyond the Project Site	Minor	Beneficial

Environment	Resource	Type	Duration	Geographic Extent	Magnitude	Quality
Social	Cultural and Historic Resources	Direct	Short-term	Localized	Minor	Adverse
Social	Cultural and Historic Resources	Indirect	Long-term	Beyond the Project Site	Minor	Beneficial
Social	Socioeconomic	Direct	Short-term	Localized	Minor to Moderate	Beneficial
Social	Socioeconomic	Indirect	Long-term	Beyond the Project Site	Minor to Moderate	Beneficial

4.5.4 Aquaculture

Aquaculture projects may include, but are not limited to, laboratory and field-based research on finfish, shellfish, algae, and other economically important species, and aquaculture habitat assessments (see Section 2.2.2.4, Aquaculture). Many of the aquaculture projects are conducted using methods and techniques identical or similar to those that have been previously described under the Research and Monitoring project type, and thus cross-references are made to applicable sections under Section 4.5.2, Research and Monitoring.

Aquaculture projects funded under the S-K Program, or projects consistent with the scope of the S-K Program, that take place in field settings have the potential to directly impact resources of the physical and biological environments (Table 2-4). In the field, aquaculture projects funded under the S-K Program typically implement studies at existing aquaculture facilities. Projects funded under the S-K Program generally do not support long-term aquaculture operations, as they are funded for a specified period. In the office or laboratory setting, projects may analyze previously collected biological materials to assess health and evaluate toxin levels. Aquaculture projects may also include the analysis of data via computer-based programs and reporting.

As presented in Table 2-4, many of the methods and techniques associated with the implementation of aquaculture projects in the field setting are identical to those taking place under the Research and Monitoring project type. For example, the use of SCUBA divers, AUVs, and ROVs to characterize baseline conditions for areas that may be proposed for aquaculture studies would result in the same impacts on the physical, biological, and social environment and their associated resources as those presented previously for Research and Monitoring activities (see Section 4.5.2, Research and Monitoring). The following techniques would result in impacts similar to those previously assessed for the Research and Monitoring and/or Gear Testing, Bycatch Reduction, and Processing Studies project types:

- Using AUVs, ROVs, and SCUBA divers or snorkelers to assess habitats.
- Tagging fish or invertebrates for study.
- Collecting biological samples, including fish and shellfish for broodstock, by trap, hook and line, or other method.
- Conducting routine monitoring and evaluation related to developing aquaculture methods for existing/candidate species.
- Deploying and testing gear and monitoring equipment, including exclusion devices, at existing aquaculture facilities.

The methods and techniques for implementation of the Aquaculture project type that are unique to this project type and are therefore assessed in this section include:

- The physical presence of new, pilot aquaculture infrastructure and new pilot facility operations.
- Outplanting of laboratory reared shellfish at existing aquaculture facilities.
- Field-based testing of new feeds and therapeutants.[3]

The following sections analyze the effects of aquaculture projects on physical, biological, and social environments and associated resources. Examples of aquaculture projects are provided in Section 2.2.2.4, Aquaculture and past projects funded by the S-K Program that are categorized within this project type are identified in Appendix B. The analysis of effects is based upon the methods and techniques employed. Methods, techniques, and environments with potential impacts to associated resources for this project type are summarized in Table 4-11.

Table 4-11. Aquaculture Projects – Methods, Techniques, and Environments with Potential Impacts to Associated Resources

Action Setting	Methods	Techniques	Physical	Biological	Social
Office or laboratory	• Biological lab research • Desktop analysis • Interviews and surveys • Workshops, trainings, informational surveys	• Conduct laboratory and desktop analysis of previously collected water, animal, plant, benthic, or seafood samples to examine genetics or develop disease and toxin assays. • Manage, analyze, and synthesize data; develop and use databases. • Test prototypes within a laboratory. • Conduct computer modeling, GIS. • Develop and use computer-based tools.	X	X	X
Field (land, water, or underwater)	• Biological field research	• Use SCUBA divers, ROVs, or AUVs for survey and mapping of seafloor and freshwater benthic habitats. • Operation of vessels for research and monitoring. • Collect broodstock and specimens of shellfish, finfish, seaweed from wild populations and habitats. • Mark or tag finfishes or invertebrates using standard procedures and safeguards. • Collect fin/tissue clips or seaweed samples for genetic or laboratory analyses. • Outplant laboratory reared finfish, shellfish, crustaceans, algae, and other economically important species at existing aquaculture facilities.	X	X	X

[3] The testing and use of new therapeutants is typically first conducted in the laboratory environment. If shown to be effective and safe, testing may occur in the field. Impact analysis for this method, within this PEIS, is based on full-scale aquaculture. Any project funded under the S-K Program is expected to be small-scale and of limited duration (i.e., research projects would be undertaken within the timeframe allotted for funding). Small-scale, research-based projects that are of limited duration would have much less effects on biological resources.

Action Setting	Methods	Techniques	Physical	Biological	Social
		• Conduct field-based testing of new feeds and therapeutants. • Conduct routine monitoring and evaluation related to developing aquaculture methods for existing/candidate species.			

4.5.4.1 Physical Environment

Offshore, Nearshore, and Freshwater

Most aquaculture projects that are funded under the S-K Program are implemented in laboratory or field settings using similar techniques described previously for other project types. Therefore, impacts on the environments and associated resources from aquaculture projects conducted under the S-K Program would be similar to those previously described under Section 4.5.2.1, Physical Environment for the Research and Monitoring projects. In addition to those impacts previously described, aquaculture projects may involve the temporary use of modified rearing structures (e.g., net pens) and placement of new anchors or shellfish rearing infrastructure in the submerged substrate or shoreline locations. In addition, equipment could become marine debris, which could entangle or be ingested by organisms resulting in injury or mortality. These structures would be tested to determine utility and future implementation for projects that are not funded under the S-K Program. Similar to the use of anchoring devices described under Section 4.5.2.1, Physical Environment for the Research and Monitoring projects, the installation of such devices would disturb the seafloor, riverbed, or lakebed and temporarily degrade the physical environment and associated resources for the duration of the study.

Based on the analysis presented in Section 4.5.2.1, Physical Environment, the implementation of aquaculture projects would have direct, short-term, and adverse impacts on resources of the physical environment in the area where specific S-K Program funded projects would take place. Depending on the nature of such projects, however, if a project leads to future management decisions that improve aquaculture rearing conditions, it could result in long-term indirect benefits to resources of the physical environment that extend beyond the area where specific projects funded under the S-K Program would take place. Considering the short duration and limited footprint of each project, indirect, long-term adverse impacts on these resources are not expected to occur.

Water Quality

Aquaculture projects funded under the S-K Program may result in minor adverse impacts on water quality. The duration of direct impacts on most resources would be short-term, and impacts are localized and minor in nature. Specific project actions and potential impacts are discussed below. Long-term, beneficial impacts on water quality could be realized if aquaculture research funded under the S-K Program determines that improvements can be made to ongoing practices that may benefit water quality (e.g., improved feeds from aquaculture-based research or improved shellfish harvest collection methods).

The placement of aquaculture infrastructure may impact water quality at a localized scale by disturbing substrates and increasing localized suspended sediments. Depending on the aquaculture type, operations may include pilot programs that include the use of new feeds and the application of antibiotics, therapeutics, pesticides, and other chemicals. These activities may impact water quality and the surrounding biotic community through the release of unconsumed feeds to the surrounding waters and to benthic habitats in the vicinity of the finfish aquaculture facilities (Rust et al. 2014). Aquaculture projects can affect water quantity when groundwater from an aquifer is removed via a well or spring, or when surface water from a neighboring stream is removed for use in the hatchery facility. The use of surface water for aquaculture

projects may reduce instream flow, sometimes leading to substantial reduction in stream flow between the water intake and discharge structures. The species subject to cultivation would also produce waste products, including feces and urine, that would be released to the surrounding waters. Aquaculture projects can negatively affect water quality parameters. Water enters aquaculture facilities and receives various inputs (e.g., fish food, pharmaceuticals used for fish health) before returning as effluent to the natural environment. Effluent typically has elevated water temperature, ammonia, organic nitrogen, total phosphorus, biochemical oxygen demand, pH, and solids (WDE 1989; Kendra 1991). Nutrients discharged to natural waters from hatchery effluent may cause an increase in algal growth that may lead to increased fluctuations in dissolved oxygen and pH because of increased algal photosynthesis, respiration, and decay. Although this effect is adverse, the scale of pilot facilities associated with projects funded under the S-K Program would be relatively small and limited in number, given that few such projects have been funded under the S-K Program (e.g., two S-K Program projects 2010–2021). Therefore, direct adverse effects on water quality would be localized and temporary, lasting only for the duration of the pilot program. Overall, effects on water quality would be minor to moderate in nature. Considering the relatively small scale, short duration, and limited footprint of each S-K Program funded project, indirect, long-term adverse impacts on these resources are not expected to occur.

Field projects funded by the S-K Program may include studies to investigate new feeds or feeding technologies for a variety of reasons, including improved growth and survival of the target species or reduced impacts on localized water quality and fauna. Similarly, S-K Program funded aquaculture projects may test new therapeutant technologies to improve the health of the target species or localized rearing environment. Although these studies may ultimately benefit the target cultivar and associated fishery, if applicable, short-term impacts on water quality would occur. Depending on the nature of the subject feed or therapeutant being tested compared to existing feeding or treatment techniques, the short-term impacts could be beneficial or adverse.

4.5.4.2 Biological Environment

The biological environment includes SAV, including algae and macroalgae, benthic invertebrates, fish (including T&E species, critical habitat and EFH), and protected species including marine mammals, sea turtles, and marine birds. Expected impacts on these resources from aquaculture projects conducted under the S-K Program, or projects consistent with the scope of the S-K Program, are discussed below.

Submerged Aquatic Vegetation, Algae, Macroalgae, and Benthic Invertebrates

Because water moves freely between aquaculture facilities and the open marine environment, the operation of pilot aquaculture facilities that may be funded under the S-K Program has the potential to introduce infectious disease into habitats occupied by benthic biological resources, including invertebrates and bivalves. Disease is a complex process that involves a pathogen (a disease-causing agent such as virus, bacteria, or parasite), a susceptible host (fish or shellfish), a sufficient number or "dose" of pathogens to overcome the immune system of the aquatic animal to cause disease, and an aquatic environment that favors the pathogen and/or stresses the susceptible host. Wild and cultured aquatic animals are known to experience stress due to a variety of causes, such as higher than normal densities, and this may increase their susceptibility to infection. The following sections describe potential impacts on benthic organisms resulting from the rearing of cultured fish or other aquatic species under pilot programs, the use of therapeutants, and the outplanting of cultured species.

Infectious diseases in cultured fish or other aquatic species reared in S-K Program funded pilot aquaculture facilities may result in mortality and decreased efficiencies in production due to slowed or altered growth patterns. To prevent or control infectious disease events the primary tools used by culturists are biologics (vaccines), antimicrobials such as antibiotics, and external therapies such as drugs/chemicals that are

applied via the aqueous rearing environment of the animal. The use of therapeutants in the environment has the potential to impact the growth and health of non-target benthic organisms. However, the use of many of these drugs for offshore aquaculture reportedly is declining, as vaccines eliminate the need to treat bacterial diseases with antibiotics and other drugs. Examples include salmon farming in Norway, where antibiotic use has decreased by 95 percent, and in Maine, where antibiotics are now rarely used (CRS 2019). The Food and Drug Administration (FDA) is responsible for approving drugs used in aquaculture, which must be shown to be safe and effective for a specific use in a specific species. Only drugs approved by the FDA Center for Veterinary Medicine may be administered to aquatic animals. The U.S. Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS) is responsible for controlling the spread of infectious diseases and requires an import permit and health certificate for certain fish species.

Over the last two decades a number of measures have been developed to effectively control bacterial diseases in farmed fish (NMFS 2019). These include vaccines, probiotics, limiting culture density, high-quality diets, and, when appropriate, judicious use of antibiotics. Antibiotics are considered a method of last resort, and their use has decreased drastically both in the United States and worldwide (NMFS 2019).

Aquaculture projects funded under the S-K Program that involve the outplanting of a small number of laboratory-reared shellfish at commercial aquaculture farms or leases may directly, adversely impact SAV, algae, macroalgae, and benthic invertebrates because of disturbance from researchers and the use of in-water equipment. Because the outplanting research conducted under the S-K Program is generally small-scale, uses the same gear as that permitted for use on the existing farm or lease area, and does not expand the footprint of the commercial farm or lease, impacts on local invertebrates, bivalves, and macroalgae would be temporary and minor. Because these projects outplant only shellfish that are disease-free and native or naturalized to the local environment, long-term impacts would not occur from disease transmission or the introduction of invasive species that may compete with native shellfish for resources. For naturalized outplants, researchers may also outplant sterile shellfish to ensure that they do not hybridize with native populations and persist in the wild, competing for resources and reducing the genetic integrity of wild species. Biosecurity measures would be implemented to reduce the potential introduction of invasive species. These measures would include cleaning and drying of lines and equipment prior to use, and following protocols established under the National Aquatic Animal Health Plan (NAAHP), as described below.

The testing and use of new therapeutants would typically be conducted first in the laboratory environment. If shown to be effective and safe, testing may occur in the field. Although therapeutant testing in the field would typically impact only those organisms that are subject to injection and drug application, therapeutants in fish effluent and uneaten food may pass through nets, settle to the seafloor, and potentially impact resident organisms. These therapeutant residues may persist in sediments below pens for a period; however, there is no indication that these residues have had long-term negative impacts on the environment. Globally, the use of vaccines to prevent bacterial diseases has reduced the use of antibiotics in marine farming by 95 percent (NOAA 2009b). Other types of drugs applied to fish are compounds to kill parasites. Sometimes these compounds are applied in the feed, while in others they are applied as a bath to kill external parasites or bacteria on the skin of the fish. Like antimicrobials, use of these compounds depends on approval by the FDA or the EPA (EPA is the lead federal agency if the compound is a pesticide and not a drug) and must be effective, safe for the host, safe for humans, and safe for the environment.

The potential use of therapeutants to control pathogens under any aquaculture project funded under the S-K Program, including antimicrobial and parasiticide therapy, may be reduced by the implementation of effective biosecurity measures (USDA APHIS 2021). Biosecurity, or risk mitigation, refers to practices that protect against infection by pathogens or other harmful agents and includes such measures as standard cleaning and disinfection of all equipment, and mandatory disease testing and reporting for early pathogen detection. In 2008 APHIS, NMFS, and USFWS released the NAAHP, which created a federal co-competency task force between these agencies to implement the recommendations in the NAAHP. These

recommendations were designed to facilitate aquatic animal movement (both interstate and international), protect the health of farm-raised and wild aquatic animals, ensure the availability of diagnostic and certification services, and minimize the impacts of disease events. In 2021, APHIS released the National Aquaculture Health Plan and Standards (NAHP&S), which replaced the NAAHP. The NAHP&S establishes guidance for national disease reporting, laboratory and testing standardization, surveillance, response, biosecurity, data management, and education and training. These actions are intended to support the overall health of the nation's aquaculture. The NAHP&S will be updated every 2 years by USDA in consultation with NMFS and the USFWS.

In accordance with the NAAHP, all aquaculture projects that include the outplanting of biota or the rearing of species, including the use of feed or therapeutants, will be required to review the plan and implement the following activities:

- Report notifiable pathogens of concern.
- Implement national biosecurity controls.
- Use strategies for national surveillance of aquatic animal pathogens.
- Plan for responses to a pathogen outbreak event.
- Manage data collected to support decisions and determinations on aquatic animal health to support national reporting to define zones or regions of pathogen presence or absence.
- Support the education of aquatic animal and aquaculture health professionals.
- Implement voluntary aquatic livestock health inspection.

Fish (T&E Species, Critical Habitats, and EFH)

The implementation of aquaculture projects—including the use of therapeutants, outplanting of cultured species, and research-based technologies—would impact fish, including T&E species and their habitat (e.g., critical habitat and EFH) in manners similar to those presented above for SAV, algae, macroalgae, and benthic invertebrates. As described previously, the use of therapeutants and the outplanting of biota would be implemented in accordance with the NAAHP. This would reduce the potential for negative effects on non-target fish and their habitats. In addition to the effects described above, which are also directly applicable to fish, including T&E species, aquaculture projects that target a specific organism or fishery and require the use of vessels for in-water observation or access, tagging, collection (e.g., hook and line, trawling), and sampling that requires handling (e.g., genetic tissue sampling, sexing, sizing) have the potential for direct, short-term, adverse impacts on fish. Aquaculture-based research may involve the use of modified rearing structures and placement of new anchors in the substrate or shoreline areas. Such installation could temporarily displace fish from the presence of new infrastructure, operation of vessels, and presence of researchers. In addition, equipment could become marine debris, which could entangle or be ingested by fish resulting in injury or mortality. The disturbance would be temporary, and direct, minor adverse impacts are expected to be localized and short-term.

In marine or freshwater settings, cultured fish from S-K Program funded pilot facilities may be exposed to existing pathogens from the surrounding open waters following placement in net pens or similar holding facilities. Due to the relatively high fish densities that are typical in pens, it is possible for pathogens to spread through the captive population and multiply sufficiently to cause an outbreak of disease that may extend to non-target fish species in the environment. The trigger for these outbreaks may be alterations in environmental conditions (e.g., temperature), handling during aquaculture operations, or other factors. As reported by NOAA (2009a), diseases that have occurred in marine aquaculture in North America have not

been demonstrated as substantial vectors for the introduction of foreign or exotic diseases in wild fish. However, exotic diseases introduced by farmed aquatic animals have resulted in disease events in native wild animals and other farmed animals, possibly due to doses that are insufficient to initiate infections in healthy wild or farmed fish, as in the case of *G. salaris* in Norway and white spot syndrome virus in shrimp in South America (Rose et al. 1989; NOAA 2009b).

NOAA (2009a) suggests that the risk of transfer of pathogens from farmed fish to wild fish is low as most infectious diseases can be prevented/managed at aquaculture facilities through the use of vaccines, which has significantly reduced the use of antibiotics in aquaculture (NOAA 2009b). As noted for benthic species, within the marine environment (e.g., finfish operations), water moves freely between farmed areas and the ocean, and disease risk flows both ways as both farm and wild populations have the potential to transmit disease and introduce pathogens and parasites (NOAA 2020b). Although sea lice shedding from salmon farms in some regions of the world appear to pose the most negative impact to wild fish populations, the mandatory implementation of lice management control programs appears to mitigate the impact to wild populations. Disease outbreaks occur in both wild and farmed fish but, except for sea lice, scant scientific data link disease episodes in wild populations to farmed fish. Sea lice control programs in Maine and Canada have demonstrated that aquaculture programs can significantly reduce infections on cultured fish to levels that eliminate the potential for significant disease on both cultured and wild fish. Such control programs would be a requirement for any pilot finfish programs funded under the S-K Program, and all researchers must obtain the appropriate state, federal, and local permits for aquaculture programs (NOAA 2009b). Further, fish health monitoring would be a requirement for all pilot aquaculture facilities, and severe infections must be treated with appropriate and approved therapeutants.

Another potential mechanism by which disease could be transferred to wild fish is through the escape of cultured fish from rearing pens. However, NOAA (2009a; 2020b) contends that the ability of such escapees to spread disease to wild fish is limited because many of the farmed fish quickly become easy victims of predators. Should escapees be carrying a disease agent (pathogen), the likelihood of their being the principal source of an outbreak in wild fish is remote because (1) any pathogens they carry are likely those to which the wild fish are routinely exposed and have developed natural immunity, (2) escapees are unlikely to generate enough infection pressure (dose) to result in disease in a healthy wild stock, and (3) environmental factors play a larger role in triggering a disease event than the presence of a pathogen (Amos and Appleby 2001; Amos and Olivier 2002). Further, many farmed fish are vaccinated against diseases prior to outplanting, which reduces potential disease transfer to wild fish (NOAA 2020b). The application of vaccinations and the use of national biosecurity measures and disease surveillance and reporting are several ways to minimize adverse impacts on wild populations in marine aquaculture (Mugimba et al. 2021).

Aquaculture projects funded under the S-K Program that involve the outplanting of a small number of laboratory-reared shellfish at commercial aquaculture farms or leases may directly, adversely impact fish through displacement and temporary behavioral disturbance caused by the presence of researchers and use of in-water equipment. Because the outplanting research conducted under the S-K Program is generally small-scale, uses the same gear as that permitted for use on the existing farm or lease area, and does not expand the footprint of the commercial farm or lease, minor impacts on local fish would be temporary. Further, because these projects outplant only shellfish that are disease-free, the spread of disease to prey resources for fish is unlikely.

Prior to undertaking or funding a site-specific action, project staff would determine if any areas of EFH are within the area where the specific project funded under the S-K Program would take place and initiate consultations with NMFS if the action “may adversely affect” EFH.

Protected Species (Sea Turtles, Marine Mammals, and Marine Birds)

Aquaculture projects that target a specific organism or fishery and require the use of aquatic vessels for in-water observation or access, tagging, collection (e.g., collect broodstock and specimens of shellfish, finfish, seaweed from wild populations and habitats), and sampling that requires handling (e.g., genetic tissue sampling, sexing, sizing) have the potential for direct, short-term, adverse impacts on protected species. Aquaculture projects may involve the use of modified rearing structures and placement of new anchors in the substrate or shoreline area. Such installation could temporarily displace protected species from the presence of new infrastructure, operation of vessels, and presence of researchers. The disturbance would be temporary and direct, adverse impacts are expected to be localized, short-term, and minor.

The use of anchors or equipment anchored to the seafloor for pilot aquaculture facilities would cause minor disturbance of sea turtles and marine mammals in the local area. If sea turtles are resting in the area of deployment, they would be displaced and temporarily disturbed by the presence of equipment and potential noise emission from the device. If anchors or other devices are installed using in-water drilling methods, compliance with the ESA and MMPA would be required. Another possible adverse impact to marine mammals or sea turtles includes the potential for entanglement with a mooring cable for aquaculture equipment. In addition, equipment could become marine debris, which could entangle or be ingested by protected species resulting in injury or mortality. These direct, adverse impacts are expected to be short-term and localized, and are therefore considered to be minor. NOAA expects that aquaculture actions with the potential for entanglement are rare, and that all such projects would include monitoring for and rectification of such impacts.

Projects funded under the S-K Program that involve the outplanting of a small number of laboratory-reared shellfish at commercial aquaculture farms or leases may directly, adversely impact protected species through displacement and temporary behavioral disturbance caused by the presence of researchers and use of in-water equipment. Because the outplanting research conducted under the S-K Program is generally small-scale, uses the same gear as that permitted for use on the existing farm or lease area, and does not expand the footprint of the commercial farm or lease, minor impacts on sea turtles, marine mammals, and marine birds would be temporary.

Field projects funded by the S-K Program under the Aquaculture project type may include studies to investigate new feeds or feeding technologies. Although protected species could therefore be exposed to water quality changes from effluent produced by cultivated species that consume new feeds, the limited number and small scale of these types of projects funded under the S-K Program would minimize both the quantity of effluent produced under individual projects and the duration of exposure to protected species. Further, if protected species were to prey upon fish or other aquatic species exposed to effluent from new feed, the likelihood of measurable impacts on individuals is low considering the limited size and duration of these research projects. As stated in previous sections, all S-K Program funded projects that involve the outplanting of biota, rearing of species, or use of feed or therapeutants would be implemented in accordance with the NAAHP and reviewed on a project-by-project basis. This will further minimize the potential for adverse impacts on protected species.

4.5.4.3 Social Environment

Recreation and Tourism

Aquaculture projects (e.g., developing pilot aquaculture facilities, field-based testing of new feeds/therapeutants) conducted in heavily visited recreational coastal or freshwater sites during peak recreational boating seasons may occasionally interfere with recreational uses. Specific impacts on recreation and tourism resources are discussed below.

Aquaculture projects may involve the use of modified rearing structures and placement of new anchors in the substrate or shoreline locations. Recreational uses may be directly impacted by deployed equipment if the instrument becomes entangled in recreational fishing or mooring lines. However, these effects are expected to be minor in nature, primarily because the action is short-term and localized.

Occasionally, outplanting of laboratory-reared finfish, shellfish, crustaceans, algae, and other economically important species at or near existing aquaculture facilities or locations may temporarily interfere with the conduct of commercial or recreational activities. However, such interference is expected to be minor in nature because each project funded under the S-K Program is implemented in the short-term, and typically impacts a localized area. Similarly, vessels used for aquaculture projects launched from and used in heavily visited recreational coastal or freshwater sites during peak recreational boating seasons may occasionally interfere with recreational and commercial boaters. However, these activities would result in minor, localized, and temporary direct impacts.

Cultural and Historic Resources

Similar to the Research and Monitoring project type (Section 4.5.2, Research and Monitoring), vessel operations, shore-based or nearshore-based research projects, the use of AUVs, ROVs, or aircraft, including drones, and SCUBA/snorkel operations are highly unlikely to have a detectable effect on cultural resources. Outplanting of laboratory-reared finfish, shellfish, crustaceans, algae, and other economically important species may occur at or near existing aquaculture facilities or locations. If these actions take place within culturally important areas to local tribes, direct, short-term, minor, adverse impacts could occur. However, it is expected that known cultural resources would be identified by appropriate experts (e.g., cultural or archeological) prior to fieldwork initiation, thus minimizing these impacts.

As described in Section 4.5.2, Research and Monitoring, NOAA will follow Administrative Order 218-8 and utilize the NOAA tribal consultation handbook (NOAA 2013c) to coordinate with Indian Tribes, Alaska Native Corporations, and Native Hawaiian Organizations to minimize and reduce impacts to cultural and historic resources that are important to these groups. NOAA shall also utilize these same principles for coordinating with other non-U.S. local communities and traditional groups to minimize and reduce impacts to cultural and historical resources that are important to these groups. In addition to the general BMPs described in Section 4.5.2, Research and Monitoring, that will be used to avoid and/or minimize effects to cultural and historic resources during aquaculture activities, S-K funded projects would have to meet any applicable requirements under the NHPA.

Socioeconomics

Aquaculture projects may have a variety of social and economic impacts, directly on grantees and the communities where projects take place as well as indirectly on other sectors of the economy or other communities. All projects funded under the program would have some positive economic impacts. The degree of economic impacts depends on the amount of grant funding and what the funds are used for over the course of the project, since different allocations to labor, equipment, and supplies will stimulate different sectors of the economy and drive different changes in final demand for goods and services, employment, and earnings. Here, we estimate the degree of economic impacts by using budget information for past projects as an indicator of what impacts similar projects may have in the future. Specifically, by categorizing budgeted expenditures, we are able to quantify total direct and indirect economic impacts using a regional input-output modeling approach. Aquaculture was identified as a secondary and tertiary project type for a number of projects (Figure 1-2); however, the analysis in this section includes only projects for which aquaculture was the primary project type.

On average, the mean total project budget was approximately $321,468 after accounting for inflation ($2021). Budget analysis of these types of projects found that overall, the largest share of the total project

budget (including any in-kind contributions, or match) was allocated to salaries and fringe benefits, followed by subcontracts, and overhead (facilities and administrative costs). The remainder of costs went to "other" costs, including equipment (capitalized costs in excess of $5,000), construction costs, tuition and fees, and other goods and services (including shipping), as well as supplies and travel costs. For more information see Appendix D. Grantees for projects in this category were primarily universities, non-governmental organizations, private research institutions, and aquaculture companies. Subcontracts were primarily for private and university researchers, fishing, aquaculture companies, and non-governmental organizations.

After adjusting for inflation, the average total output effect of aquaculture projects was $510,948. Output, or total business sales, is the total value of production, including the direct, indirect, and induced value of production. The total output effect for aquaculture projects was $1.59 for each dollar of the total budget, where the average budget amount was $321,468, of which $22,230 was brought by grantees as matching funds. The average employment effect was 4.7, meaning that 4.7 total jobs are supported on average by each grant. This includes the number of jobs directly supported by the project in terms of annual salary (e.g., consultants or researchers), indirectly (e.g., jobs needed to produce supplies), and induced (such as jobs supported by how wages are spent on goods and services like groceries and rent). Employment estimates are generated by the model and are based on regional estimates by industry and do not represent the number of unique jobs affected by any given grant. Labor income effects include the total amount paid in salaries to the direct, indirect, and induced workers. The total labor income effect across all aquaculture projects was $0.73 per dollar of the budget (Table 4-12).

Table 4-12. Aquaculture Project Type Summary IO Analysis Results ($2021)

Summary Category	Measure	Units	Amount
Total grant amount	Average per project	$ (2021)	$299,238
Total in applicant match	Average per Project	$ (2021)	$22,230
Total project amount	Average per project	$ (2021)	$321,468
Economic output effects	Average per project	$ (2021)	$510,948
Economic output effects	Dollars per project budget amount	$ (2021)	$1.59
Labor income effects	Average per project	$ (2021)	$234,831
Labor income effects	Dollars per project budget amount	$ (2021)	$0.73
Employment effects	Average per project	Number of jobs	4.68

The timing of socioeconomic impacts for these types of projects is likely to be consistent with the project timeline of 1 to 2 years, since most, if not all, project expenses will be incurred during the project period. Some indirect, longer-term socioeconomic beneficial impacts may occur, in particular where grant funds are used to purchase equipment or used for construction. Approximately one-quarter of aquaculture projects reported equipment costs, and one project reported construction costs.

The geographical extent of impacts may vary between primarily localized to the site and extending beyond the project site, due largely to the number and nature of subcontracts on the project, as well as other project expenses. Some projects have large, specialized supply or equipment costs that may mean economic benefits flow to companies far away from the project site, where the product is manufactured. In addition, grantees may subcontract with specialized firms, and the firms may not necessarily be geographically located with the other grantees or at the project site (e.g., if there is a field or lab component of the work).

Overall, the magnitude of beneficial socioeconomic impacts is expected to be minor to moderate, as it is expected that projects of this type will induce a change in social or economic conditions for some individuals, groups, or businesses—largely the grantees themselves—but indirect benefits from grant funds

will flow to a much larger network of businesses and the overall economy as a whole. Moderate impacts may be more likely to occur when grant funding flows to a small number of highly dependent recipients, in contrast to projects with large, cross-organizational teams. The magnitude of these benefits may be more minor than estimated, however, since they must be compared to the benefits from what the funds would otherwise be used for (see discussion in Section 4.5.1.1, Social Environment).

4.5.4.4 Summary of Impacts on All Resources

A majority of aquaculture projects funded under the S-K Program are expected to fall within the scope of the analysis of this PEIS; however, projects (or portions of projects) may be excluded from complete NEPA coverage under this PEIS when their impacts exceed levels described in Section 4.5, Environmental Consequences of the Proposed Action or are not commensurate with the effects described herein. Projects may also be excluded based on criteria for exclusion (Table 1-1). For most resources, the S-K Program projects within the aquaculture project type would result in minor effects (Table 4-13).

Table 4-13. Summary of Impacts from Aquaculture Projects

Environment	Resource	Type	Duration	Geographic Extent	Magnitude	Quality
Physical	Offshore, Nearshore, and Freshwater	Direct	Short-term	Localized	Minor	Adverse
Physical	Offshore, Nearshore, and Freshwater	Indirect	Long-term	Beyond the Project Site	Minor	Beneficial
Physical	Water Quality	Direct	Short-term	Localized	Minor to Moderate	Adverse or Beneficial
Physical	Water Quality	Indirect	Long-term	Beyond the Project Site	Minor	Beneficial
Biological	Benthic Organisms	Direct	Short-term	Localized	Minor	Adverse
Biological	Benthic Organisms	Indirect	Long-term	Beyond the Project Site	Minor	Beneficial
Biological	Fish	Direct	Short-term	Localized	Minor	Adverse
Biological	Fish	Indirect	Long-term	Beyond the Project Site	Minor	Beneficial
Biological	Protected Species	Direct	Short-term	Localized	Minor	Adverse
Biological	Protected Species	Indirect	Long-term	Beyond the Project Site	Minor	Beneficial
Social	Recreation and Tourism	Direct	Short-term	Localized	Minor	Adverse
Social	Recreation and Tourism	Indirect	Long-term	Beyond the Project Site	Minor	Beneficial
Social	Cultural and Historic Resources	Direct	Short-term	Localized	Minor	Adverse
Social	Cultural and Historic Resources	Indirect	Long-term	Beyond the Project Site	Minor	Beneficial
Social	Socioeconomic	Direct	Short-term	Localized or	Minor to Moderate	Beneficial
Social	Socioeconomic	Indirect	Long-term	Beyond the Project Site	Minor to Moderate	Beneficial

4.5.5 Socioeconomic Research

Socioeconomic research projects typically take place within office or laboratory settings and have limited potential to impact physical and biological environments and their associated resources. Projects that provide socioeconomic research would impact socioeconomic resources but have limited impacts on the physical, biological, and other resources of the social environment.

The following sections analyze the effects of socioeconomic research projects on socioeconomic resources within the social environment. It is not anticipated that socioeconomic research projects would have measurable effects on the physical or biological environments, since the primary techniques are limited to office or laboratory settings, or field settings that do not include biological sampling techniques. Therefore, impacts on these resources are not discussed further for this project type. Although projects funded under this project type may recommend future actions or studies that may impact these resources, any such action would be subject to independent review under NEPA and other applicable statutes. The outcome of projects within this project type does not commit NOAA to a future action that could affect the environment. Examples of socioeconomic research projects are provided in Section 2.2.2.5, Socioeconomic Research, and past projects funded by the S-K Program that fall within this project type are identified in Appendix B. The analysis of effects is based upon the techniques employed. Methods, techniques, and environments with potential impacts to associated resources for this project type are summarized in Table 4-14.

Table 4-14. Socioeconomic Research Projects – Methods, Techniques, and Environments with Potential Impacts to Associated Resources

Action Setting	Methods	Techniques	Physical	Biological	Social
Office or laboratory	• Desktop analysis • Interviews and surveys • Workshops, trainings, informational surveys	• Manage, analyze, and synthesize data; develop and use databases. • Conduct computer modeling, GIS. • Develop and use computer-based tools. • Conduct surveys, interviews, legal and policy research via in-person surveys, or phone-, paper-, or web-based surveys			X
Field (land, water, or underwater)	• Interviews and surveys • Workshops, trainings, informational surveys	• Conduct social science interviews and other research methodologies in the field (on board fishing vessels, ports and harbors, seafood markets, restaurants). These activities will be limited to interviews, observations, polling, or other socially based activities.			X

4.5.5.1 Social Environment

Socioeconomic

Socioeconomic research projects may have a variety of social and economic impacts, directly on grantees and the communities where projects take place as well as indirectly on other sectors of the economy or other communities. All projects funded under the program would have some positive economic impacts. The degree of economic impacts depends on the amount of grant funding and what the funds are used for over the course of the project, since different allocations to labor, equipment, and supplies will stimulate different sectors of the economy and drive different changes in final demand for goods and services, employment, and earnings. Here, we estimate the degree of economic impacts by using budget information for past projects as an indicator of what impacts similar projects may have in the future. Specifically, by categorizing budgeted expenditures, we are able to quantify total direct and indirect economic impacts using

a regional input-output modeling approach. Socioeconomics was identified as a secondary and tertiary project type for a number of projects (Figure 1-2); however, the analysis in this section includes only projects for which socioeconomics was the primary project type.

On average, the mean total project budget was approximately $222,749 after accounting for inflation ($2021). Budget analysis of these types of projects found that overall, the largest share of the total project budget (including any in-kind contributions, or match) was allocated to salaries and fringe benefits, followed by subcontracts, and overhead (facilities and administrative costs). The remainder of costs went to "other" costs, including equipment (capitalized costs in excess of $5,000), construction costs, tuition and fees, and other goods and services (including shipping), as well as to supplies and travel costs. For more information, see Appendix D. Grantees for projects in this category were primarily universities and state agencies. Subcontracts were primarily for academic or private researchers and non-governmental organizations.

After adjusting for inflation, the average total output effect of socioeconomic research projects was $420,786. Output, or total business sales, is the total value of production, including the direct, indirect, and induced value of production. The total output effect of socioeconomic research projects was $1.89 for each dollar of the total budget, where the average budget amount was $222,749, of which $5,926 was brought by grantees as matching funds. The average employment effect was 3.4, meaning that 3.4 total jobs are supported on average by each grant. This includes the number of jobs directly supported by the project in terms of annual salary (e.g., consultants or researchers), indirectly (e.g., jobs needed to produce supplies), and induced (such as jobs supported by how wages are spent on goods and services like groceries and rent). Employment estimates are generated by the model and are based on regional estimates by industry and do not represent the number of unique jobs affected by any given grant. Labor income effects include the total amount paid in salaries to the direct, indirect, and induced workers. The total labor income effect across all socioeconomic research projects was $0.82 per dollar of the budget (Table 4-15).

Table 4-15. Socioeconomic Research Project Type Summary IO Analysis ($2021)

Summary Category	Measure	Units	Amount
Total grant amount	Average per project	$ (2021)	$216,823
Total in applicant match	Average per project	$ (2021)	$5,926
Total project amount	Average per project	$ (2021)	$222,749
Economic output effects	Average per project	$ (2021)	$420,786
Economic output effects	Dollars per project budget amount	$ (2021)	$1.89
Labor income effects	Average per project	$ (2021)	$181,602
Labor income effects	Dollars per project budget amount	$ (2021)	$0.82
Employment effects	Average per project	Number of jobs	3.39

The timing of socioeconomic impacts for socioeconomic research projects is likely to be consistent with the project timeline of 1 to 2 years, since most, if not all, project expenses will be incurred during the project period. Some indirect, longer-term socioeconomic beneficial impacts may occur, in particular where grant funds are used to purchase equipment or used for construction. Only one socioeconomic research project reported equipment costs, and no projects reported construction costs.

The geographical extent of impacts may vary between primarily localized to the site and extending beyond the project site, largely due to the number and nature of subcontracts on the project, as well as the other project expenses. Some projects have large, specialized supply or equipment costs that may mean economic benefits flow to companies far away from the project site, where the product is manufactured. In addition,

grantees may subcontract with specialized firms, and the firms may not necessarily be geographically located with the other grantees or at the project site, (e.g., if there is a field or lab component of the work).

Overall, the magnitude of beneficial socioeconomic impacts is expected to be minor to moderate, as it is expected that projects of this type will induce a change in social or economic conditions for some individuals, groups, or businesses—largely the grantees themselves—but indirect benefits from grant funds will flow to a much larger network of businesses and the overall economy as a whole. Moderate impacts may be more likely to occur when grant funding flows to a small number of highly dependent recipients, as opposed to large, cross-organizational teams. The magnitude of these benefits may be more minor than estimated, however, since they must be compared to the benefits from what the funds would otherwise be used for (see discussion in Section 4.5.1.1, Social Environment).

4.5.5.2 Summary of Impacts on All Resources

A majority of socioeconomic research projects funded under the S-K Program are expected to fall within the scope of the analysis of this PEIS; however, projects (or portions of projects) may be excluded from complete NEPA coverage under this PEIS when their impacts exceed levels described in Section 4.5, Environmental Consequences of the Proposed Action, or are not commensurate with the effects described herein. Projects may also be excluded based on criteria for exclusion (Table 1-1). For most resources, the S-K Program projects within the socioeconomic research project type would result in minor to moderate, beneficial effects (Table 4-16).

Table 4-16. Summary of Impacts from Socioeconomic Research Projects

Environment	Resource	Type	Duration	Geographic Extent	Magnitude	Quality
Social	Socioeconomic	Direct	Short-term	Localized	Minor to Moderate	Beneficial
Social	Socioeconomic	Indirect	Long-term	Beyond the Project Site	Minor to Moderate	Beneficial

4.5.6 Outreach, Education, and Planning

Outreach, education, and planning projects typically take place within office or laboratory settings and have limited potential to impact physical or biological environments and associated resources. Although projects funded under this activity type may recommend future actions or studies that may impact these resources, any such action would be subject to independent review under NEPA and other applicable statutes. The outcome of these projects does not commit NOAA to a future action that could affect the environment.

The following sections analyze the effects of outreach, education, and planning projects on socioeconomic resources within the social environment. It is not anticipated that outreach, education, and planning projects would have measurable effects on the physical or biological environments, since the primary techniques are limited to office or laboratory settings or field settings that do not include biological sampling techniques. Therefore, impacts on these resources are not discussed further for this project type. Although projects funded under this project type may recommend future actions or studies that may impact these resources, any such action would be subject to independent review under NEPA and other applicable statutes. The outcome of projects within this project type does not commit NOAA to a future action that could affect the environment. Examples of outreach, education, and planning projects are provided in Section 2.2.2.6, Outreach, Education, and Planning, and past projects funded by the S-K Program that are categorized within this project type are identified in Appendix B. The analysis of effects is based upon the

techniques employed. Methods, techniques, and environments with potential impacts to associated resources for this project type are summarized in Table 4-17.

Table 4-17. Outreach, Education, and Monitoring Projects – Methods, Techniques, and Environments with Potential Impacts to Associated Resources

Action Setting	Methods	Typical Techniques	Physical	Biological	Social
Office or laboratory	• Desktop analysis • Interviews and surveys • Workshops, trainings, informational surveys	• Convene meetings, workshops, conferences, trainings; engage in strategic planning exercises. • Develop and deliver presentations and briefings. • Develop permanent and semi-permanent learning displays and exhibits. • Develop written materials, brochures, 1-pagers, educational and outreach materials. • Develop websites, digital media and content, social media presence. • Provide support to establish cooperative endeavors, such as consortia, networks, business incubators, and/or inter-agency agreements or to apply for a permit.			X
Field (land, water, or underwater)	• Interviews and surveys • Workshops, trainings, informational surveys	• Use SCUBA, vessel, or other means to develop multi-media products and videos.			X

4.5.6.1 Social Environment

Socioeconomic

Outreach, education, and planning projects may have a variety of social and economic impacts, directly on grantees and the communities where projects take place as well as indirectly on other sectors of the economy or other communities. All projects funded under the program would have some positive economic impacts. The degree of economic impacts depends on the amount of grant funding and what the funds are used for over the course of the project, since different allocations to labor, equipment, and supplies will stimulate different sectors of the economy and drive different changes in final demand for goods and services, employment, and earnings. Here, we estimate the degree of economic impacts by using budget information for past projects as an indicator of what impacts similar projects may have in the future. Specifically, by categorizing budgeted expenditures, we are able to quantify total direct and indirect economic impacts using a regional input-output modeling approach. Outreach, education, and planning was identified as a secondary and tertiary project type for a number of projects (Figure 1-2); however, the analysis in this section includes only projects for which outreach, education, and planning was the primary project type.

On average, the mean total project budget was approximately $255,576 after accounting for inflation ($2021). Budget analysis of these types of projects found that overall, the largest share of the total project budget (including any in-kind contributions, or match) was allocated to salaries and fringe benefits, followed by subcontracts, and overhead (facilities and administrative costs). The remainder of costs went to “other” costs, including equipment (capitalized costs in excess of $5,000), tuition and fees, construction costs, and other goods and services (including shipping), as well as supplies and travel costs. See Appendix

D for more information. Grantees for projects in this category were diverse, spanning non-governmental organizations, seafood and aquaculture companies, consulting firms, and universities. Subcontracts were primarily for research consultants and academic institutions.

After adjusting for inflation, the average total output effect of outreach, education, and planning projects was $395,559. Output, or total business sales, is the total value of production, including the direct, indirect, and induced value of production. The total output effect of outreach, education, and planning projects was $1.55 for each dollar of the total budget, where the average budget amount was $255,576, of which $13,589 was brought by grantees as matching funds. The average employment effect was 3.6, meaning that 3.6 total jobs are supported on average by each grant. This includes the number of jobs directly supported by the project in terms of annual salary (e.g., consultants or researchers), indirectly (e.g., jobs needed to produce supplies), and induced (such as jobs supported by how wages are spent on goods and services like groceries and rent). Employment estimates are generated by the model and are based on regional estimates by industry and do not represent the number of unique jobs affected by any given grant. Labor income effects include the total amount paid in salaries to the direct, indirect, and induced workers. The total labor income effect across all outreach, education, and planning projects was $0.76 per dollar of the budget (Table 4-18).

Table 4-18. Outreach, Education, and Planning Project Type Summary IO Analysis Results ($2021)

Summary Category	Measure	Units	Amount
Total grant amount	Average per project	$ (2021)	$255,576
Total in applicant match	Average per project	$ (2021)	$13,589
Total project amount	Average per project	$ (2021)	$241,987
Economic output effects	Average per project	$ (2021)	$395,559
Economic output effects	Dollars per project budget amount	$ (2021)	$1.55
Labor income effects	Average per project	$ (2021)	$193,456
Labor income effects	Dollars per project budget amount	$ (2021)	$0.76
Employment effects	Average per project	Number of jobs	3.64

The timing of socioeconomic impacts for this project type is likely to be consistent with the project timeline of 1 to 2 years, since most, if not all, project expenses will be incurred during the project period. Some indirect, longer-term socioeconomic beneficial impacts may occur, in particular where grant funds are used to purchase equipment or used for construction. Only one outreach, education, or planning project reported equipment costs, and no projects reported construction costs.

The geographical extent of impacts may vary between primarily localized to the site and extending beyond the project site, largely due to the number and nature of subcontracts on the project, as well as other project expenses. In addition, grantees may subcontract with specialized firms, and the firms may not necessarily be geographically located with the other grantees or at the project site (e.g., if there is a field or lab component of the work).

Overall, the magnitude of beneficial socioeconomic impacts is expected to be minor to moderate, as it is expected that projects of this type will induce a change in social or economic conditions for some individuals, groups, or businesses—largely the grantees themselves—but indirect benefits from grant funds will flow to a much larger network of businesses and the overall economy as a whole. Moderate impacts may be more likely to occur when grant funding flows to a small number of highly dependent recipients, as opposed to a larger cross-organizational team. The magnitude of these benefits may be more minor than estimated, however, since they must be compared to the benefits from what the funds would otherwise be used for (see discussion in Section 4.5.1.1, Social Environment).

4.5.6.2 Summary of Impacts on All Resources

A majority of outreach, education, and planning projects funded under the S-K Program are expected to fall within the scope of the analysis of this PEIS; however, projects (or portions of projects) may be excluded from complete NEPA coverage under this PEIS when their impacts exceed levels described in Section 4.5, Environmental Consequences of the Proposed Action, or are not commensurate with the effects described herein. Projects may also be excluded based on criteria for exclusion (Table 1-1). For most resources, the S-K Program projects within the outreach, education, and planning project type would result in minor to moderate, beneficial effects (Table 4-19).

Table 4-19. Summary of Impacts from Outreach, Education, and Planning

Environment	Resource	Type	Duration	Geographic Extent	Magnitude	Quality
Social	Socioeconomic	Direct	Short-term	Localized	Minor to Moderate	Beneficial
Social	Socioeconomic	Indirect	Long-term	Beyond the Project Site	Minor to Moderate	Beneficial

4.6 Cumulative Effects

To the extent reasonable and practical, this PEIS considers the combined incremental programmatic effects of the Proposed Action with the effects of other past, present, and reasonably foreseeable actions to common resources identified, regardless of what agency (federal or non-federal) undertakes such other actions. Past actions include those actions that have already occurred; present actions include those actions that are currently occurring; and reasonably foreseeable future actions are those that would be expected to occur in the future. Cumulative impacts can result from individually minor but collectively significant impacts from actions taking place over time. Cumulative impacts are important considerations for programmatic analyses because of the potential for additive effects from individual projects that may result in a cumulative effect to a resource in the area where a specific project funded under the S-K Program would take place. Analyzing cumulative effects at the programmatic level for this PEIS is also challenging, primarily because of the large geographic extent of the NOAA S-K Program, the diversity of S-K Program projects, and the future of program decisions.

The scope of the cumulative impact analysis for the NOAA S-K Program Proposed Action and alternatives involves both the geographic extent of the effects and the timeframe in which the effects could be expected to occur. When applying the concept of cumulative impacts to a programmatic analysis, additional consideration must be given to uncertainty associated with selection of specific future project locations. The implementation of S-K Program projects would occur throughout NOAA's five fisheries regions, and all specific project sites have not yet been identified. Furthermore, NOAA and/or its partners may use a wide range of existing, new, and developing technologies to implement S-K Program projects. Therefore, cumulative impacts are assessed qualitatively. Cumulative impacts of individual projects conducted under the S-K Program, as noted, will be assessed as necessary through project-level review.

4.6.1 Resources Affected

Chapter 3, Affected Environment, describes resources likely to be affected by the No Action Alternative and the Proposed Action. Based on an analysis of projects funded under the S-K Program from 2010 to 2021, the affected environment associated with the Proposed Action includes physical, biological, and social environments. Resources affected within each environment are as follows:

- Physical: Offshore, nearshore, freshwater; and water quality
- Biological: SAV, algae, and macroalgae; benthic invertebrates; fish; and protected species
- Social: Recreation and tourism; cultural and historic resources; and socioeconomics

Projects under the Seafood Promotion and Marketing; Socioeconomic Research; and Outreach, Education, and Planning S-K Program project types are not anticipated to have measurable impacts on resources of the physical or biological environments, but have the potential to impact resources of the social environment. Projects under the Research and Monitoring; Gear Testing, Bycatch Reduction, and Processing Studies; and Aquaculture S-K Program project types have the potential to impact resources of the physical, biological, and social environments. The S-K Program funded projects that impact resources of the physical and biological environments would be limited in the extent and duration of their effects, and these projects would include appropriate BMPs and/or mitigation measures (Section 2.2.3, Best Management Practices for All Project Types) to further reduce the already limited potential impacts. As reflected in previously prepared PEISs and PEAs, described in Section 4.3, Activities Addressed in Previous NEPA Assessments and Incorporated by Reference, and the analysis conducted in this PEIS, no significant impacts to environments and associated resources are anticipated as a result of implementing the Proposed Action. Taken together, these projects are not expected to result in significant adverse incremental cumulative impacts to the physical, biological, and social environments, because the long-term benefits essentially address the needs of fishing communities, optimize economic benefits by building and maintaining sustainable fisheries, and increase other opportunities to keep working waterfronts viable. The key factor for cumulative assessment is identifying any potential temporally and/or spatially overlapping or successive effects that may significantly affect resources occurring in the analysis areas (CEQ 1997; EPA 1999).

4.6.2 Geographic Boundaries and Timeframes

The spatial boundary includes those areas where S-K Program activities described in each alternative are likely to occur, which is within U.S. NOAA Fisheries regions' jurisdictions and priority international areas (Figure 1-1). Although highly migratory fish species may use areas beyond the jurisdictions, an analysis of cumulative impacts beyond these boundaries would be speculative and uninformative. Cumulative impact analyses in any subsequent tiered environmental reviews will address this potential at that more appropriate scale.

The duration of project implementation and useful project life, which can vary substantially depending on the specific details for each project, also contribute to an assessment of cumulative impacts. Historically, most S-K Program projects have been short-term in duration, lasting a maximum of 2 years. However, some S-K Program projects support parts of longer-term, larger-scale projects that have taken longer than 5 years to implement and have been supported by the S-K Program for consecutive years (e.g., Scale Up Production of a Complete Fish Feed and an Organic Fish Fertilizer from Fish Processing Waste for Sustainable Aquaculture and Agriculture in Hawaii and the Pacific Islands). These projects have a higher likelihood of resulting in cumulative impacts from other activities happening at the same time or location. Similarly, the effects of one project may persist during the implementation of another project, leading to a cumulative effect. Therefore, to account for the potential duration of cumulative effects from the implementation of an S-K Program funded project, the timeframe for analysis of cumulative impacts in this PEIS is 10 years.

4.6.3 Past, Present, and Reasonably Foreseeable Future Actions

Actions or groups of actions within the established geographic and timeframe (approximately 10 years) boundaries that are also programmatic in nature were considered. Additional small-scale activities may

exist that are not currently identified; however, these descriptions of actions provide the necessary information to fully understand the cumulative impacts that may occur.

Various impacts from other physical activities may occur at or near project sites, which may also have an additive effect on the Proposed Action. The present analysis considered the alternatives discussed in Chapter 2, Alternatives, and other programmatic-scale actions because analysis of specific actions for every potential project site or location is neither practical nor informative. Cumulative effects analysis of individual projects and other past, present, and reasonably foreseeable future actions relevant at the local level can be addressed as part of future specific NEPA reviews if needed. Project-specific analysis may be required depending on the site conditions, the type of deployment, or any other permits or permissions necessary to perform the work. Types of reasonably foreseeable future actions that may contribute negatively or positively to the natural or human environment in or proximate to a project site are described briefly below.

4.6.3.1 NOAA Restoration Projects

The NOAA Restoration Center has restored 15.8–39.7 km^2 (3,900–9,800 acres) of habitat per year since 2003. In 2016, the NOAA Restoration Center restored almost 809 km^2 (200,000 acres) of habitat and is expected to restore about 27 km^2 (6,600 acres) per year in the future. NOAA Restoration Center projects have been completed within all five NOAA fisheries regions (Figure 1-1), and a PEIS for the NOAA Restoration Center was completed in 2015 (NOAA 2015a). Cumulatively, these programs further benefit the affected environment by implementing coastal habitat restoration activities (e.g., fish passage, hydrologic/tidal reconnection, shellfish restoration, coral recovery, salt marsh and barrier island restoration) that are ecologically connected to the biological environment affected by S-K Program projects.

4.6.3.2 Other Activities Conducted by NOAA and Other Agencies

The affected environment overlaps with areas in which NOAA and other agencies conduct actions to restore habitats, conserve native species, monitor and map habitats and species, protect fish and wildlife, and protect humans from storms and flooding. State and local agency programs such as fish stocking, invasive species removal, land acquisition, and stormwater management actions result in small adverse effects over the short term but, when coupled with the objectives of the S-K Program, could benefit the physical, biological, or social environment over the long term. Cumulatively, these programs further benefit the affected environment by implementing conservation and restoration activities that focus on habitats and resources that are ecologically connected to the biological environment affected by S-K Program projects.

4.6.3.3 Land Development In and Near Affected Environment

U.S. coastal counties along the Atlantic and Pacific oceans or the Gulf of Mexico were home to about 29 percent of the total U.S. population in 2016 (U.S. Census Bureau 2019) and are concentrations of economic and social activity. Coastal landscapes will continue to be altered by redevelopment for tourism-related, residential, commercial, industrial, recreational, agricultural, and forestry purposes. Degradation or development of natural areas or disruption of natural processes through increased human activity would impact the affected area and specific project sites and resources during implementation of the Proposed Action; however, these impacts are not expected to measurably increase cumulative impacts.

4.6.3.4 Marine Transportation

Marine transportation accounts for more than 90 percent (by weight) of global trade and is responsible for widespread coastal pollution, vessel strikes to protected resources, seabird mortality, releases of invasive

species from ballast water, oil and chemical spills, garbage, underwater sound pollution, and sediment contamination of ports (Walker et al. 2019). These activities are ongoing and would occur regardless of the Proposed Action described in this PEIS. The Oil Pollution Act of 1990 (33 U.S.C. 2701-2761) created a comprehensive prevention, response, liability, and compensation regime to deal with vessel- and facility-caused oil pollution of U.S. navigable waters. The USCG is responsible for removing fuel, oil, and other hazardous materials from grounded vessels in marine waters. Degradation of natural areas or disruption of natural processes through increased human activity would impact the affected area and specific project sites and resources during implementation of the Proposed Action; however, these impacts are not expected to measurably increase cumulative impacts.

4.6.3.5 Marine Mineral Mining and Sand and Gravel Extraction

Sand and gravel are mined in some jurisdictional waters of the United States. The number of requests to the Bureau of Ocean Energy Management for sand from federal waters has increased because suitable resources in state waters are becoming depleted. Impacts from sand and gravel extraction activities may affect benthic resources, including physical and biological environments; however, these impacts are not expected to measurably increase cumulative impacts due to the localized and temporary nature of S-K Program projects.

4.6.3.6 Pollution

Point-source discharges of domestic, municipal, and industrial wastewater into freshwater and coastal waters (e.g., oil spills) of the United States and territories would be expected to continue unless/until actions or programs are undertaken to address the issue. Projects to reduce pollutant loading would improve the quality of water within the spatial boundary of S-K Program activities. These impacts are not expected to measurably increase cumulative impacts due to the localized and temporary nature of S-K Program projects.

4.6.3.7 Climate Change

For more than 200 years, since the beginning of the industrial revolution, the concentration of carbon dioxide (CO_2) in the atmosphere has increased due to the burning of fossil fuels and land use change (e.g., increased vehicular and power plant emissions and deforestation). The U.S. Global Change Research Program's National Climate Assessment indicates that the increase in human-caused carbon emissions influences ocean ecosystems through three main processes: ocean warming, acidification, and deoxygenation (USGCRP 2018). Global mean sea level is expected to rise over the 21st century (IPCC 2021).

Warming

Between 1900 and 2016, global ocean surface waters have warmed, on average, 0.7° ± 0.08°C (1.3° ± 0.14°F) per century, with more than 90 percent of the extra heat linked to carbon emissions being "contained" by the ocean. The warming of the ocean impacts sea levels, circulation and currents, productivity, and the functioning of entire ecosystems (USGCRP 2018). For example, higher global temperatures have led to the melting of glaciers and icecaps, which has caused sea levels to rise. Sea levels in the United States have risen up to 0.6 meters in the past century. As much as 4,921 km^2 of coastal wetlands have been lost in Louisiana alone during this period. The amount of future sea-level rise will depend on the expansion of ocean volume and the response of glaciers and polar ice sheets. A rise in sea level of up to 1.2 meters (4 feet) in this century has been predicted, but even another 0.6-meter (2-foot) rise would cause major loss of coastal wetlands (USGCRP 2009).

Acidification

The ocean absorbs about 30 percent of the CO_2 that is released in the atmosphere and as levels of atmospheric CO_2 increase, so do the levels in the ocean. When CO_2 is absorbed by seawater, a series of chemical reactions occur, resulting in the increased concentration of hydrogen ions. Acidity is measured as a function of the concentration of hydrogen ions (pH), so the increased concentration of hydrogen ions causes the seawater to be more acidic. A portion of the excess hydrogen ions react with carbonate (CO32-) ions to form bicarbonate (HCO3-), this causes carbonate ions to be relatively less abundant (Hardt and Safina 2008; NOAA 2013a). Carbonate (CO_3) ions are a critical component of calcium carbonate ($CaCO_3$), which many marine macroinvertebrates use to manufacture shells and exoskeletons. When the concentration of carbonate ions in ocean water is low enough, exposed $CaCO_3$ structures such as shells, exoskeletons, and coral skeletons are more difficult to build and maintain and can even begin to dissolve or disintegrate (NOAA 2013a; USGCRP 2018).

Deoxygenation

Increased CO_2 levels in the atmosphere are also causing a decline in ocean concentrations of DO. Ocean warming leads to deoxygenation because temperature has a direct influence on how much oxygen is soluble in water. Oxygen is less soluble in warmer waters; therefore, the concentration of DO is lower in waters that have been warmed by climate change. Deoxygenation can also occur from "oxygen demanding" pollutants entering the water, mostly from nitrogen and phosphorus nutrients associated with agricultural/fertilizer runoff (USGCRP 2018).

The three processes (warming, acidification, and deoxygenation) interact with one another and with other agents of environmental stress in the ocean environment, resulting in a wide array of cumulative impacts (USGCRP 2018). Impact-causing factors associated with climate change include changes to water characteristics (including temperature, acidity, and oxygen concentration), sea level rise, increased storm severity and frequency, and coastal erosion, all of which contribute to coastal infrastructure damage and the increased need to construct protective infrastructure such as barriers and seawalls (BOEM 2019). Climate change would likely contribute to cumulative impacts related to the physical, biological, and social environments described in Chapter 3, Affected Environment.

4.6.3.8 Aquaculture Development

Multiple PEISs have been developed to analyze the potential environmental impacts of federal aquaculture programs to support an environmentally sound and economically sustainable aquaculture industry in federal waters (NOAA 2009b, NOAA 2021c). In particular, the draft Programmatic Environmental Assessment for Funding Aquaculture Research and Development Projects analyzes the potential impacts of certain federal financial assistance awards to public and private entities for aquaculture research and development projects using existing grant programs (NOAA 2021a). Responsible aquaculture projects aim to provide safe, sustainable seafood (e.g., finfish, shellfish, crustaceans, algae, and other economically important species); create employment and business opportunities in coastal communities; and complement comprehensive strategies for maintaining healthy and productive marine populations, ecosystems, and vibrant coastal communities. However, adverse impacts to natural resources from these activities could be expected due to potential degradation of water quality and/or habitat, impacts to wild species due to genetics from escapements, exceedance of carrying capacity of a site, and use of public resources for private profit.

Over the past decade, while the amount of wild-caught seafood has remained relatively consistent from year to year, the amount raised through aquaculture has increased, though it is still less than 10 percent of the wild harvest by weight. National marine aquaculture production increased an average of 3.3 percent per year from 2009 to 2014 and in 2017, freshwater and marine aquaculture production was 284 million kilograms (626 million pounds) (NMFS 2020). Most marine aquaculture production consists of oysters,

clams, salmon, mussels, and shrimp. In addition to contributing to the seafood industry, aquaculture is also a tool to restore habitats and species. Hatchery stock is used to rebuild oyster reefs, grow wild fish populations, and rebuild T&E abalone and corals.

Federal aquaculture work is supported by mandates including agency aquaculture policies, Presidential Administration priorities, and legislative mandates that charge NOAA with ensuring that U.S. aquaculture develops sustainably, in concert with healthy, productive, and resilient coastal ecosystems (NOAA 2021a). In addition, the National Aquaculture Act of 1980 (Public Law 96-362. 94 Stat. 1198, 16 U.S.C. 2801, et seq.) establishes aquaculture as a national policy priority for the United States, and other federal financial assistance programs support NOAA's aquaculture initiatives. Continued aquaculture development would contribute to cumulative impacts related to physical environments including water quality; biological environments including aquatic macroinvertebrates; fish and EFH; protected species; and cultural and historic resources.

4.6.3.9 Commercial and Recreational Fishing

Commercial fishing is catching and selling fish and shellfish for profit, while recreational fishing is for sport or pleasure. The annual total landings, or poundage of fish, brought in by commercial fisheries has fluctuated between 4.3 and 4.4 billion kilograms (9.4 and 9.6 billion pounds) from 2011 to 2018. Alaska contributes the most to commercial fisheries, accounting for 58 percent of landings in 2018, followed by the Gulf of Mexico (16 percent), the Atlantic (14 percent), the Pacific (12 percent), and Hawaii and the Great Lakes (less than 1 percent each) (NMFS 2020).

Recreational fishing includes fishing from private/rental boats, party/charter boats, and onshore (e.g., a dock or the shore). In 2018, recreational fishermen took approximately 194 million saltwater fishing trips, with 55 percent in estuaries, 35 percent in state territorial seas, and 10 percent in the U.S. EEZ. Of the 163 million kilograms (359 million pounds) of harvested fish, the majority were from the Atlantic (60 percent) and the Gulf of Mexico (37 percent) (NMFS 2020). All saltwater recreational fishing together harvested about 1/30th the combined catch (by weight) of commercial fishing in 2018.

Commercial and recreational fishing activities directly impact fishery stocks and indirectly impact marine mammals and birds that prey and depend on fishery stocks. Additionally, commercial and recreational fishing contribute to overall vessel traffic in the action area and, therefore, the cumulative noise in the ocean. Over the 10-year project period, the amount of commercial and recreational fishing in the action area is expected to remain the same or increase. Impact-causing factors associated with commercial and recreational fishing include seafloor disturbance, dredging, vessel presence, vessel and equipment noise, impacts to the water column, potential accidental discharges, and air emissions (BOEM 2019). Commercial and recreational fishing would likely contribute to cumulative impacts related to physical environments; biological environments including aquatic macroinvertebrates, fish, EFH, and protected species; and cultural and historic resources.

4.6.4 Cumulative Impacts Analysis

Overall, the adverse impacts from any S-K Program funded projects, as discussed in earlier sections of Chapter 4, Environmental Consequences, are likely to be short-term and minor to moderate when they do occur. The S-K Program funded projects are intended to benefit the research and development of U.S. fisheries and contribute incrementally to long-term minor benefits to physical, biological, and social environments and associated resources. Because the S-K Program project implementation periods are short-term (2 years), and the beneficial impacts from a project are long-term, generally, the impact of the proposed program-wide activities would result in a net incremental benefit to physical, biological, and socioeconomic resources. When the effects from S-K Program funded projects are combined with the effects of other past,

present, and reasonably foreseeable future actions—including climate change, aquaculture development, and commercial and recreational fishing—the cumulative impact on physical, biological, and socioeconomic resources is expected to be minor. S-K Program funded projects are not expected to contribute substantially to cumulative impacts to the physical, biological, and social environments and associated resources when analyzed in combination with other past, present, and reasonably foreseeable future actions.

4.6.4.1 Physical Environment

Seafood promotion and marketing, socioeconomic research, and outreach, education, and planning projects typically take place in office or laboratory settings or outdoor field settings and have limited potential to impact resources within the physical environment (Sections 4.5.1, Seafood Promotion and Marketing, 4.5.5, Socioeconomic Research, and 4.5.6, Outreach, Education, and Planning). Research and monitoring, gear testing, bycatch reduction, and processing studies, and aquaculture projects have the potential to directly impact resources within the physical, biological, and social environments (Sections 4.5.2, Research and Monitoring, 4.5.3, Gear Testing, Bycatch Reduction, and Processing Studies, and 4.5.4, Aquaculture). S-K Program funded projects can temporarily create physical disturbance from human presence, and increased noise associated with implementation of research and monitoring projects that include the use of sampling devices, boats, buoys, or other appurtenances. Research or monitoring from shore or nearshore (e.g., intertidal surveys, research at existing shellfish aquaculture facilities) can affect habitats via incidental and unavoidable contact within the beach or intertidal area. Benthic disturbance may occur for projects that involve temporary buoy weights or moorings, or small buoys used for diving safety. Deployment of remote sensing equipment for research and monitoring, including AUVs, ROVs, and echosounders (i.e., sonar technology) from remote vehicles or tethered devices can disturb the water column and benthic habitats. The operation of vessels for research and monitoring may directly impact habitat resources from anchoring and from unintentional striking or groundings. Overall, the Proposed Action would have direct, short-term, and potentially adverse impacts on physical habitats in the area where a specific project funded under the S-K Program would take place (Table 4-5).

Rising sea levels, as a result of climate change, will continually erode coastlines along the U.S. EEZ and could further contribute to increased turbidity within these areas. High levels of sedimentation and turbidity can potentially cause direct respiratory damage to aquatic species and block sunlight necessary for photosynthesis by aquatic plants, macroalgae, and phytoplankton. Adverse impacts to natural resources from aquaculture development could degrade water quality and/or habitat or increase sedimentation and turbidity during construction and operation of aquaculture facilities. The presence and movement of commercial and recreational fishing vessels and deployment of fishing gear would cause an increase in sedimentation, turbidity, and the presence of chemical contaminants throughout marine, freshwater, and estuarine areas in the action area, reducing the availability of space, shelter, cover, and nutrients for dependent species. Overall, increased sedimentation and turbidity within the area where a specific project funded under the S-K Program would take place, would predominantly be dissipated by prevailing currents or winds in seconds to minutes. Temporary reductions in water quality are not expected to cumulatively reduce the availability of space, shelter/cover, nutrients, or breeding/rearing grounds in any of the habitat types found throughout the action area outside the range of natural variability.

Based on the analysis in this PEIS, overall, the minor incremental impacts to the resources within the Physical Environment resulting from S-K Program projects and projects consistent with the scope of the S-K Program (as described in Section 4.5, Environmental Consequences of the Proposed Action), when added to past, present, and reasonably foreseeable future actions (as described in Section 4.6, Cumulative Effects), are likely to have minor cumulative impacts to the resources within the Physical Environment.

4.6.4.2 Biological Environment

Seafood promotion and marketing, socioeconomic research, and outreach, education, and planning projects typically take place within office or laboratory settings or field settings and have limited potential to impact biological environments, such as SAV, algae, macroalgae, and benthic invertebrates, fish, and protected species (Sections 4.5.1, Seafood Promotion and Marketing, 4.5.5, Socioeconomic Research, and 4.5.6, Outreach, Education, and Planning). Research and monitoring, gear testing, bycatch reduction, and processing studies, and aquaculture projects directly impact physical and biological environments (Sections 4.5.2, Research and Monitoring, 4.5.3, Gear Testing, Bycatch Reduction, and Processing Studies, and 4.5.4, Aquaculture). Overall, adverse impacts from field-based project types funded under the S-K Program would be short-term and only minor to moderate. As most project sites are isolated from each other, cumulative short-term impacts from S-K Program project implementation are unlikely. On the other hand, because projects are addressing the purpose of the S-K Act, any future management decisions that benefit fisheries and coastal communities could lead to longer-term minor, moderate, or major beneficial impacts on the biological environment and associated resources, including protected resources and ecosystems of freshwater habitats and marine areas including the nearshore, offshore, and coastal United States identified as part of the affected environment in Section 3.2, Biological Environment.

Submerged Aquatic Vegetation, Algae, Macroalgae, and Benthic Invertebrates

S-K Program projects can disturb habitats and sessile invertebrates and macroalgae during fieldwork activities via incidental and unavoidable contact within the beach or intertidal area. Mobile invertebrates can be temporarily displaced, and behaviors can be temporarily altered. The operation of vessels can have adverse direct and indirect impacts on invertebrates and macroalgae from anchoring and from temporary displacement of mobile invertebrates from vessel movement. Equipment deployed by S-K Program project activities, such as anchors or instrumentation that focuses on biological data collection or monitoring, can improve the conservation and management of species and habitats in the long term, but can also temporarily disturb the benthic aquatic flora and fauna in the short term. The use of ROVs or AUVs for exploration and mapping of seafloor and freshwater benthic habitats may also impact local flora and fauna. Other S-K Program project sampling activities may indirectly, adversely affect invertebrates through behavioral disturbances caused by the instruments themselves, or more directly through contact of sessile benthic organisms (including some invertebrates) by the gear itself.

Changes in water temperature, acidity, and oxygen, as a result of climate change, could lower the overall nutrient availability or reduce the cover and structure available to dependent species from submerged vegetation or macroalgae. Increases in sedimentation and turbidity from increased storm severity and frequency may reduce the penetration of sunlight through the water column and alter the wavelengths of light reaching fish and benthic species. Aquaculture development could degrade water quality and/or benthic habitat or temporarily increase sedimentation and turbidity during construction and operation of aquaculture facilities. These impacts could lower the overall nutrient availability or reduce the cover and structure available to dependent species from submerged vegetation or macroalgae. The presence and movement of commercial and recreational fishing vessels and deployment of fishing gear would increase sedimentation and turbidity, reducing the availability of space, shelter, cover, and nutrients for benthic organisms.

Based on the analysis in this PEIS, overall, the minor incremental impacts on SAV, algae, macroalgae, and benthic invertebrates resulting from S-K Program projects and projects consistent with the scope of the S-K Program (as described in Section 4.5, Environmental Consequences of the Proposed Action), when added to past, present, and reasonably foreseeable future actions (as described in Section 4.6, Cumulative Effects) are likely to have minor cumulative impacts on SAV, algae, macroalgae, and benthic invertebrates.

Fish (T&E Species, Critical Habitat, EFH)

The activities under the Proposed Action that impact Fish (T&E Species, Critical Habitat, EFH) include physical impacts to benthic habitat (e.g., from anchoring, collection of bottom grab samples, and SCUBA operations); increase in sedimentation, turbidity, and/or chemical contaminants (e.g., from operation of sea-going vessels, operation of ROVs and AUVs, anchoring, collection of bottom grab samples, and SCUBA operations); increase in sound (e.g., from operation of crewed sea-going vessels; operation of ROVs, AUVs, and echosounders; and acoustic communication systems); and impacts to the water column (e.g., from operation of sea-going vessels, operation of ROVs and AUVs, anchoring, use of data collection equipment and bottom grab samplers, operation of drop/towed cameras and video systems, and SCUBA operations). Impacts to the water column expected from the Proposed Action would be caused by vessels or equipment moving through the water column in activities that include operation of crewed sea-going vessels; operation of ROVs, ASVs, and AUVs; anchoring; use of sound speed data collection equipment and bottom grab samplers; operation of drop/towed cameras and video systems; and SCUBA operations. These impacts would be temporary, mobile prey species would not likely move too far away, conditions would be expected to stabilize, and species would return once water column turbulence ceased.

Climate change may affect the physical environment in a variety of ways, including changes in sea level, changes in water temperatures, more frequent or extreme weather events, and alteration of ocean currents (NMFS 2015b). These changes and others are expected to continue over the reasonably foreseeable future and could aggregate with the effects of other cumulative actions to impact the physical water environment. These changes would in turn contribute to changes in the population and distribution of prey species such as fish and aquatic macroinvertebrates, and to changes in the population and distribution of fishery resources harvested in commercial fisheries, with related socioeconomic effects. In addition to changes in air and water temperatures, a related effect of climate change is increased acidification in the ocean caused by dissolved CO_2. Changes in the acidity of the world's oceans are expected to continue and accelerate over the reasonably foreseeable future. Ocean acidification can harm organisms that build shells of $CaCO_3$, including calcareous phytoplankton and zooplankton, corals, bryozoans, mollusks, and crustaceans. These organisms provide shellfish resources for humans, play vital roles in marine food webs, generate sand for beaches, and add to the physical structure of the ocean floor. Aquaculture development could impact wild species due to genetics from escapements and exceedance of carrying capacity of a site. Overfishing is the most serious threat that has led to the listing of ESA-protected marine fish due to mortality and population declines (Dulvy et al. 2003; Kappel 2005; Cheung et al. 2007; Limburg and Waldman 2009). Approximately 17 percent of the U.S.-managed fish stocks are overfished (NMFS 2018b). Overfishing impacts targeted species and non-targeted species (i.e., bycatch species) that often are prey for other fish and marine organisms.

Based on the analysis in this PEIS, overall, the minor incremental impacts on Fish (T&E Species, Critical Habitat, EFH) resulting from S-K Program projects and projects consistent with the scope of the S-K Program (as described in Section 4.5, Environmental Consequences of the Proposed Action), when added to past, present, and reasonably foreseeable future actions (as described in Section 4.6, Cumulative Effects), are likely to have minor cumulative impacts on Fish (T&E Species, Critical Habitat, EFH).

Protected Species (Sea Turtles, Marine Mammals, and Marine Birds)

Based on the analysis presented in Chapter 4, Environmental Consequences, the Proposed Action would result in minor impacts on protected species. The main effects from the Proposed Action that could impact protected species include those related to acoustic exposures from underwater acoustic sources (e.g., echosounders), entanglement, low potential for vessel strikes, and disturbance or behavioral modification (from acoustic exposures due to underwater acoustic sources, vessel noise and masking, presence and movement of vessels, and human activity). Disturbance and behavioral modifications of marine mammals are associated with underwater research, vessel and aircraft sound, and vessel and human presence. Noise

is of particular concern for marine mammals because many species use sound as a primary sense for navigating, finding prey, and communicating with other individuals. Overall, there would be localized disturbance and behavioral impacts due to vessel sound, vessel movement, and human presence within specific portions of the action area during S-K Program funded projects and activities. However, impacts are expected to be spatially localized and temporary or short-term in duration. Implementation of BMPs such as animal approach restrictions and low vessel speeds (see Section 2.2.3, Best Management Practices for All Project Types) are expected to minimize potential impacts on animal behavior. Other actions are unlikely to overlap in time and space with S-K Program funded projects because these activities are dispersed, and the sound sources are intermittent.

Habitat alteration is associated with reduced prey/food sources and degraded water quality due to climate change and other cumulative actions. Air and water pollution cannot have adverse impacts only on species themselves, as discussed above, but also on habitat as air and water quality are degraded. Increased emissions of anthropogenic GHG (CO_2, methane [CH_4], and nitrous oxide [N_2O]) are warming the atmosphere, and rising levels of CO_2 in particular are producing changes in seawater carbon chemistry. Climate change effects include changes in air and sea temperatures, precipitation, the frequency and intensity of storms, pH level of sea water, and sea level. These changes could affect overall marine productivity, leading to altered migratory routes and timing and changes in prey/food availability and reproductive success.

Reduced water quality would also displace finfish prey species from eroded areas and could potentially increase the foraging energy expenditures of marine birds. Changing climate conditions—such as rising surface water temperatures, shifting currents, and shifting wind patterns—will change the location and intensity of deep-water upwellings, an important source of oceanic nutrients. Prey distributions will likely shift along with oceanic nutrients, which could ultimately reduce the total amount of available prey if the bird dispersal rate is relatively lower than that of their prey. Seabirds are particularly susceptible to habitat reduction because their high levels of behavioral resilience and experience-based learning limit their ability to disperse to new areas and follow shifting prey distributions. Shifting prey distributions in response to changes in oceanic nutrient cycling could potentially impact the overall population of some seabird species that return to the same areas or islands to breed or forage annually. These birds have high levels of behavioral resilience and foraging specialization and would not likely be able to follow their original prey or adapt to include new species in their diet. Overfishing of many fish stocks has resulted in significant changes in trophic structure, species assemblages, and pathways of energy flow in marine ecosystems (Jackson et al. 2001; Myers and Worm 2003). These ecological changes may have adverse consequences for populations of protected species (DeMaster et al. 2001) as prey food sources are reduced.

Based on the analysis in this PEIS, overall, the minor incremental impacts on Protected Species (Sea Turtles, Marine Mammals, and Marine Birds) resulting from S-K Program projects and projects consistent with the scope of the S-K Program (as described in Section 4.5, Environmental Consequences of the Proposed Action), when added to past, present, and reasonably foreseeable future actions (as described in Section 4.6, Cumulative Effects), are likely to have minor cumulative impacts on Protected Species (Sea Turtles, Marine Mammals, and Marine Birds).

4.6.4.3 Social Environment

Recreation and Tourism

Shore-based or nearshore-based S-K Program activities (e.g., intertidal surveys, research vessel use, research at existing shellfish aquaculture facilities) conducted in heavily visited recreational coastal or freshwater sites during peak recreational boating seasons may occasionally interfere with recreational and

commercial uses. These activities would result in minor impacts because the activities associated with S-K Program funded projects would be temporary and localized.

Based on the analysis in this PEIS, overall, the minor incremental impacts on Recreation and Tourism resulting from S-K Program projects and projects consistent with the scope of the S-K Program (as described in Section 4.5, Environmental Consequences of the Proposed Action), when added to past, present, and reasonably foreseeable future actions (as described in Section 4.6, Cumulative Effects), are likely to have minor cumulative impacts on Recreation and Tourism.

Cultural and Historic Resources

Anchoring, bottom sampling, and other S-K Program funded activities that would disturb the sea floor under the Proposed Action would contribute to short-term adverse impacts associated with increases in the number of fishing vessels and boats anchoring in nearshore and/or freshwater environments. While the use of research equipment on seafloor, riverbed, or lakebed has the potential to impact submerged cultural resources, the limited scope and duration of projects funded under the S-K Program combined with the BMPs listed in Section 2.2.3, Best Management Practices for All Project Types, will minimize these effects. The inadvertent discovery of cultural and historic resources during implementation of field-based S-K Program project types would trigger reporting requirements and could ultimately benefit the resource by providing information on the previously unknown site.

Increasing water temperatures due to climate change can accelerate rusting in submerged resources, more rapid decay of organic materials, damage from increased biological activity at shallow underwater sites, and increased risk of damage due to decline and loss of protective sea grass or nearby coral reefs. Rising temperatures also lead to faster deterioration of newly exposed artifacts and sites. Ocean acidification will cause increased risk of damage to shipwrecks due to loss/decline of protective concretions and/or nearby coral reefs. It will also cause decline in reefs from coral bleaching. However, adverse impacts on cultural and historic resources from climate change would occur regardless of the Proposed Action.

Based on the analysis in this PEIS, overall, the minor incremental impacts on Cultural and Historic Resources resulting from S-K Program projects and projects consistent with the scope of the S-K Program (as described in Section 4.5, Environmental Consequences of the Proposed Action), when added to past, present, and reasonably foreseeable future actions (as described in Section 4.6, Cumulative Effects), are likely to have minor cumulative impacts on Cultural and Historic Resources.

Socioeconomics

S-K Program funded projects are expected to have minor to moderate beneficial impacts associated with increases in income, labor impacts, and induced impacts from grant-related spending. Impacts are likely to be generally minor but may be more moderately beneficial when the number of grantees is small or is dependent on grant funding.

Based on the analysis in this PEIS, overall, the minor incremental impacts to the resources within Socioeconomics resulting from S-K Program projects and projects consistent with the scope of the S-K Program (as described in Section 4.5, Environmental Consequences of the Proposed Action), when added to past, present, and reasonably foreseeable future actions (as described in Section 4.6, Cumulative Effects), are likely to have minor cumulative impacts to the resources within Socioeconomics.

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Appendix A: Saltonstall-Kennedy Program Award and Environmental Compliance Analysis Process

S-K Program Grants Award Process

The goal of the S-K Program is to address the needs of fishing communities in optimizing economic benefits by building and maintaining sustainable fisheries and practices, dealing with the impacts of conservation and management measures, and increasing other opportunities to keep working waterfronts viable. The S-K Program facilitates this goal by means of the annual Saltonstall-Kennedy Grant Competition through which NMFS awards grants in marine fishery projects ranging in funding from a minimum of $25,000 to a maximum of $300,000.

NMFS seeks applications that demonstrate direct benefits to the U.S. marine fishing and aquaculture industries. U.S. marine fisheries include any commercial fishery, recreational fishery, or aquaculture operation that is, or may be, engaged in by citizens or nationals of the United States or other eligible applicants. The competition is open to applicants from a variety of sectors, including individuals, industry, academia, and state and local governments.

The grant solicitation generally includes two separate submission processes. All interested applicants must submit a Pre-Proposal to a Notice of Funding Opportunity (NOFO). Applicants interested in submitting a full application after the pre-proposal review process then submit the full application through www.grants.gov.

All eligible full proposal applications undergo a technical review process. During this process, all proposals are evaluated and scored individually in accordance with the assigned weights of the evaluation criteria and any additional criteria published in the Saltonstall-Kennedy Notice of Funding Opportunity. Reviewers score each proposal according to the evaluation criteria to produce an overall score for the proposal. For those applications at or above the cutoff technical evaluation score, NMFS may solicit individual comments and evaluations from a panel or panels of three or more representatives selected by NOAA. Panel members will be chosen from the fishing industry, state government, non-government organizations, and others, as appropriate. The role of the panelist is to enhance the Agency's understanding of this select group of proposals received under the competition prior to recommendations for selections being made.

Process for Determining Required Level of NEPA Analysis

The process NOAA will implement to assess NEPA needs and ensure NEPA compliance will follow the established Grants Electronic Management System (GEMS) Workflow process. The GEMS process follows the requirements for NEPA documentation as established in the Department of Commerce Grants and Cooperative Agreements Manual and NOAA Administrative Order 216-6A: Compliance with the National Environmental Policy Act. A process to analyze project-specific impacts and create an administrative record for projects included under the PEIS analysis will be implemented by the NOAA S-K Program. To avoid duplication of effort, when other offices, divisions, and programs outside the S-K Program fund projects of similar scale and type as those described in the PEIS, they may choose to use the PEIS as the basis for their NEPA review, as appropriate, in accordance with the policies and procedures applicable to that office.

Documentation

Projects determined to meet the project and impact descriptions in this PEIS, and which need no further NEPA analysis, will be documented in the S-K Program Record. The S-K Program Record will include a checklist, a memorandum, and/or other electronic files for each project. Program Record documents will:

- Help determine whether the activities of a project and its actual impacts do or do not exceed those that are described in this PEIS, including any additional considerations for those complex project types that are most likely to fall outside the PEIS analysis, identified in Table 1-1.
- For projects that are not fully described, including those that will result in significant adverse impacts, the document informs the tiering process by bringing to the forefront those activities and impacts not covered by this PEIS.
- Record the total number of actions covered by this PEIS, which can be used to monitor the validity and currency of the analysis, ensuring an appropriate lifespan for the document.

The final format of the Program Record may be paper or electronic, and may contain checklists, memoranda, and/or spreadsheets and databases, but will include the following content.

- Identifying project information
- Other federal partners and their level of NEPA review
- Description of project and scope of activities for analysis
    - Project activity and site description
    - Is the full project being analyzed, or does the current analysis only cover the impact of planning and design, so that information can be gathered for a later full analysis?
- Project Impact Analysis
    - Core Questions- To be addressed in for all S-K Program projects
        - Are the activities to be carried out under this project fully described in Section 2.2.2, Project Types of the S-K Program PEIS? [A “No” response indicates a project falls outside the PEIS analysis.]
        - Are the impacts that are likely to result from this project fully described in Section 4.5, Environmental Consequences of the Proposed Action of the S-K Program PEIS?
            - Will the project have significant impacts? [A “Yes” response indicates a project falls outside the PEIS analysis.]
            - Does the level of adverse impact from the restoration activity exceed that described in Table 4-4, Table 4-7, Table 4-10, Table 4-13, Table 4-16, or Table 4-19 of the S-K Program PEIS (the appropriate table depends on project type)? [A “Yes” response indicates a project falls outside the PEIS analysis.]
        - Describe the project impacts to resources (including beneficial impacts) and any mitigating measures being implemented.
        - Describe any potential cumulative impacts that may result from past, present or reasonably foreseeable future actions (beneficial or negative).
        - Describe the opportunities for public outreach and/or comment that have taken place to this point. Are any future opportunities for public input anticipated?
        - Have any public comments raised issues of scientific controversy? Please describe.
        - Describe the most common positive and negative public comments on issues other than scientific controversy described above.
    - Supplemental Questions- To be addressed based on project type
        - Research and monitoring
            - Describe any expected lethal effects on target or incidentally caught species. How is it appropriate to the level of analysis presented in the S-K Program PEIS in Section 2.2.2.2, Research and Monitoring and Section 4.5.2, Research and Monitoring?

        - Describe the impacts to habitat. How is it appropriate to the level of analysis presented in the S-K Program PEIS in Section 2.2.2.2, Research and Monitoring and Section 4.5.2, Research and Monitoring?
    - Gear testing, bycatch reduction, and processing studies
        - Describe any expected lethal effects on target or incidentally caught species. How is it appropriate to the level of analysis presented in the S-K Program PEIS in Section 2.2.2.3, Gear Testing, Bycatch Reduction, and Processing Studies and Section 4.5.3, Gear Testing, Bycatch Reduction, and Processing Studies?
        - Describe the impacts to habitat. How is it appropriate to the level of analysis presented in the S-K Program PEIS in Section 2.2.2.3, Gear Testing, Bycatch Reduction, and Processing Studies and Section 4.5.3, Gear Testing, Bycatch Reduction, and Processing Studies?
    - Aquaculture
        - Describe any disease-prevention protocols and best management practices. Is the project appropriate to the level of analysis presented in the S-K Program PEIS in Section 2.2.2.4, Aquaculture and Section 4.5.4, Aquaculture?
        - Describe the potential for release of non-native species. How is this appropriate to the level of analysis presented in the S-K Program PEIS in Section 2.2.2.4, Aquaculture and Section 4.5.4, Aquaculture?
        - Describe the impacts to native species because of facility intake and effluent systems. How is this appropriate to the level of analysis presented in the S-K Program PEIS in Section 2.2.2.4, Aquaculture and Section 4.5.4, Aquaculture?
- NEPA Recommendations
    - The action is completely covered by the impact analysis within the S-K Program PEIS.
    - At this time funding will be limited to those portions of the action and impacts analyzed in the S-K Program PEIS.
    - The action or its impacts are not covered by the analysis within the S-K Program PEIS.
        - The project action or impacts are not described but are not significant. A tiered EA will be needed.
        - The project impacts are significant, and an EIS will be needed.

Agency Review and Public Notification

As described in the National Marine Fisheries Service Policy Directive 30-131: Delegation of Authority for Completing NEPA Documents, the NOAA S-K Program will consult with the NMFS NEPA Coordinator regarding the level of NEPA analysis for any federal action. This includes all projects determined by the S-K Program to fall under the analysis within this PEIS. When offices outside the S-K Program use this PEIS as the basis of their analysis, they will follow relevant policies for NEPA consultation and concurrence and are requested to notify the S-K Program so that the S-K Program may track the total number and types of actions covered under the PEIS in the S-K Program Record. The public will be notified of the projects that the S-K Program determines to be included under the PEIS analysis on the S-K Program website.

Projects where the action or impacts are not described, or that have significant adverse impacts, will result in an individual NEPA document and the agency review and public involvement procedures for those documents will follow NAO 216-6 and the S-K Program Quality Assurance Plan.

Appendix B: Project Summary Table

Table B-1. Projects funded through the S-K Program in 2010, 2012–2013, and 2015–2021. PEIS project types included in each project are designated by an X.

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
Adapting to Climate Change and Other Long-term Ecosystem Change	2017	Alaska	Enhancing the sustainability of shellfish harvest in Alaska; developing an understanding of Alexandrium harmful algal bloom dynamics in a changing climate	University of Alaska Southeast	$299,738		X				X
Adapting to Climate Change and Other Long-term Ecosystem Change	2016	New England/Mid-Atlantic	Can climate change induce reproductive failure in American lobster? Case study of a collapsed stock.	Fish And Game, Massachusetts Department Of	$228,454		X				X
Adapting to Climate Change and Other Long-term Ecosystem Change	2016	New England/Mid-Atlantic	Modeling the Impact of Climate Change on Larval Connectivity and Recruitment of the American Lobster off of Southern New England	Woods Hole Oceanographic Institution	$268,386		X				X
Adapting to Climate Change and Other Long-term Ecosystem Change	2016	New England/Mid-Atlantic	Development of an ecologically and economically viable northern shrimp (Pandalus borealis) fishery in a changing Gulf of Maine	University of Maine System acting through University of Maine	$291,419		X				X
Adapting to Climate Change and Other Long-term Ecosystem Change	2016	New England/Mid-Atlantic	Supporting decision-making under climate variability and change: multi-scale forecasts and resources for the Maine lobster fishery	Gulf of Maine Research Institute	$227,804		X				X
Adapting to Climate Change and Other Long-term Ecosystem Change	2017	New England/Mid-Atlantic	Assessing the potential for sustainability of fishing-dependent communities in coastal Maine in the face of environmental	University of Maine System acting through University of Maine	$275,308	X	X			X	X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
			and socioeconomic change								
Adapting to Climate Change and Other Long-term Ecosystem Change	2017	New England/Mid-Atlantic	Addressing the Issue of "Choke" Species in a Changing Climate	Gulf of Maine Research Institute	$288,888		X				X
Adapting to Climate Change and Other Long-term Ecosystem Change	2016	Pacific Islands	Assessing and building adaptive capacity to address climate change impacts on fishing communities and fisheries resources in Micronesia	University of Hawaii Systems	$299,828		X			X	X
Adapting to Climate Change and Other Long-term Ecosystem Change	2016	Southeast	Adapting to long-term ecosystem change in the Gulf of Maine - surveillance tools and climate model projections for epizootic shell disease in lobsters	Marine Applied Research Center, LLC	$249,951		X				X
Adapting to Climate Change and Other Long-term Ecosystem Change	2017	Southeast	Identifying priority areas for management of reef-associated fisheries and adaptation of dependent communities under climate change	Marine Applied Research Center, LLC	$299,558		X			X	X
Adapting to Climate Change and Other Long-term Ecosystem Change	2016	West Coast	Forecasting the effects of ocean acidification and hypoxia on reproduction of West Coast groundfish	San Jose State University Research Foundation	$298,206		X				X
Adapting to Climate Change and Other Long-term Ecosystem Change	2017	West Coast	Adapting Red Abalone Aquaculture for a Changing Ocean	University of California, Davis	$299,745		X		X		X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
Adapting to Climate Change and Other Long-term Ecosystem Change	2016	West Coast	The Old(er) Men of the Sea: Graying of the fishing industry and its impact on local community resiliency	Oregon State University	$243,078					X	X
Adapting to Climate Change and Other Long-term Ecosystem Change	2017	West Coast	Mitigating the Effects of Global Change on Aquaculture in the Northeastern Pacific Ocean	University of Washington	$299,998		X		X		X
Adapting to Environmental Changes and Other Long-term Impacts in Marine Ecosystems	2018	Alaska	Integrating local ecological knowledge and survey data to improve assessment and management of rockfishes in Alaska	University of Alaska Fairbanks	$114,492		X			X	X
Adapting to Environmental Changes and Other Long-term Impacts in Marine Ecosystems	2018	Alaska	Ecological controls of Alaskan pollock weight-at-length and size-at-age under rapid environmental change	University of Alaska Fairbanks	$199,082		X				X
Adapting to Environmental Changes and Other Long-term Impacts in Marine Ecosystems	2018	New England/Mid-Atlantic	Improving oceanographic models of bottom temperature within the Mid-Atlantic Bight through novel data assimilation and stakeholder input	Coonamessett Farm Foundation, Inc.	$257,534		X				X
Adapting to Environmental Changes and Other Long-term Impacts in Marine Ecosystems	2018	New England/Mid-Atlantic	Using climate change scenarios to project loggerhead turtle distributions in the U.S. Mid-Atlantic	Coonamessett Farm Foundation, Inc.	$35,770		X				X
Adapting to Environmental Changes and Other Long-term Impacts in	2018	New England/Mid-Atlantic	The consequences of a changing environment of the health of American lobsters	Northeastern University	$270,581		X				X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
Marine Ecosystems											
Adapting to Environmental Changes and Other Long-term Impacts in Marine Ecosystems	2018	New England/Mid-Atlantic	Do small female lobsters produce lower quality eggs?	Bigelow Laboratory for Ocean Sciences	$285,740		X				X
Adapting to Environmental Changes and Other Long-term Impacts in Marine Ecosystems	2018	New England/Mid-Atlantic	Superior Eastern Oyster Stocks for Enhancing Coastal Aquaculture	University of Maine System acting through University of Maine	$192,774		X		X		X
Adapting to Environmental Changes and Other Long-term Impacts in Marine Ecosystems	2018	New England/Mid-Atlantic	Understanding stock boundary and migration phenology of Atlantic cobia under a changing climate to inform management.	Virginia Institute of Marine Science	$297,008		X				X
Adapting to Environmental Changes and Other Long-term Impacts in Marine Ecosystems	2018	Southeast	Coupling U.S. Gulf State stock assessments to shell-budget modeling to determine sustainable harvest of oysters across the Gulf of Mexico	University of New Orleans	$299,728		X				X
Adapting to Environmental Changes and Other Long-term Impacts in Marine Ecosystems	2018	Southeast	Louisiana Estuarine and Coastal Marine Species Inventory: Associated Finfish, Shellfish, Cephalopod, and Zooplankton Biotic Components	Louisiana Department of Wildlife and Fisheries	$149,915		X				X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
Adapting to Environmental Changes and Other Long-term Impacts in Marine Ecosystems	2018	West Coast	Assessing the effects of oceanographic variability on body condition and reproductive output in economically important rockfishes (Sebastes spp) in the California Current Ecosystem	University of California, Santa Cruz	$182,382		X			X	X
Adapting to Environmental Changes and Other Long-term Impacts in Marine Ecosystems	2018	West Coast	Understanding How Climate Change Impacts Catch Rates and Composition of Nearshore Groundfish	Cal Poly Corporation	$299,140		X				X
Adapting to Environmental Changes and Other Long-term Impacts in Marine Ecosystems	2018	New England/Mid-Atlantic	The northern range expansion of Black Sea Bass: Understanding population dynamics and socioeconomic impacts of a rapid distribution shift	University of Maine System acting through University of Maine	$295,380		X			X	X
Aquaculture	2013	Alaska	Alaska Mariculture Initiative	Alaska Fisheries Development Foundation Inc	$216,812	X			X		X
Aquaculture	2016	Alaska	Relative Productivity of Hatchery Pink Salmon in a Natural Stream	Alaska Department of Fish and Game	$249,988		X		X		X
Aquaculture	2013	New England/Mid-Atlantic	Expanding Opportunities for Blue and Gold Mussel Farming in New England from Hatchery to Grow-out	Marine Biological Laboratory	$373,088	X	X		X		X
Aquaculture	2016	New England/Mid-Atlantic	Evaluation of bay scallop nursery optimization and effective growout strategies	Ward Aquafarms, LLC	$275,800		X		X		X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
Aquaculture	2016	New England/Mid-Atlantic	Piloting Surf Clam Aquaculture Techniques to Create Commercial Opportunities	Aquacultural Research Corporation	$105,245	X			X		X
Aquaculture	2010	New England/Mid-Atlantic	Enhancing sea scallop stocks in eastern Maine through applied aquaculture research and technology transfer	Downeast Institute for Applied Marine Research and Education, Inc.	$165,183		X		X		
Aquaculture	2013	New England/Mid-Atlantic	Demonstrating Shellfish Aquaculture Technology in Pilot and Commercial Scale Projects: Creating New Opportunities for Maine's Coastal Communities	Downeast Institute for Applied Marine Research and Education, Inc.	$348,767	X			X		X
Aquaculture	2010	New England/Mid-Atlantic	Submerged Culture of Steelhead Trout for Open Ocean Aquaculture in the Northeastern United States	University of New Hampshire	$225,196		X		X		X
Aquaculture	2010	New England/Mid-Atlantic	Development of Cod Aquaculture for Downeast Fishermen	Great Bay Aquaculture, LLC	$249,940	X			X		X
Aquaculture	2013	New England/Mid-Atlantic	A Multi-Trophic, All-Season Aquaculture Raft	University of New Hampshire	$249,762				X		X
Aquaculture	2016	New England/Mid-Atlantic	Evaluating a New Oyster Cage Culture System to Solve Unique Aquaculture Issues Hampering Development of Oyster Aquaculture in Delaware Bay	Rutgers, The State University of New Jersey	$249,365		X		X		X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
Aquaculture	2016	New England/Mid-Atlantic	Aquaculture methods to advance fishery restoration and commercial production of bay scallop (Argopecten irradians) on the Eastern Shore of Virginia	Virginia Institute of Marine Science	$296,320		X		X		X
Aquaculture	2010	Pacific Islands	Fishmeal Replacement using the Byproducts from Microalgae Based Biofuel Production and Food Processing in the Diets of High Value Marine Finfish	Kona Blue Water Farms, LLC	$242,889				X		X
Aquaculture	2016	Pacific Islands	Herbivorous marine finfish culture - the compelling case for kyphosids	Kampachi Farms, LLC.	$127,865		X		X		X
Aquaculture	2016	Pacific Islands	Development of a Supplemental Feed and Fertilizer from Fish Processing Waste for Island Farmers and Small Businesses for Sustainable Aquaculture and Agriculture	Aquafeed.com, LLC	$250,000		X		X		X
Aquaculture	2013	Southeast	Sustainable Expansion of the Live Marine Baitfish Industry: Economic and Ecological Considerations for Pinfish	Live Advantage Bait, LLC	$247,229	X			X	X	X
Aquaculture	2016	Southeast	Pilot-commercial evaluation of salt-incorporated diets for black sea bass production in a low-salinity recirculating aquaculture system:	University of North Carolina at Wilmington	$195,446				X	X	X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
			expanding siting options for land-based finfish mariculture								
Aquaculture	2010	Southeast	Construction of a Genetic Map for Direct Use in Aquaculture and Management of Red Drum (Sciaenops ocellatus) Resources in the Gulf of Mexico and U.S. South Atlantic	Texas A&M Research Foundation	$159,661		X		X		
Aquaculture	2010	West Coast	The Use of Fish Processing Trimmings to Replace Traditional Industrial Fish Meal and Fish Oil Ingredients in Aquaculture Feeds for Marine Finfish	Hubbs-SeaWorld Research Institute	$210,470		X	X	X	X	
Aquaculture	2016	West Coast	Deployment and Operation of the Imaging Flow Cytobot at Catalina Sea Ranch to Support Real-Time Monitoring of Harmful Algae, Phytoplankton Assemblages, and Invertebrate Larvae	University of California, Santa Cruz	$299,284		X		X		X
Aquaculture	2010	West Coast	Evaluation and Development of Advanced Farm Management and Harvesting Tools for Economically Efficient and Environmentally Sustainable Production of Manila Clams	Pacific Shellfish Institute	$224,118		X		X	X	

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
Aquaculture	2016	West Coast	Comparative habitat use of estuarine habitats with and without Cultch-on-Longline gear present.	Confluence Environmental Company	$274,282		X		X		X
Aquaculture	2016	West Coast	Seed Health Research & Technical Training in New Oyster Seed Rearing Practices	Pacific Shellfish Institute	$289,802		X		X		X
Aquaculture	2019	Alaska	Alaska Mariculture Initiative - Phase 2	Alaska Fisheries Development Foundation Inc	$287,680	X			X		X
Aquaculture	2018	New England/Mid-Atlantic	Optimizing Methods to Improve Larval Feeding and Water Quality	University of Illinois	$299,990		X		X		X
Aquaculture	2018	New England/Mid-Atlantic	Development Of Offshore Shellfish Aquaculture In Federal Waters Along The Atlantic Coast	Salem State University	$295,408	X		X	X		X
Aquaculture	2019	New England/Mid-Atlantic	Reducing risk for shellfish farmers through real-time, automated, harmful algal bloom monitoring and mitigation	Ward Aquafarms, LLC	$297,172		X		X		X
Aquaculture	2017	New England/Mid-Atlantic	A 'Halo' for Shellfish Aquaculture: Discovering the Phytoremediation Potential of Farmed Kelp	Bigelow Laboratory for Ocean Sciences	$298,932		X		X		X
Aquaculture	2017	New England/Mid-Atlantic	Demonstrating Aquaculture Technologies Designed to Increase the Supply, Quality, and Diversification of Domestic Seafood:	Downeast Institute for Applied Marine Research and Education, Inc.	$278,000	X	X		X		X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
			Field Experiments with Cultured Arctic Surfclams, Mactromeris polynyma								
Aquaculture	2017	New England/Mid-Atlantic	Advancing submerged mussel farming technologies to alleviate Eider duck predation	University of New Hampshire	$298,110			X	X	X	X
Aquaculture	2017	New England/Mid-Atlantic	Assembling the Best Available Science to Inform the Interstate Transport of Shellfish Seed	Rutgers, The State University of New Jersey	$300,000		X		X		X
Aquaculture	2017	New England/Mid-Atlantic	Optimizing seaweed and shellfish integrated multi-trophic aquaculture: developing a spatially explicit ecosystem model	University of Rhode Island	$299,434	X			X		X
Aquaculture	2018	New England/Mid-Atlantic	Pilot program for commercial/ subsistence educational Macro Algae Aquaculture development for Alaska	University of Rhode Island	$300,000				X		X
Aquaculture	2017	New England/Mid-Atlantic	Influence of Gonadal Stage and Ploidy on Human-Pathogenic Vibrio Levels in the Oyster Crassostrea Virginica	Virginia Institute of Marine Science	$299,475		X		X		X
Aquaculture	2018	New England/Mid-Atlantic	Understanding disease progression in polyploid eastern oysters	Virginia Institute of Marine Science	$246,952		X		X		X
Aquaculture	2017	New England/Mid-Atlantic	Transitioning Traditional Hawaiian Fishponds Into Sustainable Aquaculture Enterprises	Oceanic Institute of Hawaii Pacific University	$284,203	X			X		X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
Aquaculture	2017	New England/Mid-Atlantic	Sustainable Capture-based Aquaculture, of Siganids, with associated Hatchery-based Aquaculture Development, in Pohnpei, FSM, an Alternative Income and Food Security for Rural Fishing Communities	University of Hawaii Systems	$245,580	X			X		X
Aquaculture	2018	Pacific Islands	Developing cost-effective fishmeal-free and fish oil minimized diets for high market value U.S. marine fish aquaculture	Kampachi Farms, LLC.	$289,480	X	X		X		X
Aquaculture	2018	Pacific Islands	Developing Culture Methods for Native Fish Species in Support of New Business Models for Increased Participation in Mariculture	University of Hawaii Systems	$272,622	X			X		X
Aquaculture	2018	Pacific Islands	Culture of the indigenous southern quahog, Mercenaria campechiensis, to diversify and expand the Florida aquaculture industry	Gulf Shellfish Institute, Inc.	$243,613		X		X		X
Aquaculture	2018	Pacific Islands	Development Of Aquaculture Methods For Hogfish	University of Florida	$288,165	X	X		X		X
Aquaculture	2019	Southeast	Development of a Fishermen Operated Pilot-Scale Queen Conch (Lobatus gigas) Hatchery and Nursery Facility for Sustainable Seafood Supply and	Florida Atlantic University	$299,949	X	X		X		X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
			Restoration of Wild Populations in Puerto Rico								
Aquaculture	2018	Southeast	Monitoring Interactions and Reducing Probability of Protected Species Entanglement in Marine Aquaculture Gear: Physical Measurements and Stakeholder Workshop	Hubbs-SeaWorld Research Institute	$250,838		X	X	X		X
Aquaculture	2018	Southeast	Optimization of a probiotic treatment to promote oyster larval health and prevent disease	Oregon State University	$299,972		X		X		X
Aquaculture	2017	West Coast	Development of Genetic Risk Assessment Tools and Management Strategy Evaluation for Aquaculture of Native Shellfish	University of Washington	$299,703		X		X		X
Aquaculture	2017	West Coast	Proposal 031 - Modeling transmission of a bacterial pathogen among farmed and wild abalones in the face of climate change and declining wild populations: Filling data gaps and forecasting outcomes.	University of Washington	$299,982		X		X		X
Aquaculture	2017	West Coast	Effects of Off-Bottom Aquaculture and Development of Best Management Practices	Pacific Shellfish Institute	$287,257		X		X		X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
Aquaculture	2018	West Coast	Probiotics for bivalve aquaculture: Commercial production and hatchery implementation	Aquafeed.com, LLC	$300,000		X		X		X
Conservation Engineering	2013	New England/Mid-Atlantic	Conservation engineering within the Monkfish Gillnet Fishery: Reducing Negative fishery interaction through gear modification and assessing post release mortality and behavior of Atlantic Sturgeon	Delaware State University	$316,325		X	X			X
Conservation Engineering	2013	New England/Mid-Atlantic	Design and Test of a Topless Shrimp Trawl to Reduce Finfish Bycatch in Pamlico Sound, North Carolina	University of Massachusetts, Dartmouth	$189,085			X			X
Conservation Engineering	2013	New England/Mid-Atlantic	Developing whale and turtle-friendly subtidal aquaculture gear	Marine Biological Laboratory	$125,638			X	X		X
Conservation Engineering	2013	New England/Mid-Atlantic	Improving survivability of cusk and Atlantic cod bycatch discarded in the Gulf of Maine lobster trap fishery	University of Maine System acting through University of Maine	$229,243	X		X			X
Conservation Engineering	2013	New England/Mid-Atlantic	Testing Raised Foot Lines in Virginia Striped Bass Fishery: A Gear Based Method of Reducing Sturgeon Interactions in Anchored Gillnet	Virginia Institute of Marine Science	$138,632			X			X
Conservation Engineering	2010	Southeast	Climate-related hydrological regimes and their influence in Gulf menhaden recruitment in the	University of Southern Mississippi	$148,690		X				

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
			northcentral Gulf of Mexico.								
Conservation Engineering	2010	West Coast	Development of a self-contained modular dryer for utilization of seafood processing by-products and by-catch	Dantec, Inc.	$249,787			X			
Conservation Engineering	2013	West Coast	Quantification of Seafloor Habitat Impacts from Bottom Trawling under Selected Trawl Modifications	University Corporation At Monterey Bay	$319,611			X			X
Conservation Engineering	2013	West Coast	Investigating alternative, low-impact fishery options for west coast swordfish	Pfleger Institute of Environmental Research	$243,503			X			X
Conservation Engineering	2013	West Coast	Minimizing bycatch, maximizing fishing opportunities, and evaluating the contribution of the Rockfish Conservation Areas to rebuilding overfished species on the West Coast	San Jose State University Research Foundation	$314,147		X	X			X
Conservation Engineering	2010	West Coast	Validating current method for forecasting impacts on ESA-listed Chinook stocks by Washington ocean Chinook fisheries	Washington Department of Fish and Wildlife	$212,770		X				X
Conservation Engineering	2010	West Coast	Development of high resolution DNA markers to manage fishery interactions of chum salmon in Western Washington	University of Washington	$245,300		X				X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
Ecosystem Studies	2013	New England/Mid-Atlantic	Ecosystem Studies of Atlantic cod spawning aggregations in relation to fisheries interactions using novel active and passive acoustic approaches.	The Nature Conservancy	$400,000		X				X
Ecosystem Studies	2013	New England/Mid-Atlantic	Otolith stable isotopes: A natural marker of contingent structure for Northwest Atlantic mackerel	University of Maryland Center for Environmental Science	$175,940		X				X
Ecosystem Studies	2013	New England/Mid-Atlantic	The effects of regional temperature cycles on the development and disease susceptibility of the American lobster (Homarus americanus)	University of Maine System acting through University of Maine	$249,516		X				X
Ecosystem Studies	2013	New England/Mid-Atlantic	Continuation of the Maine Inshore Acoustic Herring Survey: Collaborative research to support the Maine Lobster industry	Gulf of Maine Research Institute	$385,263		X				X
Ecosystem Studies	2013	New England/Mid-Atlantic	Ecological diversity of the Atlantic Cod in the Gulf of Maine and its roles in resiliency of a fishery	Gulf of Maine Research Institute	$332,741		X				X
Ecosystem Studies	2013	New England/Mid-Atlantic	Genetic Tagging of Bluefin Tuna: Marker Optimization and Preliminary Assessment	Virginia Institute of Marine Science	$107,924		X				X
Ecosystem Studies	2013	New England/Mid-Atlantic	Laboratory Studies on the effect of temperature on Epizotic Shell Disease in the	Virginia Institute of Marine Science	$279,492		X		X		X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
			American Lobster Homarus Americanus								
Ecosystem Studies	2013	New England/Mid-Atlantic	Nursery Habitat Contributions to the Chesapeake Blue Crab Spawning Stock	Smithsonian Institution	$323,341		X				X
Ecosystem Studies	2013	Southeast	Examination of Catch and Discards within the Commercial Snapper-Grouper Vertical Hook-and-Line Sector in the South Atlantic United States	Gulf And South Atlantic Fisheries Foundation, Inc.	$329,869		X				X
Ecosystem Studies	2013	Southeast	Improving Southern Flounder management in the Southeastern United States through characterization of habitat effects on juvenile sex ratios	North Carolina State University	$213,866		X				X
Fisheries Socioeconomics	2013	Alaska	Stakeholder-Driven Management and Economic Valuation of Regional Micronesian Coral Reef and Nearshore Pelagic Fisheries	Pacific Marine Resources Institute, Inc.	$174,225	X				X	X
Fisheries Socioeconomics	2013	Alaska	Social and Ecological Consequences of Regulatory Change in the Alaska Recreational Halibut Fishery	University of Alaska Fairbanks	$192,327					X	X
Fisheries Socioeconomics	2010	New England/Mid-Atlantic	Socioeconomic Impacts of herring fisheries management in the Northeast: Looking back to move forward	Massachusetts Institute of Technology	$180,034					X	

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
Fisheries Socioeconomics	2013	New England/Mid-Atlantic	Assessing social impacts in groundfish fishing communities	Northeastern University	$236,785					X	X
Fisheries Socioeconomics	2010	New England/Mid-Atlantic	Understanding Opportunities and Barriers to Increased Profitability for the Gulf of Maine Lobster Industry	Gulf of Maine Research Institute	$165,659	X	X			X	X
Fisheries Socioeconomics	2010	New England/Mid-Atlantic	A Study of the Social and Economic Capacity of Eastern Maine Fishing Communities: How Can Small-Scale Fishing Communities Participate in Catch Share Programs?	University of Maine	$207,176		X			X	
Fisheries Socioeconomics	2013	New England/Mid-Atlantic	Improving the Profitability of Fishermen by Expanding Fishing Specific Financial and Business Planning Resources	Regents of The University of Minnesota	$325,628	X				X	X
Fisheries Socioeconomics	2010	New England/Mid-Atlantic	The economic impacts of no-fishing zones on Stellwagen Bank National Marine Sanctuary: an analysis of the small-scale ground-fishing fleet and their local coastal communities	University of Rhode Island	$208,164					X	X
Fisheries Socioeconomics	2013	West Coast	Evaluation of governance alternatives in managing recreational fisheries in the U.S.	University of Washington	$180,544		X			X	X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
Fisheries Socioeconomics	2016	Alaska	Changing the Paradigm of Halibut Bycatch Management in Alaska	University of Alaska Fairbanks	$297,995		X			X	X
Fisheries Socioeconomics	2016	New England/Mid-Atlantic	Engaging fishers to improve management of striped bass	Northeastern University	$240,859		X			X	X
Fisheries Socioeconomics	2017	New England/Mid-Atlantic	Developing Strategies to Reduce the Effects of Gray Meat Disease on the Atlantic Sea Scallop Fishery	University of Massachusetts	$248,825		X			X	X
Fisheries Socioeconomics	2016	New England/Mid-Atlantic	Supply Chains for Aquacultured Oysters: Enhancing Opportunities for Businesses and Shellfish Growers, and Examining Traceability and Food Safety	Johns Hopkins University, The	$233,218					X	X
Fisheries Socioeconomics	2016	West Coast	Socioeconomic Research and the Development of Fishing Community Sustainability Plans on the California North Coast	Humboldt State University Sponsored Programs Foundation	$271,225					X	X
Fishery Data Collection	2016	Alaska	Chinook Salmon Scale-Based Age Study	Alaska Department of Fish and Game	$190,335		X				X
Fishery Data Collection	2017	Alaska	Southern Bering Sea Juvenile Chinook Salmon Survey 2018 - 2020	Alaska Department of Fish and Game	$299,652		X				X
Fishery Data Collection	2017	Alaska	Inseason Genetic Mixed Stock Analysis of Chignik Sockeye Salmon Escapement to Inform Commercial	Alaska Department of Fish and Game	$90,745		X				X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
			Salmon Fishery Management								
Fishery Data Collection	2017	Alaska	Sonar weir in the lower Copper River to enumerate early run salmon for in-season management	Prince William Sound Science Center	$121,318		X				X
Fishery Data Collection	2017	Alaska	Development of Age Determination Methods for Alaska Crabs.	Alaska Department of Fish and Game	$78,224		X				X
Fishery Data Collection	2016	New England/Mid-Atlantic	Feasibility of a hook and line survey to assess tautog (Tautoga onitis) in southern Massachusetts	Fish And Game, Massachusetts Department Of	$79,762		X				X
Fishery Data Collection	2016	New England/Mid-Atlantic	A Cooperative Jonah Crab Tagging Effort to Determine Migration, Growth, and Stock Structure	Fish And Game, Massachusetts Department Of	$67,482		X				X
Fishery Data Collection	2016	New England/Mid-Atlantic	Investigating the stock structure and life history of Atlantic halibut, a Species of Concern off New England	The Nature Conservancy	$269,616		X				X
Fishery Data Collection	2016	New England/Mid-Atlantic	A multi-faceted investigation of the movement patterns, spatial and temporal habitat use, and stock structure of the common thresher shark (Alopias vulpinus) in the western North Atlantic	University of Massachusetts	$164,244		X				X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
Fishery Data Collection	2017	New England/Mid-Atlantic	Developing a method for assessing blueline (Caulolatilus microps) and golden (Lopholatilus chamaeleonticeps) tilefish stocks using a baited underwater video system	Coonamessett Farm Foundation, Inc.	$247,750		X				X
Fishery Data Collection	2017	New England/Mid-Atlantic	Evaluating the life history and stock structure of yellowfin tuna (Thunnus albacares) in the northwest Atlantic Ocean	University of Maine System acting through University of Maine	$299,623		X				X
Fishery Data Collection	2016	New England/Mid-Atlantic	Reducing uncertainty in the data- poor assessment of Atlantic wolffish (Anarhichas lupus)	University of New Hampshire	$194,507		X				X
Fishery Data Collection	2017	New England/Mid-Atlantic	Lobster Migration and Growth: Continuation and Expansion of 2015 Tagging Effort on Georges Bank and in the Gulf of Maine	Atlantic Offshore Lobstermen'S Association	$141,092		X				X
Fishery Data Collection	2017	New England/Mid-Atlantic	Got Data? A Collaborative Approach to Addressing Data Needs in the American Lobster (Homarus americanus) and Jonah Crab (Cancer borealis) Fisheries	Commercial Fisheries Research Foundation	$298,669		X				X
Fishery Data Collection	2016	New England/Mid-Atlantic	Age structure and recruitment in the ocean quahog Arctica islandica	Virginia Institute of Marine Science	$275,743		X				X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
Fishery Data Collection	2017	Pacific Islands	Establishing a fisheries-dependent monitoring network across Micronesia to maximize economic benefits, food security, and ecosystem health	University of Guam	$214,460		X				X
Fishery Data Collection	2016	Southeast	A genomic assessment of stock structure and genetic demography of yellowfin tuna (Thunnus albacares) in the Atlantic Ocean	University of Southern Mississippi	$255,836		X				X
Fishery Data Collection	2016	Southeast	Stock structure and life history of the bonnethead, Sphyrna tiburo, in U.S. waters	Natural Resources, South Carolina Department Of	$282,498		X				X
Fishery Data Collection	2016	Southeast	Origin of yellowfin tuna in the western Atlantic Ocean: importance of outside production to US fisheries	Texas A&M University - Galveston	$278,823		X				X
Fishery Data Collection	2017	Southeast	Ocean basin connectivity of Pacific bluefin tuna (Thunnus orientalis), linking natal origin and trans-Pacific movements into population dynamics	Texas A&M University - Galveston	$291,298		X				X
Fishery Data Collection	2016	West Coast	Improving stock structure estimates for west coast swordfish using Fishery Independent methods.	Pfleger Institute of Environmental Research	$259,645		X				X
Fishery Data Collection	2016	West Coast	Using spatial variation in demography and life history to improve stock assessments of	San Jose State University Research Foundation	$299,782		X				X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
			West Coast groundfish								
Fishery Data Collection	2017	West Coast	Improving information for stock assessments: Comparison of NMFS trawl surveys and visual surveys of adjacent untrawlable areas in the Rockfish Conservation Areas	San Jose State University Research Foundation	$280,790		X				X
Fishery Data Collection	2017	West Coast	Validating Underwater Stereo-video for Determining Life-history Parameters of Aggregation Spawning Coral Reef Fishes	Coral Reef Research Foundation	$183,025		X				X
Fishery Data Collection	2017	West Coast	Improving Stock Definitions and Understanding of Stock Boundaries for North Pacific Albacore (Thunnus alaunga)	Oregon State University	$285,418		X				X
Fishery Data Collection	2017	West Coast	Development of Combined Hydroacoustic and Visual Survey	Oregon Department of Fish and Wildlife	$299,021		X				X
Fishery Data Collection	2016	West Coast	Hookahua building a strong foundation for a statewide fisheries licensing system in Hawaii	Conservation International Foundation	$242,326		X				X
Fishery Data Collection	2016	West Coast	Seasonal and ontogenetic movements of Pacific cod from genetic stock identification	University of Washington	$267,114		X				X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
Fishery Data Collection	2017	West Coast	Improving Chinook Salmon Bycatch Estimates for the Gulf of Alaska Trawl Fleet: Alternatives addressing accuracy, cost, and timeliness	Fishnext Research, LLC	$183,382		X				X
Improve the Cost-Effectiveness and Capacity for Observations	2015	Alaska	Enable Spatial Data for Statistical Areas of Commercial Fisheries Harvest.	Alaska Department of Fish and Game	$398,258		X				X
Improve the Cost-Effectiveness and Capacity for Observations	2015	New England/Mid-Atlantic	Using archival tagging data to develop geolocation methodologies for North Atlantic groundfish: application to Atlantic cod, yellowtail flounder, and monkfish	University of Massachusetts, Dartmouth	$131,491		X				X
Improve the Cost-Effectiveness and Capacity for Observations	2015	New England/Mid-Atlantic	Comparison of video camera sled with diver surveys and efficacy of marine protected areas for conservation of queen conch (Lobatus gigas) in Puerto Rico	University of Maryland Eastern Shore	$358,305		X				X
Improve the Cost-Effectiveness and Capacity for Observations	2015	New England/Mid-Atlantic	Do Closed Areas Promote Healthy Age Structures in New England Groundfish?	Gulf of Maine Research Institute	$236,198		X				X
Improve the Cost-Effectiveness and Capacity for Observations	2015	New England/Mid-Atlantic	Maine Inshore Acoustic Survey for Northern Shrimp	Gulf of Maine Research Institute	$360,105		X				X
Improve the Cost-Effectiveness	2015	New England/Mid-Atlantic	A hook and line survey to assess spatial population	National Fisheries Institute	$392,959		X				X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
and Capacity for Observations			dynamics of black sea bass								
Improve the Cost-Effectiveness and Capacity for Observations	2015	Pacific Islands	Identifying Stock Connectivity in Data Poor Regions of the North Pacific: Striped Marlin Co-operative PSAT and Conventional Tagging Program for Hawaii and Mariana Islands	Pacific Islands Fisheries Group	$395,402		X				X
Improve the Cost-Effectiveness and Capacity for Observations	2015	Southeast	Cooperative Bottom Long Line Survey to Augment Fisheries Independent Reef Fish Data Collection in the Deepwater Snapper-Grouper Fishery of the South Atlantic United States	Gulf And South Atlantic Fisheries Foundation, Inc.	$299,945		X				X
Improve the Cost-Effectiveness and Capacity for Observations	2015	Southeast	Estimating the proportion of red snapper on artificial and natural reefs in the western Gulf of Mexico: implications concerning stock productivity and status.	Louisiana State University	$398,790		X				X
Improve the Cost-Effectiveness and Capacity for Observations	2015	Southeast	Management of red hind (Epinephelus guttatus) spawning aggregations in the U.S. Caribbean Islands: What is the most effective option for stock enhancement?	University of the Virgin Islands	$400,000		X				X
Improve the Cost-Effectiveness	2015	West Coast	Improving the Data Available for Stock Assessments and Management of West	Cal Poly Corporation	$390,559		X				X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
and Capacity for Observations			Coast Groundfish through Collaborative Research								
Improve the Cost-Effectiveness and Capacity for Observations	2015	West Coast	Fine scale ocean distribution patterns of Klamath River Chinook salmon, in comparison to other stocks of interest, including the ESA-listed Central California Chinook	California Salmon Council	$398,340		X				X
Improve the Cost-Effectiveness and Capacity for Observations	2015	West Coast	Transforming Data into Knowledge: Integrating Information to Support Collaborative Fisheries Management	Oregon Department of Agriculture	$353,410		X				X
Improve the Cost-Effectiveness and Capacity for Observations	2015	West Coast	Using satellite pop-up tags to track movements of sablefish during spawning and changes in vertical position in the water column	University of Washington	$399,684		X				X
Improve the Quality and Quantity of Fishery Information from the U.S. Territories	2015	Southeast	Capacity Building for Design and Analysis of Fishery-Independent Surveys of Reef-fishes in Puerto Rico and the U.S Virgin Islands	University of Miami	$386,212		X				X
Improve the Quality and Quantity of Fishery Information from the U.S. Territories	2015	Southeast	Extending Fishery-Independent Surveys for Reef-fishes in Puerto Rico to Mid-Depth and Deep Reefs.	University of Miami	$400,000		X				X

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Improve the Quality and Quantity of Fishery Information from the U.S. Territories	2015	Southeast	Assessing the relative resilience of coral reefs and herbivorous fish communities to climate change in U.S. territories to inform ecosystem-based fisheries management	Marine Applied Research Center, LLC	$266,451		X				X
Improve the Quality and Quantity of Fishery Information from the U.S. Territories	2015	Southeast	Sustainability and recovery of groupers in Puerto Rico and the US Virgin Islands	Hector Ruiz	$339,195	X	X				X
Increase the Supply, Quality, and Diversification of Domestic Seafood	2015	Alaska	Genetic stock structures of red sea cucumbers and geoduck clams in Alaska and development of a genetic framework for stock enhancement	Alaska Department of Fish and Game	$218,398		X		X		X
Increase the Supply, Quality, and Diversification of Domestic Seafood	2015	New England/Mid-Atlantic	Development and field testing of novel antifouling coatings for the aquaculture industry	University of Connecticut	$336,025		X		X		X
Increase the Supply, Quality, and Diversification of Domestic Seafood	2015	New England/Mid-Atlantic	Development of a Greenwater Alternative for Larval Sablefish (Anoplopoma fimbria)	The Board of Trustees of The University of Illinois	$389,049	X	X		X		X
Increase the Supply, Quality, and Diversification of Domestic Seafood	2015	New England/Mid-Atlantic	Municipal outreach for restoring and growing the softshell clam industry in Maine through aquaculture.	Manomet, Inc.	$287,775	X			X		X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
Increase the Supply, Quality, and Diversification of Domestic Seafood	2015	New England/Mid-Atlantic	Improving the management of an overfished, data poor species: Investigating the movements and stock structure of thorny skates using novel fishery-independent tagging technology	New England Aquarium Corporation	$320,855		X				X
Increase the Supply, Quality, and Diversification of Domestic Seafood	2015	New England/Mid-Atlantic	Establishing High End and Sashimi-Grade Markets for Seafood from the Northeast United States	Gulf of Maine Research Institute	$191,768	X					X
Increase the Supply, Quality, and Diversification of Domestic Seafood	2015	New England/Mid-Atlantic	Quality Improvement Project to Optimize Utilization of Georges Bank Haddock Resource	Teresa Marie IV Inc	$250,000	X		X			X
Increase the Supply, Quality, and Diversification of Domestic Seafood	2015	New England/Mid-Atlantic	Assessment of the genetic stock structure of Tautog, Tautoga onitis, along the U.S. Atlantic coast from Massachusetts to Virginia	Virginia Institute of Marine Science	$206,709		X				X
Increase the Supply, Quality, and Diversification of Domestic Seafood	2015	New England/Mid-Atlantic	Protecting the Chesapeake Bay Aquaculture Industry from a Dynamic Carbonate Chemistry Environment	Virginia Polytechnic Institute and State University	$353,766		X		X		X
Increase the Supply, Quality, and Diversification of Domestic Seafood	2015	Pacific Islands	Hawaii Pelagic Longline Fishery Bycatch Nutrient Assessment	Hawaii Seafood Council	$165,000	X	X				X

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Increase the Supply, Quality, and Diversification of Domestic Seafood	2015	Pacific Islands	Diversification of Income for Fishing Communities in the FSM and Republic of the Marshall Islands through Low-input Sustainable Aquaculture of Marine Invertebrates for the Marine Ornamental Trade	University of Hawaii Systems	$236,042	X			X		X
Increase the Supply, Quality, and Diversification of Domestic Seafood	2015	Pacific Islands	Commercial Scale Sustainable Feed for Aquaculture Development in Hawaii	Fresh Island Fish	$400,000		X		X		X
Increase the Supply, Quality, and Diversification of Domestic Seafood	2015	Southeast	Assessing the Viability of a Commercial Lionfish Fishery in the U.S. Virgin Islands	Emory University	$314,437	X	X				X
Increase the Supply, Quality, and Diversification of Domestic Seafood	2015	Southeast	Development of a genomic toolkit for Haliotis species to guide broodstock selection and endangered species restoration	Iowa State University	$281,563		X		X		X
Increase the Supply, Quality, and Diversification of Domestic Seafood	2015	Southeast	Development of a genomic toolkit to guide broodstock selection and culture practices for Seriola lalandi and Seriola rivoliana	Iowa State University	$298,480		X		X		X
Increase the Supply, Quality, and Diversification of Domestic Seafood	2015	Southeast	Large-Scale Movements, Spawning Locations, and Structure of the Gulf of Mexico Blue Crab Spawning Stock	Nicholls State University	$230,237		X				X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
Increase the Supply, Quality, and Diversification of Domestic Seafood	2015	Southeast	Genetic Stock Structure and Connectivity of Atlantic Blackfin Tuna (Thunnus Atlanticus)	University of Southern Mississippi	$268,225		X				X
Increase the Supply, Quality, and Diversification of Domestic Seafood	2015	Southeast	Application of Dry-Extrusion Technology Using By-Products from Seafood Processing to Produce Novel Marine Ingredients for Aquafeeds	Texas A&M AgriLife Research	$288,845			X	X		X
Increase the Supply, Quality, and Diversification of Domestic Seafood	2015	West Coast	Nutritional approaches in larval marine fish culture to maximize fish production and quality for stocking and farming programs	Hubbs-SeaWorld Research Institute	$399,643		X		X		X
Increase the Supply, Quality, and Diversification of Domestic Seafood	2015	West Coast	Sustainable aquaculture feed from processed aquaculture trim	Fish Breeders of Idaho, Inc.	$46,058		X	X	X		X
Increase the Supply, Quality, and Diversification of Domestic Seafood	2015	West Coast	Development of red sea cucumber (Parastichopus californicus) poly-aquaculture for nutrient uptake and seafood export	Pacific Shellfish Institute	$392,752		X		X		X
Increase the Supply, Quality, and Diversification of Domestic Seafood	2015	West Coast	Production of Macroalgae for Human Consumption in the Pacific Northwest: Controls for production methods, Product Quality and Consumer Response	Sol-Sea Ltd	$268,356	X				X	X

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Increase the Supply, Quality, and Diversification of Domestic Seafood	2015	West Coast	Quantification of functional relationships between shellfish culture and seagrass in US west Coast estuaries to inform regulatory decisions	Pacific Shellfish Institute	$295,192		X		X		X
Maximize Fishing Opportunities and Jobs	2015	Alaska	Reducing Sperm Whale Longline Fisheries Interactions: enabling fishermen to use avoidance through real-time updates from satellite tags and fishermen reports.	Sitka Sound Science Center	$311,951		X				X
Maximize Fishing Opportunities and Jobs	2015	Alaska	Linking Blue Crab Abundance, Growth and Mortality to Marsh Fragmentation and Submerged Aquatic Vegetation Cover	The Water Institute of the Gulf	$283,578		X				X
Maximize Fishing Opportunities and Jobs	2015	Alaska	Fishing Vessel Energy Efficiency Project - Phase II	Alaska Fisheries Development Foundation Inc	$399,697		X				X
Maximize Fishing Opportunities and Jobs	2015	Alaska	Lynn Canal Sockeye Stock Identification.	Alaska Department of Fish and Game	$256,739		X				X
Maximize Fishing Opportunities and Jobs	2015	New England/Mid-Atlantic	Improving an Ecosystem Friendly Scallop Dredge	Coonamessett Farm Foundation, Inc.	$237,528			X			X
Maximize Fishing Opportunities and Jobs	2015	New England/Mid-Atlantic	From pot to plate: gear innovation and market creation for selectively-harvested West Coast lingcod	The Nature Conservancy	$300,000	X		X			X

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Maximize Fishing Opportunities and Jobs	2015	New England/Mid-Atlantic	Investigating Offshore Essential Fish Habitat of Southern New England Winter Flounder	Coonamessett Farm Foundation, Inc.	$259,532		X				X
Maximize Fishing Opportunities and Jobs	2015	New England/Mid-Atlantic	Supporting Infrastructure & Innovation	Cape Ann Seafood Exchange, Inc.	$363,604	X		X			X
Maximize Fishing Opportunities and Jobs	2015	New England/Mid-Atlantic	Reducing Yellowtail and Windowpane Flounder Bycatch: Application of a Modified European Grid System in the Georges Bank Haddock Fishery	University of Massachusetts, Dartmouth	$233,535			X			X
Maximize Fishing Opportunities and Jobs	2015	New England/Mid-Atlantic	A Modified Sort-X Grid to Reduce the Catch of Juvenile Haddock and Cod in the Georges Bank Haddock Fishery	University of Massachusetts, Dartmouth	$247,502			X			X
Maximize Fishing Opportunities and Jobs	2015	New England/Mid-Atlantic	Combining Fishermen's Knowledge to Locate, Evaluate, and Predict Gray Meat Outbreaks	University of Massachusetts, Dartmouth	$299,551		X			X	X
Maximize Fishing Opportunities and Jobs	2015	New England/Mid-Atlantic	TickleDredge: Bycatch Reduction for the Sea Scallop Fishery	Provincetown Center for Coastal Studies, Inc.	$96,181			X			X
Maximize Fishing Opportunities and Jobs	2015	New England/Mid-Atlantic	Evaluation of methods to reverse the acute effects of barotraumas and increase the post-release survival of cusk (Brosme brosme) discarded in the Gulf of Maine recreational fishery	New England Aquarium Corporation	$226,117		X				X

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Maximize Fishing Opportunities and Jobs	2015	New England/Mid-Atlantic	Use of Electronic Monitoring (EM) to achieve full accountability and cost-effective implementation of EM in the West Coast Swordfish Drift Gillnet (DGN) Fishery	The Nature Conservancy	$329,288		X				X
Maximize Fishing Opportunities and Jobs	2015	New England/Mid-Atlantic	Field Testing an Electric Decoy for Reducing Elasmobranch Bycatch in Longline Fisheries	New England Aquarium Corporation	$113,419			X			X
Maximize Fishing Opportunities and Jobs	2015	New England/Mid-Atlantic	Estimating the discard mortality rate and deriving best catch-and-release guidelines for haddock (Melanogrammus aeglefinus) discarded in Gulf of Maine recreational fisheries	New England Aquarium Corporation	$114,249		X				X
Maximize Fishing Opportunities and Jobs	2015	New England/Mid-Atlantic	Disease and discard mortality in the blue crab fishery: using new information about an old virus to improve management of the resource	University of Maryland Center for Environmental Science	$299,381		X	X			X
Maximize Fishing Opportunities and Jobs	2015	New England/Mid-Atlantic	Forecasting Protozoan Parasites in the Gulf of Maine and the Risk of Bioaccumulation of Human Waterborne Pathogens in Oysters	Bigelow Laboratory for Ocean Sciences	$394,694		X				X
Maximize Fishing Opportunities and Jobs	2015	New England/Mid-Atlantic	Developing an Ultra-Low-Opening Groundfish Trawl to Avoid Cod and Ensure a Prosperous Inshore Fishing Fleet	Gulf of Maine Research Institute	$264,827			X			X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
Maximize Fishing Opportunities and Jobs	2015	New England/Mid-Atlantic	Post-Release Mortality of Yellowfin Tuna in the U.S. Rod and Reel Recreational Fishery	University of Maine System acting through University of Maine	$281,460		X				X
Maximize Fishing Opportunities and Jobs	2015	New England/Mid-Atlantic	Determining natal sources of adult winter flounder in the GOM and SNE/MA stocks: tracking fish using otolith chemical signatures as natural tags	University of New Hampshire	$282,432			X			X
Maximize Fishing Opportunities and Jobs	2015	New England/Mid-Atlantic	Restoring Long Island's winter flounder inshore fisheries - Approaches to avoid extirpation	The Research Foundation for the State University of New York	$399,993		X				X
Maximize Fishing Opportunities and Jobs	2015	New England/Mid-Atlantic	Supporting Management of the Emerging Jonah Crab Fishery and the Iconic Lobster Fishery in the Northeast USA: A Collaborative Fishing Vessel Research Fleet Approach	Commercial Fisheries Research Foundation	$399,870		X				X
Maximize Fishing Opportunities and Jobs	2015	New England/Mid-Atlantic	Creation of a climate change adaptation blueprint for Rhode Island commercial fisheries through industry-led collective visioning	Rhode Island Natural History Survey	$75,241	X				X	X
Maximize Fishing Opportunities and Jobs	2015	New England/Mid-Atlantic	Characterizing the behavior and preferences of anglers in the recreational fishery for Atlantic bluefin tuna (Thunnus thynnus) along the U.S. east coast	Virginia Institute of Marine Science	$279,899					X	X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
Maximize Fishing Opportunities and Jobs	2015	New England/Mid-Atlantic	Post-Release Mortality in the Atlantic Recreational Billfish Fishery: Quantifying the Effects of Air Exposure	Virginia Institute of Marine Science	$156,710		X				X
Maximize Fishing Opportunities and Jobs	2015	New England/Mid-Atlantic	Assessing the Effects of Hematodinium perezi on Recruitment of the Blue Crab Callinectes sapidus	Virginia Institute of Marine Science	$399,860		X				X
Maximize Fishing Opportunities and Jobs	2015	New England/Mid-Atlantic	Impacts of Epizootic Shell Disease and Environmental Change on Sustainability of the New England Lobster Stocks, with Implications for Managing the Fisheries.	Virginia Institute of Marine Science	$319,971		X				X
Maximize Fishing Opportunities and Jobs	2015	Pacific Islands	The effects of handling on post-release mortality rates of shark bycatch in longline fisheries: Identifying "best practices" and improving stock assessments.	University of Hawaii Systems	$313,279		X				X
Maximize Fishing Opportunities and Jobs	2015	Pacific Islands	Building capacity for sustainable fisheries management through science and tradition: Micronesian Outer Islands	Hawaii Wildlife Fund	$193,010	X	X				X
Maximize Fishing Opportunities and Jobs	2015	Pacific Islands	Testing the Commercial Viability and Practicality of a Catch-triggered Deterrence Device for Mitigating Marine Mammal Depredation	Hawaii Longline Association	$223,250	X		X			X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
			in the Hawaii Deep-set Longline Fishery								
Maximize Fishing Opportunities and Jobs	2019	Pacific Islands	Mark-recapture as a tool to assess Kona crab, Ranina, post-release mortality and local population estimates for the Main Hawaiian Islands	Poseidon Fisheries Research LLC	$91,189		X				X
Maximize Fishing Opportunities and Jobs	2015	Southeast	Advancing effective ecosystem-based fisheries management in the California Current System: Metrics for quantifying prey availability to predators thus to model allocations of allowable biological catch	TRIPLE HS, INC.	$309,314		X				X
Maximize Fishing Opportunities and Jobs	2015	Southeast	Assessing the differential and combined effects of capture depth vs. thermal change on the condition and post-release mortality of managed reef fish including Red Snapper in the northern Gulf of Mexico	University of Southern Mississippi	$171,782		X				X
Maximize Fishing Opportunities and Jobs	2015	Southeast	Communication Avenues for Vietnamese-American Fishing Communities on the Gulf of Mexico with Coastal Resource Agencies	Mississippi State University	$258,032					X	X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
Maximize Fishing Opportunities and Jobs	2015	Southeast	Estimating discard mortality and number of dead discarded dolphinfish (Coryphaena hippurus) in the U.S. South Atlantic recreational fishery	North Carolina State University	$288,568		X	X			X
Maximize Fishing Opportunities and Jobs	2015	Southeast	An Economic & Social Analysis of North Carolina Commercial Fisheries: Wild Harvest Fisheries of the Atlantic Ocean, Estuarine Fisheries from Core Sound to the SC State Line, and Shellfish Aquaculture	North Carolina Department of Environmental Quality	$57,460					X	X
Maximize Fishing Opportunities and Jobs	2015	Southeast	Capture mortality and post-release survival of blacktip sharks (Carcharhinus limbatus) in the Gulf of Mexico recreational fishery	Texas A&M University - Galveston	$355,572		X				X
Maximize Fishing Opportunities and Jobs	2015	Southeast	Increasing Fishing Opportunities and Creating Jobs through Baitfish Aquaculture	The University of Texas At Austin	$271,514	X	X		X		X
Maximize Fishing Opportunities and Jobs	2015	Southeast	Development of a rapid colorimetric assay based on LAMP to genetically distinguish bluefin tuna (Thunnus thynnus) from other tunas in the field	Texas A&M University - Galveston	$174,624		X				X
Maximize Fishing Opportunities and Jobs	2015	Southeast	Testing the Effects of Community-managed "Rest Areas" on Coastal Hawaiian Fisheries	Texas A&M University - Corpus Christi	$399,516		X				X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
Maximize Fishing Opportunities and Jobs	2015	West Coast	The current and potential contribution of manmade reef habitats to fisheries resources and protected species recovery in southern California.	Occidental College	$211,224	X	X				X
Maximize Fishing Opportunities and Jobs	2015	West Coast	Determining catch and release survivorship and best handling practices for Pacific Bluefin tuna	Pfleger Institute of Environmental Research	$329,232		X				X
Maximize Fishing Opportunities and Jobs	2015	West Coast	Selective Flatfish Bycatch Reduction Device Development and Testing	Pacific States Marine Fisheries Commission	$132,887			X			X
Maximize Fishing Opportunities and Jobs	2015	West Coast	Survival of Pacific halibut released from Bering Sea flatfish trawl catches through expedited sorting: applying advanced tags to observe survival rates and relating outcomes to viability assessments.	Fishnext Research, LLC	$258,462			X			X
Maximize Fishing Opportunities and Jobs	2015	West Coast	Assessing the Value and Supply Chain for Coastal Fisheries in the Main Hawaiian Islands	Conservation International Foundation	$249,498		X			X	X
Maximize Fishing Opportunities and Jobs	2015	West Coast	Improving Salmon Survival Forecasts through Prey Field Monitoring and Indicator Development	The Tulalip Tribes of Washington	$376,203		X				X
Maximize Fishing Opportunities and Jobs	2015	West Coast	Improving modeled harvest impacts using genetic data: Comparisons of modeled estimates from FRAM and estimates from GMA	Washington Department of Fish and Wildlife	$243,541		X				X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
			using WA coastal Chinook commercial non-treat and recreational salmon fisheries								
Optimum Utilization of Harvested Resources Under Federal or State Management	2010	Alaska	Quantifying Quality in Bristol Bay: Advancing a proven project to specify, quantify and communicate best fishing and handling practices in America's most valuable salmon fishery	Bristol Bay Regional Seafood Development Association	$95,500			X			X
Optimum Utilization of Harvested Resources under Federal or State Management	2013	New England/Mid-Atlantic	Harmful Algal Blooms: A Compendium Desk Reference	University of Connecticut	$217,865		X		X		X
Optimum Utilization of Harvested Resources under Federal or State Management	2013	New England/Mid-Atlantic	Sustaining Redfish	Cape Ann Seafood Exchange, Inc.	$391,670	X		X			X
Optimum Utilization of Harvested Resources Under Federal or State Management	2010	New England/Mid-Atlantic	Conduct a collaborative research study on one of Maine's 'Species of Concern' in the near-shore Gulf of Maine, Cusk (Brosme Brosme)	Maine Department of Marine Resources	$33,845			X			X
Optimum Utilization of Harvested Resources Under Federal or State Management	2010	New England/Mid-Atlantic	Dismissing Dogma II: The Use of Satellite Tags to Examine the Behavior of Spiny Dogfish (Squalus acanthias) in Relation to Habitat Use, Depth	University of New England	$100,000		X				

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
			Preference and Movement Patterns in the NW Atlantic								
Optimum Utilization of Harvested Resources Under Federal or State Management	2010	New England/Mid-Atlantic	Developing Markets for Underutilized and Undervalued Seafood Products in the Northeast: An industry collaboration led by the Gulf of Maine Research Institute	Gulf of Maine Research Institute	$176,486	X					X
Optimum Utilization of Harvested Resources under Federal or State Management	2013	New England/Mid-Atlantic	Optimum Utilization of Spiny Dogfish, Squalus acanthias, through Industry Partnerships and Product Development and Marketing	University of New England	$245,246	X					X
Optimum Utilization of Harvested Resources under Federal or State Management	2013	New England/Mid-Atlantic	Collecting Fishery Dependent Data on the Developing Offshore Whelk fishery in the Mid-Atlantic Bight and Using HabCam to Estimate Relative Abundance	Rutgers, The State University of New Jersey	$262,940		X				X
Optimum Utilization of Harvested Resources Under Federal or State Management	2010	New England/Mid-Atlantic	Restoring Long Island???s winter flounder fishery	The Research Foundation for the State University of New York	$234,596	X	X				X
Optimum Utilization of Harvested Resources Under Federal or State Management	2010	New England/Mid-Atlantic	Seasonal Frequency and Development of Hemic Neoplasia in the soft shell clam Mya arenaria along the East Coast of the United States	West Chester University of Pennsylvania	$116,210		X		X		

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
Optimum Utilization of Harvested Resources under Federal or State Management	2013	New England/Mid-Atlantic	Bioconversion of Squid and Scallop Processing Byproducts into Specialty Aquaculture Feed Ingredients Employing Energy Efficient Hydrolysis and Low-Cost Drying Processes	University of Rhode Island	$279,554	X		X	X		X
Optimum Utilization of Harvested Resources Under Federal or State Management	2010	Pacific Islands	Hawaii Oio Tagging project to provide data used in tracking movement and growth of oio obtained on the island of Oahu and analyze /compare deep water bag net fishing method to hook/line tag deployment	Pacific Islands Fisheries Group	$84,810		X				X
Optimum Utilization of Harvested Resources under Federal or State Management	2013	Southeast	Assessing the current status of red drum (Sciaenops ocellatus) in the northern Gulf of Mexico: a multistate cooperative effort.	University of South Alabama	$399,823		X				X
Optimum Utilization of Harvested Resources Under Federal or State Management	2010	Southeast	Species Identification of Grouper in Commerce Utilizing Real Time PCR	Applied Food Technologies LLC	$135,000		X				X
Optimum Utilization of Harvested Resources under Federal or State Management	2013	Southeast	Tools for Sustainably Managing the Florida Lobster Fishery Under Threat from Disease and Climate Change	University of Florida	$248,115		X				X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
Optimum Utilization of Harvested Resources under Federal or State Management	2013	Southeast	Prediction and Verification of Snapper-Grouper Spawning Aggregation Sites on the Offshore Banks of the Northwestern Gulf of Mexico	Gulf And South Atlantic Fisheries Foundation, Inc.	$387,179					X	X
Optimum Utilization of Harvested Resources Under Federal or State Management	2010	Southeast	Assessing and Developing Best Practices in Seafood Marketing and Consumption: A Regional Ethnographic Approach	East Carolina University	$134,263	X					
Optimum Utilization of Harvested Resources under Federal or State Management	2013	Southeast	Evaluation of the Role of Salinity in Determining Levels of Vibrio vulnificus and Vibrio parahaemolyticus in North Carolina Oysters and Clams	University of North Carolina, Charlotte	$308,203		X		X		X
Optimum Utilization of Harvested Resources under Federal or State Management	2013	Southeast	East Carolina University (ECU) Cooperative Winter Tagging Cruise 201X-2015	East Carolina University	$194,084		X				X
Optimum Utilization of Harvested Resources Under Federal or State Management	2010	Southeast	Population Structure, Gene Flow and Genetic Demography of the Blacknose Shark (Carcharhinus Acronotus) in U.S. waters and genetic marker development for the Smooth Dogfish (Mustelus canis)	Texas A&M Research Foundation	$240,463		X				

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
Promotion, Development, and Marketing	2018	Alaska	Overcoming the Last Hurdle of Dogfish: Changing the Name	University of Alaska Fairbanks	$87,965	X					X
Promotion, Development, and Marketing	2018		Staging A Market Come-Back	Rutgers, The State University of New Jersey	$281,080	X					X
Promotion, Development and Marketing	2017	Alaska	Socially Responsible Practices in Small Boat Commercial Fishing Fleets	Alaska Fisheries Development Foundation Inc	$157,916	X				X	X
Promotion, Development and Marketing	2021		Promoting the Resurgence of the New Jersey Oyster Through Shell Recycling	American Littoral Society	$300,000	X			X		X
Promotion, Development and Marketing	2021	Alaska	Increasing Market Access and Consumer Confidence with Trusted Nutrient and Contaminant Data and Outreach for Alaska Seafood	Alaska Department of Commerce, Community & Economic Development,	$298,450	X	X				X
Promotion, Development and Marketing	2016	Alaska	Establishing Local Markets and Sustainable Supply Distribution Chains to Increase Domestic Consumption of Skate & Spiny Dogfish	Cape Cod Commercial Fishermen's Alliance, Inc.	$220,373	X					X
Promotion, Development and Marketing	2018	New England/Mid-Atlantic	Investigating the viability of a soft-shell green crab industry in New England	Manomet, Inc.	$267,440	X	X				X
Promotion, Development and Marketing	2018	New England/Mid-Atlantic	Optimizing production and products for scallop aquaculture	Cape Cod Commercial Fishermen's Alliance, Inc.	$37,047	X	X		X		X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
Promotion, Development and Marketing	2020	New England/Mid-Atlantic	Adapting High Pressure Processing (HPP) Technology to Enhance the Competitiveness of the Domestic Blue Crab Industry	University of Maryland, College Park	$299,963	X		X			X
Promotion, Development and Marketing	2020	New England/Mid-Atlantic	Improving Business Practices to Reduce Mortality in the Lobster Supply Chain	University of Maine System acting through University of Maine	$299,104	X	X	X			X
Promotion, Development and Marketing	2021	New England/Mid-Atlantic	Improving the marketability, quality and value of US caught Atlantic bluefin tuna	University of Maine System acting through University of Maine	$296,879	X	X				X
Promotion, Development and Marketing	2017	New England/Mid-Atlantic	Assessing the Potential for Development and Promotion of a Consumer Market for Underutilized Fish Species in Restaurants and Foodservice	University of New Hampshire	$120,801	X				X	X
Promotion, Development and Marketing	2021	New England/Mid-Atlantic	Increasing Local Seafood Consumption Through Demo, Dialogue and Donations	Cornell University Cooperative Extension of Suffolk County	$63,668	X				X	X
Promotion, Development and Marketing	2020	New England/Mid-Atlantic	Fishadelphia: Expanding a successful program connecting NJ seafood harvesters with culturally and economically diverse seafood consumers	Fishadelphia Limited Liability Company	$299,680	X				X	X
Promotion, Development and Marketing	2016	New England/Mid-Atlantic	The Other EBFM: Designing Ecosystem-Based Fisheries Marketing Strategies to	University of Rhode Island	$155,026	X	X				X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
			Complement Ecosystem-Based Fisheries Management								
Promotion, Development and Marketing	2018	New England/Mid-Atlantic	Development of a Marketable Seafood Product from Scup (Stenotomus chrysops), an Abundant, Low Value Species in the Northeast and Mid-Atlantic USA	Commercial Fisheries Research Foundation	$281,394	X		X		X	X
Promotion, Development and Marketing	2021	New England/Mid-Atlantic	Realizing the Full Potential of Rhode Island Seafood in Rhode Island - a statewide seafood marketing and promotion campaign to bolster the market for Rhode Island seafood in Rhode	Rhode Island Department of Environmental Management	$300,000	X				X	X
Promotion, Development and Marketing	2021	New England/Mid-Atlantic	Evaluating production constraints and consumer demand in an emerging blue catfish (Ictalurus furcatus) fishery	Virginia Institute of Marine Science	$256,103	X				X	X
Promotion, Development and Marketing	2020	Pacific Islands	Community ideas and projects for Ahi, yellowfin tuna, landed on Kauai	Pacific Islands Fisheries Group	$116,144	X	X			X	X
Promotion, Development and Marketing	2021	Pacific Islands	Hawaii Seafood Marketing in the age of COVID	Hawaii Seafood Council	$300,000	X					X
Promotion, Development and Marketing	2021	Pacific Islands	Development of Hawaii Squid Fishery and Marketable Products	Pacific Islands Fisheries Group	$119,283	X				X	X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
Promotion, Development and Marketing	2021	Pacific Islands	Hawaii Seafood Culinary Best Practice Digital Promotion	University of Hawaii	$299,985	X					X
Promotion, Development and Marketing	2016	Pacific Islands	Expanding Fisheries and Economic Opportunities for Pohnpei, Micronesia Coral Reef Fishers	Mariana Islands Nature Alliance (Mina)	$189,950	X		X			X
Promotion, Development and Marketing	2021	Pacific Islands	Operationalizing offshore pelagic fisheries in the Palau National Marine Sanctuary (PNMS) through a public-private partnership to benefit local fishing communities	Republic of Palau	$300,000	X				X	X
Promotion, Development and Marketing	2021	Southeast	Know Thy Oysters: Evaluating the Effectiveness of Seafood Server Training Programs to Increase Sales of American Seafood	Oyster South Company	$299,413	X			X	X	X
Promotion, Development and Marketing	2021	Southeast	Developing Effective, Low-Cost Community Outreach Tools for Fishers and Seafood Farmers	Georgia Southern University Research & Service Fdn, Inc.	$240,139	X				X	X
Promotion, Development and Marketing	2017	Southeast	Shrimp Quality Enhancement Through Plate Freezing: New Market Opportunities	Louisiana State University	$189,820	X		X			X
Promotion, Development and Marketing	2021	Southeast	Improving U.S. wild catfish market opportunities through improved cold chain management and packaging	Louisiana State University Agricultural Center	$299,598	X		X			X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
Promotion, Development and Marketing	2020	Southeast	An Economic Profiling of North Carolina Shellfish Growers and Their Business Challenges, and an Exploration of Innovative Regulatory Strategies to Promote Growth	North Carolina Department of Environmental Quality	$57,013	X			X	X	X
Promotion, Development and Marketing	2021	Southeast	Collaboration with local fish processing industry to convert fish trimmings and skins into value added fish meal and fish oil to promote sustainability	North Carolina State University	$265,625	X	X	X	X		X
Promotion, Development and Marketing	2021	Southeast	Promoting Gullah Geechee Maritime Cultural Heritage and Enhancing Economic Resilience through a Gullah Geechee Seafood Trail	Gullah Geechee Chamber Foundation Inc	$282,768	X			X	X	X
Promotion, Development and Marketing	2020	Southeast	Resolving Barriers to Sustainable Fishery Certification for the Gulf of Mexico Federal Otter Trawl Shrimp Fishery	LGL Ecological Research Associates, Inc.	$299,724	X		X			X
Promotion, Development and Marketing	2018	West Coast	A Culinary Engineering Approach to Increasing the Value of Local Fisheries: Reducing Fish Discards at Sea and Promoting Full Utilization	Catalina Offshore Products, Inc	$139,700	X		X			X
Promotion, Development and Marketing	2018	West Coast	Gathering essential fishery information for the brown box crab, Lopholithodes foraminatus, to assess the potential	The University of California, Santa Barbara	$279,317	X	X				X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
			for a new California trap fishery								
Promotion, Development and Marketing	2020	West Coast	Feasibility and Design for a Fish Auction in San Diego	Michael Conroy	$104,073	X				X	X
Promotion, Development and Marketing	2020	West Coast	A Modern Approach to a Classic Catch: Full Utilization of Tuna Landings in San Diego, CA	Catalina Offshore Products, Inc	$247,500	X		X			X
Promotion, Development and Marketing	2021	West Coast	Expanding Domestic Marketing and Commercial Export Opportunities for Micronesian Value-added Nearshore Pelagic Fish Products	MarAlliance	$299,035	X					X
Promotion, Development and Marketing	2021	West Coast	The Local Fish Initiative: Developing a Hybrid Restaurant & Community Supported Fishery Model and Web-Based Marketing Tool Built for Fishermen and Consumers	Saraspe Seafoods, LLC	$299,494	X				X	X
Promotion, Development and Marketing	2018	West Coast	Scale Up Production of a Complete Fish Feed and an Organic Fish Fertilizer from Fish Processing Waste for Sustainable Aquaculture and Agriculture in Hawaii and the Pacific Islands	Oregon Department of Agriculture	$299,899	X			X		X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
Promotion, Development and Marketing	2020	West Coast	A health and nutrition focused marketing outreach program and a supportive product and consumer appeal study, designed to revitalize market demand for underutilized MSC-certified West Coast groundfish	Positively Groundfish	$299,516	X	X			X	X
Promotion, Development and Marketing	2019	West Coast	Developing an Alternative Model for Sustainable Commercial Salmon Fisheries of the Lower Columbia River Sub-basin.	Wild Fish Conservancy	$285,646	X	X	X			X
Promotion, Development and Marketing	2020	West Coast	Advancing the Promotion, Development, and Marketing for Hawaii's Local Sustainable Fisheries	Conservation International Foundation	$299,633	X				X	X
Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting	2020	Alaska	Development and testing of an in situ imaging and identification system for the assessment of fish passage in small streams.	Prince William Sound Science Center	$282,109		X				X
Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting	2020	Alaska	Hatchery Capacity & Technology Development to Secure Oyster Seed Supply in Alaska	Alaska Fisheries Development Foundation Inc	$298,927		X		X		X
Science or Technology that Promotes Sustainable U.S. Seafood	2021	Alaska	Improving the Genetic Baseline of Western Alaska Chinook Salmon for Mixed Stock Analysis	Alaska Department of Fish and Game	$115,881		X				X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
Production and Harvesting			(MSA) in the Bering Sea								
Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting	2021	Alaska	Development of a Management Strategy Evaluation Framework for Subsistence Salmon Fisheries of the Kuskokwim River Watershed	University of Alaska Fairbanks	$266,186		X			X	X
Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting	2021	New England/Mid-Atlantic	Novel Bottom Culture of Sugar Kelp (Saccharina latissima) for Diversifying Marine Farms	Woods Hole Oceanographic Institution	$151,806		X	X	X		X
Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting	2020	New England/Mid-Atlantic	Enhancing sustainable development of the winter bait fishery for Atlantic Menhaden through the use of industry acoustics	University of Maryland Center for Environmental Science	$297,064		X	X			X
Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting	2021	New England/Mid-Atlantic	Knowledge is power: Resolving the geographic distribution and host range of OsHV-1 on the East and Gulf coasts to mitigate impediments on shellfish aquaculture commerce	University of Maryland Baltimore County	$299,376	X	X		X		X
Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting	2020	New England/Mid-Atlantic	Expanding a New England green crab pilot fishery by providing a molt detection assay and identifying seasonal aggregations for harvest	Wells National Estuarine Research Reserve	$261,620	X	X				X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting	2021	New England/Mid-Atlantic	Implications of resolving a mismatch in the scale of Atlantic cod fishery management	Gulf of Maine Research Institute	$247,161		X				X
Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting	2020	New England/Mid-Atlantic	Sustainable Innovations for the Channeled Whelk Fishery: Trap Modifications and Alternative Bait	University of New Hampshire	$296,337			X			X
Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting	2020	New England/Mid-Atlantic	Sustainable US Cleanerfish Production: Developing a Lumpfish Broodstock Program	University of New Hampshire	$296,931		X		X		X
Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting	2021	New England/Mid-Atlantic	Conservation Gear Technology- Quantifying Bycatch Reduction Benefits of an Excluder in the Small Mesh Fisheries of the Northeast with Focus on Red Hake	Cornell University Cooperative Extension of Suffolk County	$249,246			X			X
Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting	2021	New England/Mid-Atlantic	Assessment of an Alternate Frequency Pinger to Mitigate Gray Seal Interaction in the Northeast Sink Gillnet	Cornell University Cooperative Extension of Suffolk County	$206,279			X			X
Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting	2020	New England/Mid-Atlantic	CFRF's Lobster and Jonah Crab Research Fleet: A Collaborative Fishing Vessel Approach to Addressing Data Needs for the American Lobster	Commercial Fisheries Research Foundation	$194,983	X	X				X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
			and Jonah Crab Fisheries								
Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting	2021	New England/Mid-Atlantic	Economic and environmental feasibility of soft-shell clam aquaculture in Virginia	Virginia Institute of Marine Science	$300,000				X	X	X
Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting	2021	New England/Mid-Atlantic	Commercial Enhancement of Bivalve Hatchery Sustainability Through Applied Technology Application	Virginia Polytechnic Institute and State University	$169,828		X		X		X
Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting	2020	Pacific Islands	Determining Patterns and Drivers of Life-History Variation to Inform Present and Future Fishery Management in the U.S. Pacific	University of Guam	$279,786		X				X
Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting	2020	Pacific Islands	Building Resiliency in Hawaiian Fishing Communities: A Pilot Project Assessing the Feasibility of Developing a Local Fishmeal Plant	Hawaii Feed And Fertilizer LLC	$220,000	X		X	X		X
Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting	2021	Pacific Islands	Establishing a Supply and Training Program for Aquaculture Production of Hawaiian Sea Cucumber	Pacific American Foundation	$299,154	X			X		X
Science or Technology that Promotes Sustainable U.S. Seafood	2021	Pacific Islands	Community Management of a Data and Capacity Limited Coral Reef Fishery in American Samoa	Poseidon Fisheries Research LLC	$198,806		X				X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
Production and Harvesting											
Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting	2021	Pacific Islands	Engaging Hawaii's Fishing Community to Establish Marine Aquaculture Techniques for Kumu, an Endemic Hawaiian Goatfish (Parupeneus porphyreus)	Oceanic Institute of Hawaii Pacific University	$295,409	X			X		X
Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting	2020	Southeast	Creating resilient oysters (Crassostrea virginica) to enhance aquaculture and restoration	Marine Environmental Sciences Consortium	$298,985	X	X		X		X
Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting	2021	Southeast	Alabama Off Bottom Oyster Wet Storage and Depuration Facility Pilot Project Using Vacuum Air Lift (VAL) Technology	Ankers Subsea LLC	$300,000	X		X	X	X	X
Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting	2020	Southeast	Increasing Resilience for Fishing Communities of the Southeast U.S.: Development of Yellowtail Snapper (Ocyurus chrysurus) Pilot-scale Growout Technology	University of Miami	$299,917	X	X		X		X
Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting	2020	Southeast	Novel technology development to create in situ point of use field-tester for red tide toxins in shellfish	Mote Marine Laboratory, Inc.	$300,000	X	X				X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting	2020	Southeast	Strengthening the Supply Chain for Lionfish to Promote Fishing and Protect Native Species	Reef Environmental Education	$299,087	X		X			X
Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting	2020	Southeast	Application of IMTA-Technology to Revive and Sustain Livelihood of Fishing Communities in Puerto Rico	Florida Institute of Technology, Inc.	$299,424	X			X		X
Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting	2021	Southeast	Moving toward Science-driven Management of Bottomfish Stocks in Guam and the CNMI	The University of Central Florida Board of Trustees	$300,000		X				X
Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting	2021	Southeast	Refining Culture Methods to Improve Aquaculture Production of Hogfish (Lachnolaimus maximus)	University of Florida	$300,000		X		X		X
Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting	2021	Southeast	Enhancing Marine Aquaculture in the Tropical U.S.: Methods for sustainable commercial co-cultivation of shellfish and seaweed in Florida	Two Docks Shellfish, LLC	$264,481		X		X		X
Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting	2021	Southeast	A Fishers-Operated Queen Conch Hatchery for Growout of Sustainable Seafood for Local Markets in Puerto Rico (Tracking# 21SER020)	Florida Atlantic University	$299,283	X	X		X		X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting	2021	Southeast	Strengthening the Georgia hard clam industry through expansion into southern quahog, Mercenaria campechiensis, mariculture.	The University of Georgia Research Foundation, Inc.	$229,704	X	X		X		X
Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting	2020	Southeast	Epidemiology and Reproductive Impacts of the newly discovered Egg Parasite Carcinonemertes obrieni on the Caribbean Spiny Lobster Fishery in Florida and the Caribbean.	Clemson University	$298,235		X				X
Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting	2021	Southeast	Methylation-Based Aging: An Efficient Approach to Mass-ageing Fisheries Species	Texas A&M University - Corpus Christi	$297,986		X				X
Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting	2020	West Coast	Combining Underwater Video and Hook and Line Surveys of Untrawlable Areas in the Cowcod Conservation Areas to Inform Harvest Opportunities and Management Measures	San Jose State University Research Foundation	$300,000		X	X			X
Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting	2020	West Coast	Creating new products and markets - Development of techniques for the cultivation of monkeyface pricklebacks as a sustainable	San Jose State University Research Foundation	$300,000	X			X		X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting	2021	West Coast	Expanding selective fishing operations and supporting management of opah off the California coast.	Pfleger Institute of Environmental Research	$260,500	X	X	X			X
Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting	2020	West Coast	Toward a more sustainable and data-driven management paradigm for the vermilion rockfish complex	Pacific States Marine Fisheries Commission	$299,229		X				X
Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting	2020	West Coast	Consumer Acceptability and Shelf-life Assessment of Frozen Seafood for Market Success	Oregon State University	$299,957	X		X			X
Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting	2021	West Coast	Liposome-based microparticles for improved nutrition and production efficiency of marine fish larvae	Oregon State University	$299,962		X		X		X
Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting	2020	West Coast	Utilize an industry-seine fishing vessel to enhance data collection and improve assessment of Pacific Coast pelagic species for the benefit of the fishing industry and fishing communities	Ocean Gold Seafoods, Inc	$295,800		X				X
Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting	2021	West Coast	Development and testing of a fish oil diffuser as an alternative method of baiting crab pots	University of Washington	$67,283			X			X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting	2021	West Coast	Building resiliency in tribal fishing communities: Using Indigenous aquaculture techniques to enhance clam production	Swinomish Indian Tribal Community	$299,060		X		X	X	X
Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting	2021	West Coast	Increasing US fisheries yields by reducing bycatch: the potential of dynamic ocean management and other tools to adapt to climate change	University of Washington	$258,483		X	X			X
Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting	2021	West Coast	Understanding Triploid Pacific Oyster Mortalities on the U.S. West Coast	Pacific Shellfish Institute	$299,853		X		X		X
Science or Technology that Promotes Sustainable U.S. Seafood Production and Harvesting	2021	West Coast	From nuisance to profit: Monetizing seaweeds and cockles that foul shellfish aquaculture farms	Puget Sound Restoration Fund	$298,017	X	X		X		X
Techniques for Reducing Bycatch and other Adverse Impacts	2016	New England/Mid-Atlantic	Complementary testing of off-bottom trawls to target Georges Bank haddock	Fish And Game, Massachusetts Department Of	$299,083			X			X
Techniques for Reducing Bycatch and other Adverse Impacts	2016	New England/Mid-Atlantic	Improving the selectivity of lobster traps to reduce the incidental capture of groundfish	Gulf of Maine Research Institute	$158,217			X			X
Techniques for Reducing Bycatch and other Adverse Impacts	2016	New England/Mid-Atlantic	Evaluation of Conservation Gear Technology to Reduce Black Sea Bass Bycatch in the	Cornell University Cooperative Extension of Suffolk County	$119,520			X			X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
			Small Mesh Longfin Squid Fishery								
Techniques for Reducing Bycatch and other Adverse Impacts	2016	Southeast	Development of Specialized Turtle Excluder Devices (TEDs) Designed to Eliminate Bycatch of Sea Turtles in Small Skimmer Trawls, Wing Nets, and Try Nets with Headrope Lengths Less than 12 feet	University of New Orleans	$232,559			X			X
Techniques for Reducing Bycatch and other Adverse Impacts	2017	Southeast	Evaluating the Efficacy of Descender Devices in Promoting the Survival of Deepwater Groupers Using Telemetry	North Carolina State University	$295,651		X	X			X
Techniques for Reducing Bycatch and other Adverse Impacts	2016	Southeast	Trawl Gear Modification Workshop For the U.S. West Coast and Alaska	Buccaneer Fishing	$69,250			X			X
Techniques for Reducing Bycatch and other Adverse Impacts	2017	West Coast	Exempted testing of deep-set techniques to reduce bycatch in the west coast swordfish fishery	Pfleger Institute of Environmental Research	$229,777	X		X			X
Techniques for Reducing Bycatch and other Adverse Impacts	2016	West Coast	Further testing of LED lights as a technique to reduce bycatch in the ocean shrimp trawl fishery	Pacific States Marine Fisheries Commission	$133,843			X			X
Techniques for Reducing Bycatch and other Adverse Impacts	2016	West Coast	Perfecting the design of the čibu.d to reduce bycatch of overfished rockfish species during recreational halibut fisheries	Makah Indian Tribe of The Makah Indian Reservation	$138,080			X			X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
Techniques for Reducing Bycatch and other Adverse Impacts	2017	West Coast	Improving discard mortality rate estimates in the Pacific halibut by integrating handling practices, physiological condition and post-release survival	International Pacific Halibut Commission	$286,121		X	X			X
Territorial Science	2017	Pacific Islands	Expansion of the existing Saipan Bio-sampling Data Collection Program (Northern Mariana Islands) into age & growth and sexual maturity research for commercially important reef fish species	Micronesian Environmental Services	$290,018	X	X				X
Territorial Science	2013	Pacific Islands	Age-validated life history using bomb radiocarbon dating in support of Territorial Science and Bio-sampling of fisheries in Guam and the Commonwealth of the Northern Mariana Islands.	University of Guam	$196,112		X				X
Territorial Science	2016	Pacific Islands	Development of Fish Import and Export Data Collection and Monitoring System in the Mariana Islands	Government of Guam-Department of Administration	$245,195		X				X
Territorial Science	2013	Pacific Islands	Rapid Increases in Reproductive Information for Exploited Reef Fishes and in Research Capacity on US-Associated Pacific Islands	Bishop Museum	$161,482		X				X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
Territorial Science	2016	Pacific Islands	American Samoa - Jungle Histology	Bishop Museum	$201,611		X				X
Territorial Science	2018	Pacific Islands	Exploratory research and data collection to determine viability of developing a squid fishery in the Mariana Islands	Pacific Islands Fisheries Group	$216,260	X	X				X
Territorial Science	2018	Pacific Islands	Fisheries 101: Improving Territorial Science and Fishery Management in US Pacific Islands	Hawaii Seafood Council	$165,000						X
Territorial Science	2018	Southeast	Achieving sustainability and building capacity for Puerto Rico's HMS fisheries: A fisheries-dependent and fisheries-independent research, education and outreach program	Mote Marine Laboratory, Inc.	$255,790		X				X
Territorial Science	2018	Southeast	A commercial fishery census of Puerto Rico to develop a new baseline on fishery participation, markets, and infrastructure in the small-scale fishery sector	Marine & Coastal Research, Corp.	$127,149					X	X
Territorial Science	2018	Southeast	Investigating the use of eDNA sampling to locate fish spawning aggregations	Isla Mar Research Expeditions, LLC	$292,755		X				X
Territorial Science	2018	Southeast	Novel Approaches to Age Validation in Data-Poor U.S. Caribbean Reef Fishes	University of South Carolina	$299,817		X				X

Funding Priority	Year	NOAA Region	Project Title	Applicant	Amount Funded	Seafood Promotion and Marketing	Research and Monitoring	Gear Testing, Bycatch Reduction, and Processing	Aquaculture	Socioeconomic Research	Outreach, Education, and Planning
Territorial Science	2017	West Coast	Estimates of movement, stock structure and mortality to improve assessment and conservation of Red Hind in the US Virgin Islands	Oregon State University	$292,526		X				X

Appendix C: Protected Species Tables

Table C-1. ESA-Listed Fish Occurring in the Action Area

Group	Common Name	Scientific Name	ESA Status	Lead Agency	Region*	Critical Habitat
Perch-likes (Perciformes)	Nassau grouper	*Epinephelus striatus*	Threatened	NMFS	SER	No
Perch-likes (Perciformes)	Tidewater goby	*Eucyclogobius newberryi*	Endangered	USFWS	WCR	Yes
Salmon. Smelts, etc. (Salmoniformes)	Atlantic salmon (Gulf of Maine DPS)	*Salmo salar*	Endangered	USFWS/ NMFS	GAR	Yes
Salmon. Smelts, etc. (Salmoniformes)	Chinook salmon (California Coastal ESU)	*Oncorhynchus tshawytscha*	Threatened	NMFS	WCR	Yes
Salmon. Smelts, etc. (Salmoniformes)	Chinook salmon (Central Valley Spring-run ESU)	*Oncorhynchus tshawytscha*	Threatened	NMFS	WCR	Yes
Salmon. Smelts, etc. (Salmoniformes)	Chinook salmon (Lower Columbia River ESU)	*Oncorhynchus tshawytscha*	Threatened	NMFS	WCR	Yes
Salmon. Smelts, etc. (Salmoniformes)	Chinook salmon (Puget Sound ESU)	*Oncorhynchus tshawytscha*	Threatened	NMFS	WCR	Yes
Salmon. Smelts, etc. (Salmoniformes)	Chinook salmon (Sacramento River Winter-run ESU)	*Oncorhynchus tshawytscha*	Endangered	NMFS	WCR	Yes
Salmon. Smelts, etc. (Salmoniformes)	Chinook salmon (Snake River Fall-run ESU)	*Oncorhynchus tshawytscha*	Threatened	NMFS	WCR	Yes
Salmon. Smelts, etc. (Salmoniformes)	Chinook salmon (Snake River Spring/Summer-run ESU)	*Oncorhynchus tshawytscha*	Threatened	NMFS	WCR	Yes
Salmon. Smelts, etc. (Salmoniformes)	Chinook salmon (Upper Columbia River Spring-run ESU)	*Oncorhynchus tshawytscha*	Endangered	NMFS	WCR	Yes
Salmon. Smelts, etc. (Salmoniformes)	Chinook salmon (Upper Willamette River ESU)	*Oncorhynchus tshawytscha*	Threatened	NMFS	WCR	Yes
Salmon. Smelts, etc. (Salmoniformes)	Chinook salmon (Upper Klamath-Trinity River)	*Oncorhynchus tshawytscha*	Candidate	NMFS	WCR	--
Salmon. Smelts, etc. (Salmoniformes)	Chum salmon (Columbia River ESU)	*Oncorhynchus keta*	Threatened	NMFS	WCR	Yes
Salmon. Smelts, etc. (Salmoniformes)	Chum salmon (Hood Canal Summer-run ESU)	*Oncorhynchus keta*	Threatened	NMFS	WCR	Yes
Salmon. Smelts, etc. (Salmoniformes)	Coho salmon (Central California Coast ESU)	*Oncorhynchus kisutch*	Endangered	NMFS	WCR	Yes
Salmon. Smelts, etc. (Salmoniformes)	Coho salmon (Lower Columbia River ESU)	*Oncorhynchus kisutch*	Threatened	NMFS	WCR	Yes
Salmon. Smelts, etc. (Salmoniformes)	Coho salmon (Oregon Coast ESU)	*Oncorhynchus kisutch*	Threatened	NMFS	WCR	Yes
Salmon. Smelts, etc. (Salmoniformes)	Coho salmon (Southern Oregon/Northern California Coast ESU)	*Oncorhynchus kisutch*	Threatened	NMFS	WCR	Yes
Salmon. Smelts, etc. (Salmoniformes)	Sockeye salmon (Ozette Lake ESU)	*Oncorhynchus nerka*	Threatened	NMFS	WCR	Yes
Salmon. Smelts, etc. (Salmoniformes)	Sockeye salmon (Snake River ESU)	*Oncorhynchus nerka*	Endangered	NMFS	WCR	Yes

Group	Common Name	Scientific Name	ESA Status	Lead Agency	Region*	Critical Habitat
Salmon. Smelts, etc. (Salmoniformes)	Steelhead (California Central Valley DPS)	*Oncorhynchus mykiss*	Threatened	NMFS	WCR	Yes
Salmon. Smelts, etc. (Salmoniformes)	Steelhead (Central California Coast DPS)	*Oncorhynchus mykiss*	Threatened	NMFS	WCR	Yes
Salmon. Smelts, etc. (Salmoniformes)	Steelhead (Lower Columbia River DPS)	*Oncorhynchus mykiss*	Threatened	NMFS	WCR	Yes
Salmon. Smelts, etc. (Salmoniformes)	Steelhead (Middle Columbia River DPS)	*Oncorhynchus mykiss*	Threatened	NMFS	WCR	Yes
Salmon. Smelts, etc. (Salmoniformes)	Steelhead (Northern California DPS)	*Oncorhynchus mykiss*	Threatened	NMFS	WCR	Yes
Salmon. Smelts, etc. (Salmoniformes)	Steelhead (Puget Sound DPS)	*Oncorhynchus mykiss*	Threatened	NMFS	WCR	Yes
Salmon. Smelts, etc. (Salmoniformes)	Steelhead (Snake River Basin DPS)	*Oncorhynchus mykiss*	Threatened	NMFS	WCR	Yes
Salmon. Smelts, etc. (Salmoniformes)	Steelhead (South Central California Coast DPS)	*Oncorhynchus mykiss*	Threatened	NMFS	WCR	Yes
Salmon. Smelts, etc. (Salmoniformes)	Steelhead (Southern California DPS)	*Oncorhynchus mykiss*	Endangered	NMFS	WCR	Yes
Salmon. Smelts, etc. (Salmoniformes)	Steelhead (Upper Columbia River DPS)	*Oncorhynchus mykiss*	Threatened	NMFS	WCR	Yes
Salmon. Smelts, etc. (Salmoniformes)	Steelhead (Upper Willamette River DPS)	*Oncorhynchus mykiss*	Threatened	NMFS	WCR	Yes
Salmon. Smelts, etc. (Salmoniformes)	Bull trout (Coastal Recovery Unit)	*Salvelinus confluentus*	Threatened	USFWS	WCR	Yes
Salmon. Smelts, etc. (Salmoniformes)	Eulachon (Southern DPS)	*Thaleichthys pacificus*	Threatened	NMFS	WCR, AR	Yes
Scorpionfishes (Scorpaeniformes)	Bocaccio (Puget Sound/Georgia Basin DPS)	*Sebastes paucispinis*	Endangered	NMFS	WCR, AR	No
Scorpionfishes (Scorpaeniformes)	Yelloweye rockfish (Puget Sound/Georgia Basin DPS)	*Sebastes ruberrimus*	Threatened	NMFS	WCR, AR	Yes
Sharks, Skates, Rays, & Chimeras (Chondrichthyes)	Giant manta ray	*Manta birostris*	Threatened	NMFS	GAR, SER, PIR	No
Sharks, Skates, Rays, & Chimeras (Chondrichthyes)	Scalloped hammerhead shark (Eastern Pacific DPS)	*Sphyrna lewini*	Endangered	NMFS	WCR, PIR	No
Sharks, Skates, Rays, & Chimeras (Chondrichthyes)	Scalloped hammerhead shark (Central and Southwest Atlantic DPS)	*Sphyrna lewini*	Threatened	NMFS	SER	No
Sharks, Skates, Rays, & Chimeras (Chondrichthyes)	Scalloped hammerhead shark (Indo-West Pacific DPS)	*Sphyrna lewini*	Threatened	NMFS	PIR	No
Sharks, Skates, Rays, & Chimeras (Chondrichthyes)	Largetooth sawfish	*Pristis*	Endangered	NMFS	SER	No
Sharks, Skates, Rays, & Chimeras (Chondrichthyes)	Smalltooth sawfish	*Pristis pectinata*	Endangered	NMFS	SER	No

Group	Common Name	Scientific Name	ESA Status	Lead Agency	Region*	Critical Habitat
Sturgeons (Acipenseriformes)	Atlantic sturgeon (New York Bight DPS)**	*Acipenser oxyrinchus*	Endangered	NMFS	GAR	Yes
Sturgeons (Acipenseriformes)	Atlantic sturgeon (Carolina DPS)**	*Acipenser oxyrinchus*	Endangered	NMFS	SER	Yes
Sturgeons (Acipenseriformes)	Atlantic sturgeon (Chesapeake Bay DPS)**	*Acipenser oxyrinchus*	Endangered	NMFS	GAR	Yes
Sturgeons (Acipenseriformes)	Atlantic sturgeon (South Atlantic DPS)**	*Acipenser oxyrinchus*	Endangered	NMFS	SER	Yes
Sturgeons (Acipenseriformes)	Atlantic sturgeon (Gulf of Maine DPS)**	*Acipenser oxyrinchus*	Threatened	NMFS	GAR	Yes
Sturgeons (Acipenseriformes)	Atlantic sturgeon (Gulf of Mexico subspecies)	*Acipenser oxyrinchus desotoi*	Threatened	USFWS/ NMFS	SER	Yes
Sturgeons (Acipenseriformes)	Green sturgeon (Southern DPS)	*Acipenser medirostris*	Threatened	NMFS	WCR	Yes
Sturgeons (Acipenseriformes)	Shortnose sturgeon	*Acipenser brevirostrum*	Endangered	NMFS	GAR, SER	No

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

*** All five Atlantic sturgeon DPSs mix in the offshore/marine environment (i.e., an adult Atlantic sturgeon encountered in the Atlantic Ocean could be from any one of the five DPSs).*

Table C-2. Cetaceans Occurring in the Action Area

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

Group	Common Name	Scientific Name	MMPA Depleted?	ESA Status	Lead Agency	Region	Critical Habitat	General Habitat
Baleen Whales – Mysticetes	Humpback whale	*Megaptera novaeangliae*		--	NMFS	All	--	Shallow to deep waters
Baleen Whales – Mysticetes	Humpback whale (Mexico DPS)	*Megaptera novaeangliae*		Threatened	NMFS	WCR, AR	No	Shallow to deep waters
Baleen Whales – Mysticetes	Humpback whale (Central America DPS)	*Megaptera novaeangliae*		Endangered	NMFS	WCR	No	Shallow to deep waters
Baleen Whales – Mysticetes	Humpback whale (Western North Pacific DPS)	*Megaptera novaeangliae*		Endangered	NMFS	AR, PIR	No	Shallow to deep waters
Toothed Whales	Baird's beaked whale	*Berardius bairdii*	No	--	NMFS	WCR, AR	--	Cold, deep, oceanic waters, occasionally near shore along narrow continental shelves
Toothed Whales	Beluga whale	*Delphinapterus leucas*	No	--	NMFS	AR	--	Shallow coastal waters, deep water, estuaries, and large river deltas
Toothed Whales	Beluga whale (Cook Inlet DPS)	*Delphinapterus leucas*	Yes: Cook Inlet stock	Endangered	NMFS	AR	Yes	Shallow coastal waters, deep water, estuaries, and large river deltas
Toothed Whales	Long-beaked common dolphin	*Delphinus capensis*	No	--	NMFS	WCR	--	Shallow, tropical, subtropical, and warmer temperate waters closer to the coast and on the continental shelf
Toothed Whales	Short-beaked common dolphin	*Delphinus delphis*	No	--	NMFS	GAR, SER, WCR, PIR	--	Oceanic and offshore, underwater ridges, seamounts, and continental shelf
Toothed Whales	Pygmy killer whale	*Feresa attenuata*	No	--	NMFS	GAR, SER, PIR	--	Deep water

Group	Common Name	Scientific Name	MMPA Depleted?	ESA Status	Lead Agency	Region	Critical Habitat	General Habitat
Toothed Whales	Long-finned pilot whale	*Globicephala melas*	No	--	NMFS	GAR, SER	--	Pelagic
Toothed Whales	Short-finned pilot whale	*Globicephala macrorhynchus*	No	--	NMFS	All	--	Pelagic
Toothed Whales	Risso's dolphin	*Grampus griseus*	No	--	NMFS	All	--	Pelagic over steep slopes, seamounts, and escarpments
Toothed Whales	Northern bottlenose whale	*Hyperoodon ampullatus*	No	--	NMFS	GAR	--	Pelagic deep water; known to forage in submarine canyons
Toothed Whales	Longman's beaked Whale	*Indopacetus pacificus*	No	--	NMFS	PIR	--	Warm, deep pelagic waters
Toothed Whales	Pygmy sperm whale	*Kogia breviceps*	No	--	NMFS	GAR, SER, WCR, PIR	--	Continental shelf edge, deep water
Toothed Whales	Dwarf sperm whale	*Kogia sima*	No	--	NMFS	GAR, SER, WCR, PIR	--	Continental shelf edge, deep water
Toothed Whales	Atlantic white-sided dolphin	*Lagenorhynchus acutus*	No	--	NMFS	GAR, SER	--	Continental shelf, slope, and canyons
Toothed Whales	White-beaked dolphin	*Lagenorhynchus albirostris*	No	--	NMFS	GAR	--	Continental shelf waters, especially along shelf edge
Toothed Whales	Fraser's dolphin	*Lagenodelphis hosei*	No	--	NMFS	SER, PIR	--	Waters over 1,000 m (3,280 ft) deep
Toothed Whales	Pacific white-sided dolphin	*Lagenorhynchus obliquidens*	No	--	NMFS	AR, WCR	--	Continental margins, occasionally enter inshore passages
Toothed Whales	Northern right whale dolphin	*Lissodelphis borealis*	No	--	NMFS	WCR	--	Shelf and slope waters up to and >2,000m
Toothed Whales	Sowerby's beaked whale	*Mesoplodon bidens*	No	--	NMFS	GAR	--	Pelagic deep water of continental shelf edge and slopes
Toothed Whales	Hubbs' beaked whale	*Mesoplodon carlhubbsi*	No	--	NMFS	WCR	--	Pelagic deep water

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

Group	Common Name	Scientific Name	MMPA Depleted?	ESA Status	Lead Agency	Region	Critical Habitat	General Habitat
Toothed Whales	False killer whale (Main Hawaiian Islands Insular DPS)	*Pseudorca crassidens*	Yes: Main Hawaiian Islands Insular stock	Endangered	NMFS	PIR	Yes	Deep offshore waters
Toothed Whales	Pantropical spotted dolphin	*Stenella attenuata*	No	--	NMFS	GAR, SER, PIR	--	Deeper waters
Toothed Whales	Clymene dolphin	*Stenella clymene*	No	--	NMFS	GAR, SER	--	Deep tropical, subtropical, and temperate waters throughout the Atlantic Ocean
Toothed Whales	Striped dolphin	*Stenella coeruleoalba*	No	--	NMFS	GAR, SER, WCR, PIR	--	Pelagic edge of continental shelf, occasionally coastal
Toothed Whales	Atlantic spotted dolphin	*Stenella frontalis*	No	--	NMFS	GAR, SER	--	Continental shelf waters <250 m (820 ft) deep
Toothed Whales	Spinner dolphin	*Stenella longirostris*	No	--	NMFS	GAR, SER, PIR	--	Pelagic and near oceanic islands
Toothed Whales	Rough-toothed dolphin	*Steno bredanensis*	No	--	NMFS	GAR, SER, WCR, PIR	--	Deep offshore waters

Group	Common Name	Scientific Name	MMPA Depleted?	ESA Status	Lead Agency	Region	Critical Habitat	General Habitat
Toothed Whales	Bottlenose dolphin	*Tursiops truncatus*	Yes: Western North Atlantic Central Florida Coastal stock, Western North Atlantic Northern Florida Coastal stock, Western North Atlantic Northern Migratory Coastal stock, Western North Atlantic South Carolina-Georgia Coastal stock, and Western North Atlantic Southern Migratory Coastal stock	--	NMFS	GAR, SER, WCR, PIR	--	Harbors, bays, gulfs, estuaries, nearshore coastal waters, deeper waters over the continental shelf, and far offshore pelagic
Toothed Whales	Cuvier's beaked whale	*Ziphius cavirostris*	No	--	NMFS	All	--	Pelagic deep water

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

Table C-3. Pinnipeds, Manatees, and Fissipeds Occurring in the Action Area

Group	Common Name	Scientific Name	MMPA Depleted?	ESA Status	Lead Agency	Region	Critical Habitat	General Habitat
Walruses-Obodenids	Pacific walrus	*Odobenus rosmarus*	No	--	USFWS	AR	--	Coastal, loose pack ice
Eared Seals – Otariids	Guadalupe fur seal	*Arctocephalus townsendi*	Yes: throughout its range	Threatened	NMFS	WCR	No	Coastal, shelf, pelagic during foraging
Eared Seals – Otariids	Northern fur seal	*Callorhinus ursinus*	Yes: Pribilof Island/ Eastern Pacific stock	--	NMFS	AR, WCR	--	Pelagic, coastal
Eared Seals – Otariids	Steller sea lion (Western DPS)	*Eumetopias jubatus*	Yes: Western DPS	Endangered	NMFS	AR	Yes	Coastal, shelf, sea ice
Eared Seals – Otariids	Steller sea lion (Eastern DPS)	*Eumetopias jubatus*	No	--	NMFS	WCR, AR	Yes	Coastal, shelf, sea ice
Eared Seals – Otariids	California sea lion	*Zalophus californianus*	No	--	NMFS	WCR	--	Coastal, shelf

Group	Common Name	Scientific Name	MMPA Depleted?	ESA Status	Lead Agency	Region	Critical Habitat	General Habitat
Earless Seals – Phocids	Hooded seal	*Cystophora cristata*	No	--	NMFS	GAR	--	Pack ice and pelagic
Earless Seals – Phocids	Bearded seal (Beringia DPS)	*Erignathus barbatus nauticus*	Yes: Beringia DPS	Threatened	NMFS	AR	No	Sea ice, shelf areas
Earless Seals – Phocids	Gray seal	*Halichoerus grypus*	No	--	NMFS	GAR	--	Coastal, coastal waters
Earless Seals – Phocids	Ribbon seal	*Histriophoca fasciata*	No	--	NMFS	AR	--	Pack ice and pelagic
Earless Seals – Phocids	Northern elephant seal	*Mirounga angustirostris*	No	--	NMFS	WCR, AR	--	Coastal to pelagic during foraging and migrating
Earless Seals – Phocids	Hawaiian monk seal	*Neomonachus schauinslandi*	Yes: throughout its range	Endangered	NMFS	PIR	Yes	Coastal, reefs, submerged banks, deepwater coral beds, pelagic
Earless Seals – Phocids	Harp seal	*Pagophilus groenlandicus*	No	--	NMFS	GAR	--	Pack ice and pelagic
Earless Seals – Phocids	Ringed seal (Arctic subspecies)	*Phoca hispida*	Yes: Arctic subspecies	Threatened	NMFS	AR	No	Pack ice
Earless Seals – Phocids	Spotted seal (Bering Sea DPS)	*Phoca largha*	No	--	NMFS	AR	--	Seasonal sea ice, coastal, pelagic
Earless Seals – Phocids	Harbor seal	*Phoca vitulina*	No	--	NMFS	GAR, WCR, AR	--	Coastal waters
Manatees	West Indian manatee (Antillean subspecies)	*Trichechus manatus*	Yes: Antillean subspecies	Threatened	USFWS	SER	No	Submerged aquatic vegetation in shallow freshwater, brackish water, and marine waters
Manatees	West Indian manatee (Florida subspecies)	*Trichechus manatus latirostris*	Yes: Florida subspecies	Threatened	USFWS	SER	Yes	Submerged aquatic vegetation in shallow freshwater, brackish water, and marine waters
Mustelids	Northern sea otter	*Enhydra lutris kenyoni*	No	--	USFWS	AR, WCR	--	Shallow, coastal, kelp forests
Mustelids	Northern sea otter (Southwest Alaska DPS)	*Enhydra lutris kenyoni*	Yes: Southwest Alaska DPS	Threatened	USFWS	AR	Yes	Shallow, coastal, kelp forests

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

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Table C-4. Sea Turtles Occurring in the Action Area

Group	DPS (if applicable)	ESA Status	Lead Agency	Region	Critical Habitat	General Habitat
Loggerhead – Caretta	Northwest Atlantic	Threatened	NMFS, USFWS	GAR, SER	Yes	Nesting: occurs from April to September, peaking in June and July. Within the action area, nesting for the Northwest Atlantic DPS typically occurs on high energy, narrow, steep, coarse-grained beaches from Texas to Virginia. Most nesting within the action area occurs within Florida, Georgia, South Carolina, and North Carolina. Outside the action area, the North Pacific DPS nests in Japan and the South Pacific DPS nests mainly in Queensland, Australia. Post hatchling: local downwellings with floating algae and/or seaweed. Pelagic developmental phase (7-15 years): offshore oceanic zone. Late juvenile and adult: nearshore coastal and/or continental shelf.
Loggerhead – Caretta	North Pacific	Endangered	NMFS, USFWS	WCR, AR	No	Nesting: occurs from April to September, peaking in June and July. Within the action area, nesting for the Northwest Atlantic DPS typically occurs on high energy, narrow, steep, coarse-grained beaches from Texas to Virginia. Most nesting within the action area occurs within Florida, Georgia, South Carolina, and North Carolina. Outside the action area, the North Pacific DPS nests in Japan and the South Pacific DPS nests mainly in Queensland, Australia. Post hatchling: local downwellings with floating algae and/or seaweed. Pelagic developmental phase (7-15 years): offshore oceanic zone. Late juvenile and adult: nearshore coastal and/or continental shelf.
Loggerhead – Caretta	South Pacific	Endangered	NMFS	PIR	No	Nesting: occurs from April to September, peaking in June and July. Within the action area, nesting for the Northwest Atlantic DPS typically occurs on high energy, narrow, steep, coarse-grained beaches from Texas to Virginia. Most nesting within the action area occurs within Florida, Georgia, South Carolina, and North Carolina. Outside the action area, the North Pacific DPS nests in Japan and the South Pacific DPS nests mainly in Queensland, Australia. Post hatchling: local downwellings with floating algae and/or seaweed. Pelagic developmental phase (7-15 years): offshore oceanic zone. Late juvenile and adult: nearshore coastal and/or continental shelf.
Green – Chelonia mydas	North Atlantic	Threatened	NMFS, USFWS	GAR, SER	Yes	Nesting: Occurs from June to September. Nesting typically occurs on beaches with a sloping platform and minimal disturbance. Most nesting within the action area occurs in Florida and Hawaii, with some nesting occurring in the U.S. Virgin Islands, Puerto Rico, Georgia, South Carolina, and North Carolina. Pelagic developmental phase (5 to 7 years): offshore oceanic zone, pelagic drift communities. Late juvenile and adult: Nearshore, bays, lagoons, reefs, especially areas with seagrass beds.
Green – Chelonia mydas	South Atlantic	Threatened	NMFS, USFWS	SER	No	Nesting: Occurs from June to September. Nesting typically occurs on beaches with a sloping platform and minimal disturbance. Most nesting within the action area occurs in Florida and Hawaii, with some nesting occurring in the U.S. Virgin Islands, Puerto Rico, Georgia, South Carolina, and North Carolina.

Group	DPS (if applicable)	ESA Status	Lead Agency	Region	Critical Habitat	General Habitat
						Pelagic developmental phase (5 to 7 years): offshore oceanic zone, pelagic drift communities. Late juvenile and adult: Nearshore, bays, lagoons, reefs, especially areas with seagrass beds.
Green – Chelonia mydas	Central North Pacific	Threatened	NMFS, USFWS	PIR	No	Nesting: Occurs from June to September. Nesting typically occurs on beaches with a sloping platform and minimal disturbance. Most nesting within the action area occurs in Florida and Hawaii, with some nesting occurring in the U.S. Virgin Islands, Puerto Rico, Georgia, South Carolina, and North Carolina. Pelagic developmental phase (5 to 7 years): offshore oceanic zone, pelagic drift communities. Late juvenile and adult: Nearshore, bays, lagoons, reefs, especially areas with seagrass beds.
Green – Chelonia mydas	Central West Pacific	Endangered	NMFS, USFWS	PIR	No	Nesting: Occurs from June to September. Nesting typically occurs on beaches with a sloping platform and minimal disturbance. Most nesting within the action area occurs in Florida and Hawaii, with some nesting occurring in the U.S. Virgin Islands, Puerto Rico, Georgia, South Carolina, and North Carolina. Pelagic developmental phase (5 to 7 years): offshore oceanic zone, pelagic drift communities. Late juvenile and adult: Nearshore, bays, lagoons, reefs, especially areas with seagrass beds.
Green – Chelonia mydas	Central South Pacific	Endangered	NMFS, USFWS	PIR	No	Nesting: Occurs from June to September. Nesting typically occurs on beaches with a sloping platform and minimal disturbance. Most nesting within the action area occurs in Florida and Hawaii, with some nesting occurring in the U.S. Virgin Islands, Puerto Rico, Georgia, South Carolina, and North Carolina. Pelagic developmental phase (5 to 7 years): offshore oceanic zone, pelagic drift communities. Late juvenile and adult: Nearshore, bays, lagoons, reefs, especially areas with seagrass beds.
Green – Chelonia mydas	East Pacific	Threatened	NMFS, USFWS	WCR	No	Nesting: Occurs from June to September. Nesting typically occurs on beaches with a sloping platform and minimal disturbance. Most nesting within the action area occurs in Florida and Hawaii, with some nesting occurring in the U.S. Virgin Islands, Puerto Rico, Georgia, South Carolina, and North Carolina. Pelagic developmental phase (5 to 7 years): offshore oceanic zone, pelagic drift communities. Late juvenile and adult: Nearshore, bays, lagoons, reefs, especially areas with seagrass beds.
Hawksbill – Ertmochelys imbricate	--	Endangered	NMFS, USFWS	GAR, SER, WCR, PIR	Yes	Nesting: Occurs April to November. Nesting occurs on beaches and "pocket" beaches with little or no sand. Most nesting within the action area occurs within the U.S. Virgin Islands, Puerto Rico, and Hawaii. Nest sites have also been documented in American Samoa and Guam. Pelagic developmental phase: offshore oceanic zone, floating algal mats, flotsam and jetsam drift lines. Late juvenile and adult: shallow coastal zones, coral reefs, high-energy shoals, and mangroves.
Kemp's Ridley - *Lepidochelys kempii*	--	Endangered	NMFS, USFWS	GAR, SER	No	Nesting: Occurs from April to July. Nesting within the action area occurs primarily on Texas beaches of the Gulf of Mexico, although nest sites have been documented on Atlantic beaches of North Carolina, South Carolina, and Florida.

Group	DPS (if applicable)	ESA Status	Lead Agency	Region	Critical Habitat	General Habitat
						Pelagic developmental phase (1 to 2 years): offshore oceanic zone primarily of the Gulf of Mexico but also the Atlantic by way of the Gulf Stream, floating Sargassum mats. Juvenile and adult: nearshore, areas of the Gulf of Mexico or northwestern Atlantic.
Olive Ridley - *Lepidochelys olivacea*	--	Threatened	NMFS, USFWS	SER, WCR, PIR	No	Nesting: Occurs from June to December up to 3 times in a single nesting season. Nesting occurs outside the action area in the Pacific beaches of Mexico and Costa Rica; and in Indian Ocean beaches of India, Bangladesh, Myanmar, Malaysia, and Pakistan. Breeding: coastal areas Juvenile/adult: mainly pelagic, but can inhabit coastal areas, bays, and estuaries.
Leatherback - *Dermochelys coriacea*	--	Endangered	NMFS, USFWS	All	Yes	Nesting: Occurs from March to July on beaches. Nesting within the action area occurs on the Atlantic coast of Florida, the U.S. Virgin Islands, and Puerto Rico. Juvenile/adult: pelagic

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Table C-5. Federally Protected Seabirds, Shorebirds, and Coastal Birds, and Waterfowl Occurring in the Action Area

Group	Common Name	Scientific Name	ESA Status	Lead Agency	Region *	Critical Habitat
Seabirds	Marbled murrelet	*Brachyramphus marmoratus*	Threatened	USFWS	WCR	Yes
Seabirds	Band-rumped storm-petrel	*Oceanodroma castro*	Endangered	USFWS	PIR	No
Seabirds	Short-tailed albatross	*Phoebastria albatrus*	Endangered	USFWS	AR, PIR, WCR	No
Seabirds	Hawaiian petrel	*Pterodroma sandwichensis*	Endangered	USFWS	PIR	No
Seabirds	Newell's shearwater	*Puffinus auricularis newelli*	Threatened	USFWS	PIR	No
Seabirds	California least tern	*Sternula antillarum browni*	Endangered	USFWS	WCR	No
Seabirds	Roseate tern	*Sterna dougallii*	Threatened	USFWS	GAR	No
Shorebirds and Coastal Birds	Red knot	*Calidris canutus rufa*	Threatened	USFWS	GAR, SER	No
Shorebirds and Coastal Birds	Piping Plover	*Charadrius melodus*	Threatened	USFWS	GAR, SER	Yes
Shorebirds and Coastal Birds	Western snowy plover	*Charadrius nivosus*	Threatened	USFWS	WCR	Yes
Shorebirds and Coastal Birds	Hawaiian coot	*Fulica americana alai*	Endangered	USFWS	PIR	No
Shorebirds and Coastal Birds	Whooping crane	*Grus americana*	Endangered	USFWS	GAR, SER	Yes
Shorebirds and Coastal Birds	Bald eagle	*Haliaeetus leucocephalus*	Least Concern	USFWS	All	No
Shorebirds and Coastal Birds	Hawaiian stilt	*Himantopus mexicanus knudseni*	Endangered	USFWS	PIR	No
Shorebirds and Coastal Birds	Wood stork	*Mycteria americana*	Threatened	USFWS	SER	No
Shorebirds and Coastal Birds	Eskimo curlew	*Numenius borealis*	Endangered	USFWS	AR	No
Shorebirds and Coastal Birds	Light-footed clapper rail	*Rallus longirostris levipes*	Endangered	USFWS	WCR	No
Shorebirds and Coastal Birds	California clapper rail	*Rallus longirostris obsoletus*	Endangered	USFWS	WCR	No
Waterfowl	Laysan duck	*Anas laysanensis*	Endangered	USFWS	PIR	No
Waterfowl	Hawaiian duck	*Anas wyvilliana*	Endangered	USFWS	PIR	No
Waterfowl	Steller's eider	*Polysticta stelleri*	Threatened	USFWS	AR	Yes
Waterfowl	Spectacled eider	*Somateria fischeri*	Threatened	USFWS	AR	Yes

**SER = Southeast Region (includes Gulf of Mexico, the Caribbean, and the Atlantic seaboard from North Carolina to Florida); WCR = West Coast Region (includes Washington, Oregon, and California); PIR = Pacific Islands Region (includes the Hawaiian, Marianas, and American Samoa archipelagos, Wake Island, and the Remote Pacific Islands).*

Appendix D: Input-Output Analysis Tables

Summary

The economic impact analysis used for this PEIS was based on the budgets for past funded projects as an indicator of the impacts that similar projects would have in the future. This analysis uses budget information including costs allocated to overhead (such as rent or utilities), any subcontracts, supplies, salaries and fringe, travel costs, equipment, or any other necessary purchases. Then, each major category and subcontract was assigned an industry sector code to be used in the input-output regional economic impact analysis. This analysis determines the extent that grant-related spending would stimulate the economy, which depends on both how grant funds are spent (what budget categories) and where funds are spent (what state or country spending occurs in).

Input-output analysis was conducted using IMPLAN and results are summarized by NMFS Region in the Socioeconomic Impacts sections throughout Chapter 4 of the PEIS. This appendix provides the complete summary of results by the project's primary location (state or country). It is important to note that occasionally this does not necessarily correspond to the grant applicant's home NOAA Fisheries Region, but instead where a majority of economic impacts were determined to occur, or where a majority of funds were spent. In some cases, the project's location was not a U.S. state or territory, and multipliers were not available for these locations. These locations included Papua New Guinea, Federated States of Micronesia, and Palau. In these instances, multipliers were used from the most relevant U.S. territory, Commonwealth of the Northern Mariana Islands, as a proxy.

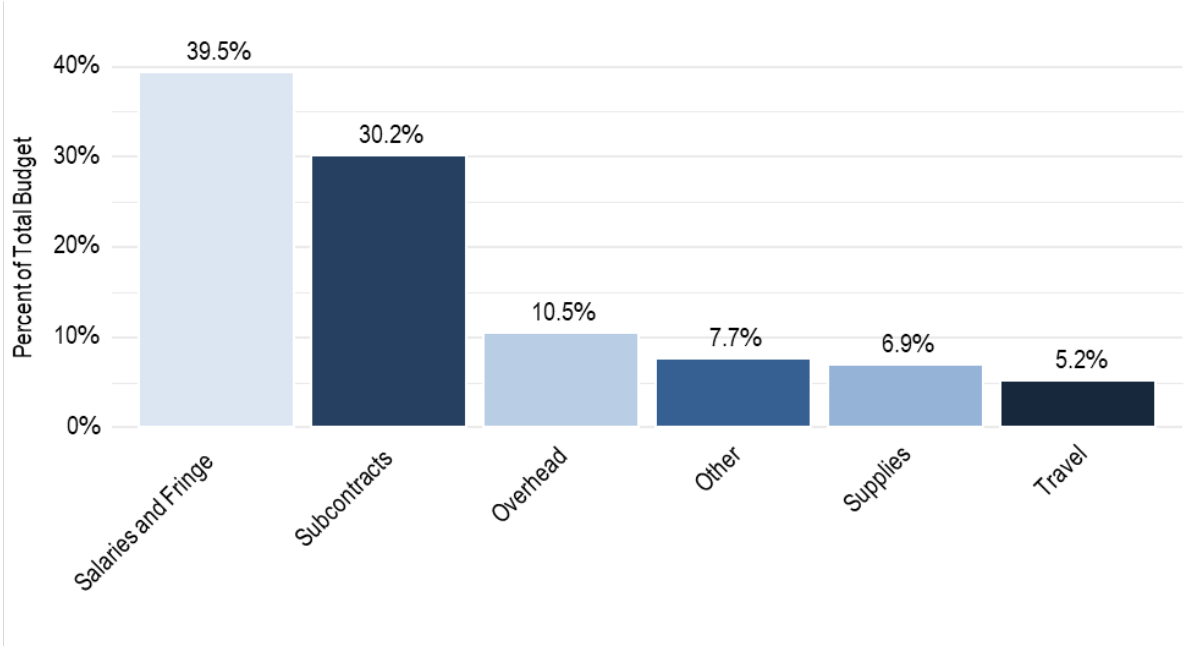
For each funded project, one project state was identified that best represented where the majority of economic impacts were incurred. For most projects, this was the grantee's state of employment.

Input-Output results consist of direct, indirect, and induced economic effects across three indicators: output, employment, and labor income. Here, indirect and induced effects are both considered to be types of indirect economic impacts. Total effects are the sum of direct, indirect, and induced effects. Direct effects represent the change in initial expenditures of the basket of goods and services included in past grants; indirect effects are those caused by secondary inter-industry exchanges; and induced effects are those created by household spending of those directly and indirectly employed as a result of the grant (Schmit et al. 2013).

This section includes more detailed economic impact results than is included in the main body of the PEIS for each project type.

Seafood Promotion and Marketing

Figure D-1. Seafood Promotion and Marketing - Average Budget Composition.



Note: Percentages are with respect to the total grant budget including any matching funds. "Other" costs include equipment, tuition and fees, construction costs, shipping, and any other goods and services listed.

Table D-1. Seafood Promotion and Marketing Project Type Summary and Aggregate IO Analysis Results for each NOAA Fisheries Region ($2021).

Regional Summary	Alaska	New England/ Mid-Atlantic	Pacific Islands	Southeast	West Coast	All Regions
Number of grants	1	6	6	3	3	19
Average match	$13,874	$21,617	$0	$16,985	$0	$10,238
Average budget	$313,874	$269,630	$284,996	$235,485	$243,899	$267,357
Average grant	$300,000	$248,014	$284,996	$218,500	$243,899	$257,119
Total economic output per dollar of budget	$1.28	$1.60	$1.38	$1.57	$1.61	$1.50
Total economic output per project	$400,453	$431,389	$393,710	$368,730	$391,963	$401,743
Total labor income per dollar of budget	$0.62	$0.69	$0.81	$0.67	$0.80	$0.74
Total labor income per project	$194,473	$185,831	$230,981	$158,657	$195,973	$197,855
Total employment per project (jobs)	3.56	3.38	4.59	3.35	2.98	3.70

Note: Pacific Islands Region includes project locations that are not U.S. states or territories and include Papua New Guinea, Federated States of Micronesia, and Palau.

Table D-2. Summary of Seafood Promotion and Marketing Project Input-Output results by project state or country. All dollar values are in thousands of $2021 dollars.

Economic Impact Category and Type	AK	CA	FM	HI	LA	MA	ME	NC	NH	OR	PA	PW	RI	SC	WA	Total
Direct Economic Output (spending)	$247.1	$106.4	$472.1	$758.5	$173.5	$594.8	$176.0	$197.7	$103.1	$276.7	$258.7	$261.0	$278.0	$278.5	$265.6	**$4,447.6**
Indirect Economic Output (spending)	$45.6	$15.9	$27.9	$147.1	$33.2	$243.1	$35.8	$55.8	$29.8	$69.1	$60.1	$17.4	$97.3	$89.8	$68.9	**$1,036.9**
Induced Economic Output (spending)	$107.8	$73.4	$119.1	$488.3	$90.5	$270.5	$110.9	$96.2	$46.0	$163.8	$167.9	$70.7	$116.4	$91.1	$136.0	**$2,148.7**
Total Economic Output (spending)	**$400.5**	**$195.7**	**$619.1**	**$1,394.0**	**$297.2**	**$1,108.4**	**$322.7**	**$349.7**	**$178.9**	**$509.7**	**$486.7**	**$349.2**	**$491.7**	**$459.3**	**$470.5**	**$7,633.1**
Direct Employment (jobs)	1	1	3	5	1	1	2	1	1	2	2	2	1	1	1	**24**
Indirect Employment (jobs)	1	0	6	4	1	4	1	1	1	2	1	3	2	2	1	**32**
Induced Employment (jobs)	1	0	1	3	1	2	1	1	0	1	1	1	1	1	1	**15**
Total Employment (jobs)	**4**	**1**	**11**	**11**	**3**	**7**	**4**	**3**	**2**	**4**	**4**	**6**	**4**	**3**	**3**	**70**
Direct Labor Income (wages)	$99.5	$61.3	$190.8	$344.9	$83.4	$61.3	$89.3	$75.0	$28.0	$102.1	$103.9	$95.9	$33.2	$35.7	$88.7	**$1,493.1**
Indirect Labor Income Effect (wages)	$59.4	$21.6	$174.9	$223.3	$40.0	$284.7	$38.1	$61.2	$34.5	$100.1	$87.8	$117.0	$123.5	$95.3	$90.7	**$1,551.9**
Induced Labor Income Effect (wages)	$35.6	$24.5	$35.9	$181.9	$27.1	$82.9	$35.4	$31.2	$15.9	$54.1	$58.6	$21.3	$37.8	$27.0	$44.9	**$714.3**
Total Labor Income Effect (wages)	**$194.5**	**$107.3**	**$401.6**	**$750.1**	**$150.5**	**$429.0**	**$162.8**	**$167.5**	**$78.4**	**$256.3**	**$250.3**	**$234.2**	**$194.6**	**$158.0**	**$224.3**	**$3,759.2**

Note: "FM" stands for Federated States of Micronesia and "PW" stands for Palau.

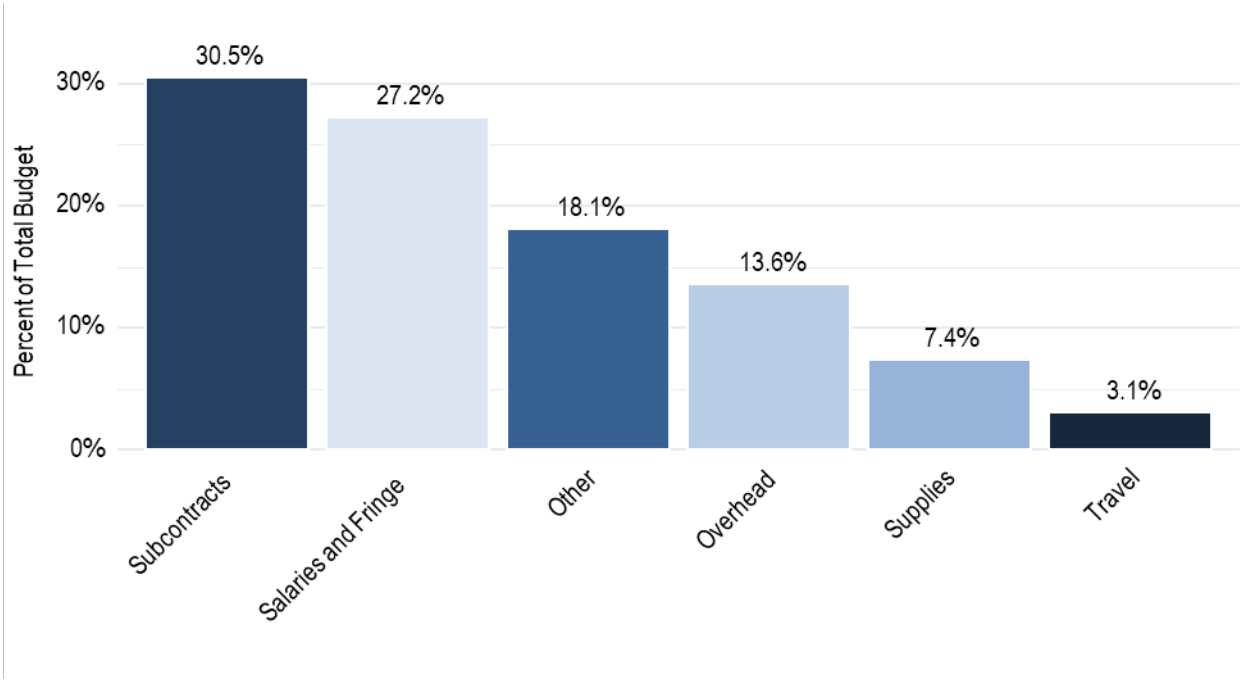
Table D-3. Summary of Seafood Promotion and Marketing Project Input-Output results by NOAA Fisheries Region. All dollar values are real 2021 dollars.

Effect Category	Impact Type	Alaska	New England/Mid-Atlantic	Pacific Islands	International	Southeast	West Coast	Total
Project Summary	Match	$13,874	$129,700	$0	$0	$50,954	$0	$194,527
Project Summary	Number of Projects	1	6	3	3	3	3	19
Project Summary	Total Grant	$300,000	$1,488,082	$910,390	$799,584	$655,500	$731,697	$4,885,254
Project Summary	**Total Budget**	**$313,874**	**$1,617,782**	**$910,390**	**$799,584**	**$706,454**	**$731,697**	**$5,079,781**
Output Effects	Direct Spending	$247,123	$1,410,480	$758,525	$733,056	$649,637	$648,733	$4,447,553
Output Effects	Indirect	$45,567	$466,152	$147,134	$45,357	$178,774	$153,900	$1,036,884
Output Effects	Induced	$107,762	$711,702	$488,328	$189,861	$277,780	$373,255	$2,148,688
Output Effects	**Total**	**$400,453**	**$2,588,333**	**$1,393,986**	**$968,275**	**$1,106,191**	**$1,175,888**	**$7,633,125**
Employment Effects	Direct	1	6	5	5	3	4	24
Employment Effects	Indirect	1	10	4	9	5	3	32
Employment Effects	Induced	1	5	3	2	2	2	15
Employment Effects	**Total**	**4**	**20**	**11**	**16**	**10**	**9**	**70**

Note: "International" represents non-US territory locations, specifically Palau, Papua New Guinea, and Federated States of Micronesia.

Gear Testing, Bycatch Reduction and Processing Studies

Figure D-2. Gear Testing, Bycatch Reduction, and Processing Studies - Average Budget Composition.



Note: Percentages are with respect to the total grant budget including any matching funds. "Other" costs include equipment, tuition and fees, construction costs, shipping, and any other goods and services listed.

Table D-4. Gear Testing, Bycatch Reduction, and Processing Studies Project Type Summary and Aggregate IO Analysis Results for each NOAA Fisheries Region ($2021).

Regional Summary	Alaska	New England/ Mid-Atlantic	Pacific Islands	Southeast	West Coast	All Regions
Number of Grants	1	21	2	5	15	44
Average Match	$40,823	$51,179	$15,539	$26,017	$39,123	$42,354
Average Budget	$158,251	$321,399	$255,789	$308,763	$281,437	$299,649
Average Grant	$117,428	$270,220	$240,250	$282,745	$242,314	$257,295
Total economic output per dollar of budget	$1.48	$1.39	$1.55	$1.63	$1.63	$1.50
Total economic output per project	$233,979	$445,674	$395,567	$504,523	$458,582	$449,673
Total employment per project (jobs)	1.94	3.28	2.71	4.52	3.04	3.28
Total labor income per dollar of budget	$0.70	$0.61	$0.64	$0.70	$0.75	$0.67
Total labor income per project	$110,217	$194,490	$164,545	$215,721	$211,136	$199,301

Table D-5. Summary of Gear Testing, Bycatch Reduction and Processing Studies Project Input-Output results by project state or country. All dollar values are in thousands of $2021 dollars.

Effect Category and Type	AK	CA	DE	FL	HI	LA	MA	MD	ME	NC	NY	OR	RI	TX	VA	WA	Total
Direct Economic Output (spending)	$137.7	$2,064.3	$395.0	$351.1	$440.0	$468.7	$2,039.3	$285.3	$1,041.8	$217.9	$553.5	$533.3	$559.9	$301.6	$164.9	$987.2	**$10,541.5**
Indirect Economic Output (spending)	$35.1	$693.4	$194.6	$141.9	$141.9	$140.9	$780.2	$77.6	$327.9	$67.2	$185.3	$224.5	$133.4	$101.2	$59.1	$281.9	**$3,586.1**
Induced Economic Output (spending)	$61.2	$1,335.0	$135.4	$222.3	$209.2	$218.3	$1,088.2	$129.5	$577.9	$117.2	$270.0	$248.2	$281.7	$174.2	$78.7	$510.9	**$5,657.9**
Total Economic Output (spending)	**$234.0**	**$4,092.6**	**$725.0**	**$715.4**	**$791.1**	**$827.8**	**$3,907.7**	**$492.4**	**$1,947.6**	**$402.3**	**$1,008.8**	**$1,006.1**	**$974.9**	**$577.1**	**$302.8**	**$1,780.0**	**$19,785.6**
Direct Employment (jobs)	0	6	1	2	2	2	5	0	5	1	2	2	2	1	1	4	**36**
Indirect Employment (jobs)	1	14	4	2	2	4	13	3	8	2	2	3	6	3	1	5	**74**
Induced Employment (jobs)	0	7	1	1	1	2	6	1	4	1	1	2	2	1	0	3	**34**
Total Employment (jobs)	**2**	**27**	**5**	**6**	**5**	**8**	**24**	**4**	**17**	**4**	**6**	**6**	**10**	**5**	**2**	**12**	**144**
Direct Labor Income (wages)	$18.5	$525.8	$54.7	$111.3	$135.6	$145.0	$344.0	$13.0	$264.0	$38.6	$178.7	$100.0	$136.8	$37.6	$30.9	$316.6	**$2,451.0**
Indirect Labor Income Effect (wages)	$71.5	$981.6	$162.1	$112.8	$129.4	$149.3	$948.2	$169.6	$391.6	$107.3	$186.2	$204.1	$235.6	$151.7	$77.6	$343.0	**$4,421.6**
Induced Labor Income Effect (wages)	$20.2	$445.3	$44.2	$67.3	$64.1	$65.3	$405.6	$42.5	$184.4	$35.9	$99.0	$81.9	$91.6	$56.5	$24.0	$168.7	**$1,896.6**
Total Labor Income Effect (wages)	**$110.2**	**$1,952.6**	**$261.0**	**$291.4**	**$329.1**	**$359.6**	**$1,697.8**	**$225.0**	**$840.0**	**$181.8**	**$463.9**	**$386.1**	**$464.0**	**$245.8**	**$132.5**	**$828.4**	**$8,769.2**

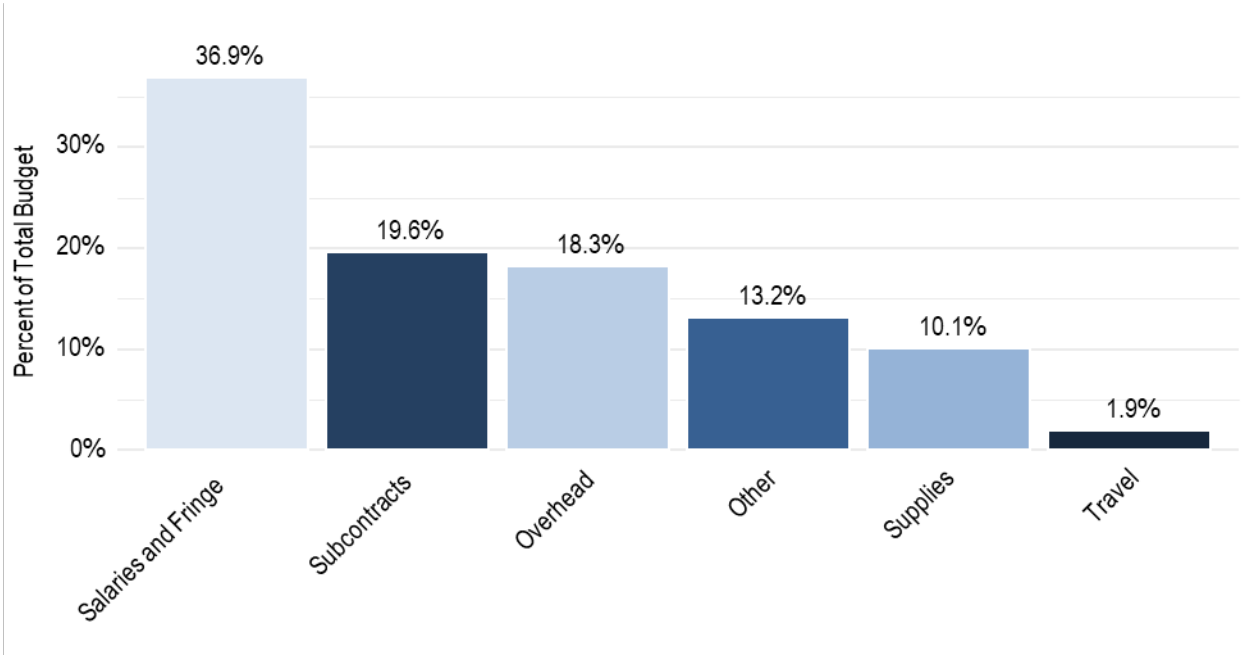
Table D-6. Summary of Gear Testing, Bycatch Reduction and Processing Studies Project Input-Output results by NOAA Fisheries Region. All dollar values are real 2021 dollars.

Effect Category	Impact Type	Alaska	New England/ Mid-Atlantic	Pacific Islands	International	Southeast	West Coast	Total
Project Summary	Match	$40,823	$1,074,763	$31,078	$0	$130,087	$586,842	**$1,863,594**
Project Summary	Number of Projects	1	21	2	0	5	15	**44**
Project Summary	Total Grant	$117,428	$5,674,616	$480,499	$0	$1,413,727	$3,634,708	**$11,320,978**
Project Summary	**Total Budget**	**$158,251**	**$6,749,379**	**$511,578**	**$0**	**$1,543,814**	**$4,221,550**	**$13,184,572**
Output Effects	Direct Spending	$137,699	$5,039,726	$439,985	$0	$1,339,267	$3,584,860	**$10,541,537**
Output Effects	Indirect	$35,096	$1,758,089	$141,948	$0	$451,269	$1,199,744	**$3,586,146**
Output Effects	Induced	$61,184	$2,561,348	$209,202	$0	$732,076	$2,094,125	**$5,657,935**
Output Effects	**Total**	**$233,979**	**$9,359,162**	**$791,135**	**$0**	**$2,522,613**	**$6,878,728**	**$19,785,617**
Employment Effects	Direct	0	16	2	0	6	12	**36**
Employment Effects	Indirect	1	37	2	0	12	22	**74**
Employment Effects	Induced	0	16	1	0	5	12	**34**
Employment Effects	**Total**	**2**	**69**	**5**	**0**	**23**	**46**	**144**
Labor Income Effects	Direct (Wages and Salaries)	$18,490	$1,022,022	$135,567	$0	$332,517	$942,412	**$2,451,007**
Labor Income Effects	Indirect	$71,485	$2,170,965	$129,394	$0	$521,091	$1,528,661	**$4,421,595**
Labor Income Effects	Induced	$20,242	$891,301	$64,130	$0	$224,998	$695,961	**$1,896,631**
Labor Income Effects	**Total**	**$110,217**	**$4,084,287**	**$329,091**	**$0**	**$1,078,606**	**$3,167,033**	**$8,769,234**

Note: "International" represents non-US territory locations, specifically Palau, Papua New Guinea, and Federated States of Micronesia.

Aquaculture

Figure D-3. Aquaculture - Average Budget Composition.



Note: Percentages are with respect to the total grant budget including any matching funds. "Other" costs include equipment, tuition and fees, construction costs, shipping, and any other goods and services listed.

Table D-7. Aquaculture Project Type Summary and Aggregate IO Analysis Results for each NOAA Fisheries Region ($2021).

Regional Summary	Alaska	New England/ Mid-Atlantic	Pacific Islands	Southeast	West Coast	All Regions
Number of Grants	ND	16	6	9	6	37
Average Match	ND	$20,527	$7,819	$18,425	$46,892	$22,230
Average Budget	ND	$304,664	$299,828	$311,985	$402,143	$321,468
Average Grant	ND	$284,137	$292,010	$293,560	$355,250	$299,238
Total economic output per dollar of budget	ND	$1.58	$1.61	$1.60	$1.58	$1.59
Total economic output per project	ND	$482,433	$481,827	$498,145	$635,313	$510,948
Total employment per project (jobs)	ND	4.49	4.18	5.28	4.8	4.68
Total labor income per dollar of budget	ND	$0.74	$0.71	$0.72	$0.74	$0.73
Total labor income per project	ND	$226,687	$212,363	$223,156	$296,530	$234,831

Note: "ND" means no data are available since no projects were categorized as being located in that region.

Table D-8. Summary of Aquaculture Project Input-Output results by project state or country. All dollar values are in thousands of $2021 dollars.

Economic Impact Category and Type	AL	CA	FL	HI	MA	ME	NC	NH	NJ	PR	RI	TX	VA	WA	Total
Direct economic output (spending)	$94.2	$990.7	$1,276.7	$1,672.9	$729.3	$923.6	$196.1	$977.2	$535.7	$592.2	$295.7	$267.2	$858.5	$1,065.7	**$10,475.7**
Indirect economic output (spending)	$39.2	$307.9	$384.7	$407.5	$181.5	$274.4	$69.9	$239.9	$158.4	$87.9	$80.1	$57.2	$203.3	$286.9	**$2,778.8**
Induced economic output (spending)	$31.5	$640.7	$854.2	$810.5	$465.8	$499.4	$105.9	$507.5	$267.2	$257.9	$150.4	$168.4	$371.0	$520.0	**$5,650.5**
Total economic output (spending)	**$164.8**	**$1,939.3**	**$2,515.7**	**$2,891.0**	**$1,376.5**	**$1,697.5**	**$371.9**	**$1,724.7**	**$961.3**	**$938.0**	**$526.2**	**$492.8**	**$1,432.8**	**$1,872.6**	**$18,905.1**
Direct employment (jobs)	0	4	8	6	4	6	1	7	2	2	2	2	4	3	**51**
Indirect employment (jobs)	1	8	12	14	5	7	2	7	3	8	2	2	8	8	**88**
Induced employment (jobs)	0	3	6	5	3	3	1	3	2	2	1	1	2	3	**35**
Total employment (jobs)	**1**	**15**	**25**	**25**	**12**	**16**	**4**	**17**	**6**	**12**	**5**	**5**	**15**	**14**	**173**
Direct labor income (wages)	$0.0	$311.1	$431.5	$412.3	$279.5	$272.9	$62.4	$363.1	$148.9	$73.2	$114.2	$115.2	$258.2	$231.3	**$3,073.8**
Indirect labor income effect (wages)	$46.2	$412.3	$429.4	$613.4	$275.8	$294.4	$69.5	$312.4	$198.6	$293.7	$90.5	$67.6	$254.7	$439.0	**$3,797.6**
Induced labor income effect (wages)	$9.2	$213.7	$258.6	$248.5	$173.5	$159.4	$32.5	$174.9	$94.2	$64.8	$48.8	$54.6	$113.0	$171.8	**$1,817.4**
Total labor income effect (wages)	**$55.4**	**$937.0**	**$1,119.5**	**$1,274.2**	**$728.8**	**$726.7**	**$164.4**	**$850.4**	**$441.6**	**$431.6**	**$253.6**	**$237.4**	**$625.9**	**$842.1**	**$8,688.8**

Note: "PR" stands for Puerto Rico.

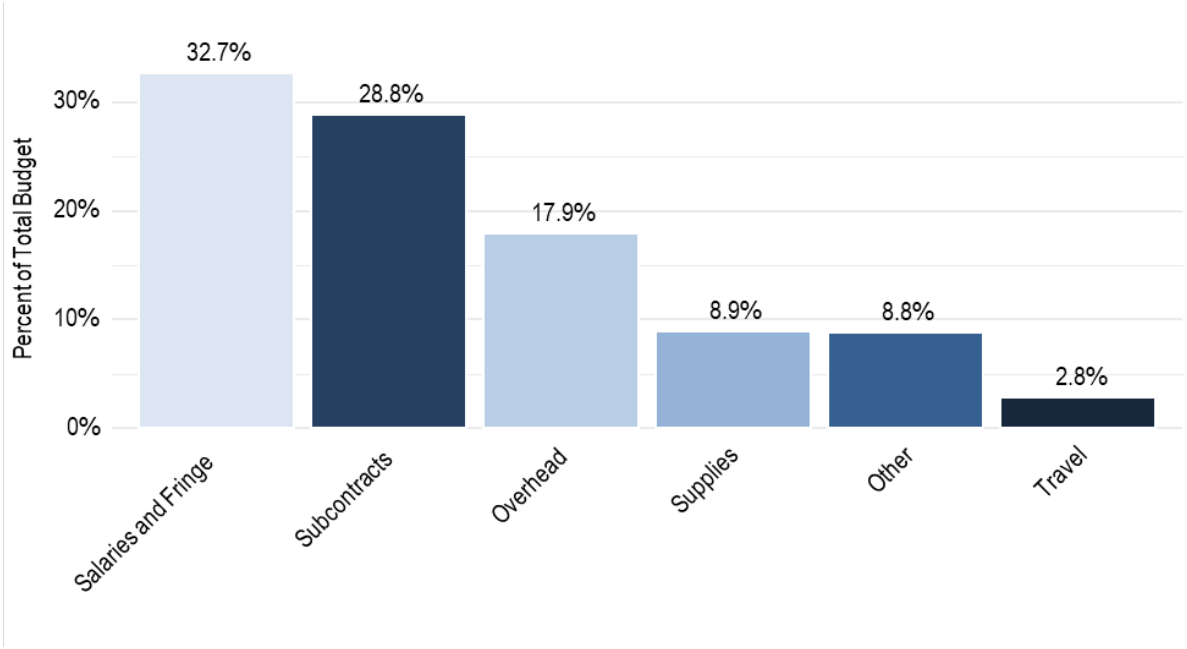
Table D-9. Summary of Aquaculture Project Input-Output results by NOAA Fisheries Region. All dollar values are real 2021 dollars.

Effect Category	Impact Type	Alaska	New England/Mid-Atlantic	Pacific Islands	International	Southeast	West Coast	Total
Project Summary	Match	$0	$328,427	$46,912	$0	$165,827	$281,353	**$822,519**
Project Summary	Number of Projects	0	16	6	0	9	6	**37**
Project Summary	Total Grant	$0	$4,546,194	$1,752,059	$0	$2,642,038	$2,131,502	**$11,071,792**
Project Summary	**Total Budget**	**$0**	**$4,874,621**	**$1,798,971**	**$0**	**$2,807,864**	**$2,412,855**	**$11,894,311**
Output Effects	Direct Spending	$0	$4,319,964	$1,672,931	$0	$2,426,418	$2,056,416	**$10,475,728**
Output Effects	Indirect	$0	$1,137,698	$407,491	$0	$638,898	$594,726	**$2,778,812**
Output Effects	Induced	$0	$2,261,268	$810,543	$0	$1,417,987	$1,160,736	**$5,650,535**
Output Effects	Total	$0	$7,718,930	$2,890,964	$0	$4,483,303	$3,811,878	**$18,905,076**
Employment Effects	Direct	0	25	6	0	13	7	**51**
Employment Effects	Indirect	0	33	14	0	25	16	**88**
Employment Effects	Induced	0	14	5	0	10	6	**35**
Employment Effects	**Total**	**0**	**72**	**25**	**0**	**48**	**29**	**173**
Labor Income Effects	Direct (Wages and Salaries)	$0	$1,436,835	$412,253	$0	$682,309	$542,411	**$3,073,808**
Labor Income Effects	Indirect	$0	$1,426,386	$613,403	$0	$906,490	$851,282	**$3,797,561**
Labor Income Effects	Induced	$0	$763,766	$248,523	$0	$419,608	$385,486	**$1,817,383**
Labor Income Effects	**Total**	**$0**	**$3,626,986**	**$1,274,179**	**$0**	**$2,008,407**	**$1,779,180**	**$8,688,753**

Note: "International" represents non-US territory locations, specifically Palau, Papua New Guinea, and Federated States of Micronesia.

Research and Monitoring

Figure D-4. Research and Monitoring - Average Budget Composition.



Note: Percentages are with respect to the total grant budget including any matching funds. "Other" costs include equipment, tuition and fees, construction costs, shipping, and any other goods and services listed.

Table D-10. Research and Monitoring Project Type Summary and Aggregate IO Analysis Results for each NOAA Fisheries Region ($2021).

Regional Summary	Alaska	New England/ Mid-Atlantic	Pacific Islands	Southeast	West Coast	All Regions
Number of Grants	21	83	26	48	43	221
Average Match	$33,576	$15,163	$13,100	$17,501	$23,977	$18,893
Average Budget	$301,831	$289,088	$281,573	$326,122	$331,013	$305,616
Average Grant	$268,255	$273,925	$268,473	$308,621	$307,037	$286,723
Output Effects						**Average**
Total economic output per dollar of budget	$1.33	$1.65	$1.33	$1.50	$1.59	$1.54
Total economic output per project	$402,031	$476,979	$373,520	$490,435	$526,927	$470,326
Employment Effects						**Average**
Total employment per project (jobs)	3.21	3.98	4.45	4.92	3.74	4.12
Labor Income Effects						**Average**
Total labor income per dollar of budget	$0.62	$0.77	$0.68	$0.65	$0.73	$0.71
Total labor income per dollar of budget	$187,025	$221,192	$191,457	$212,917	$241,855	$216,670

Note: Pacific Islands Region includes project locations that are not U.S. states or territories and include Papua New Guinea, Federated States of Micronesia, and Palau.

Table D-11. Summary of Research and Monitoring Project Input-Output results by project state or country. All dollar values are in thousands of $2021 dollars.

Economic Impact Category and Type	AK	AL	AS	CA	CNMI	CT	FL	FM	GA	GU	HI	IA	ID	IL	LA
Direct Economic Output (spending)	$5,086.7	$707.2	$382.8	$5,886.5	$231.0	$521.3	$2,090.0	$1,147.2	$200.7	$969.3	$3,482.3	$512.3	$51.4	$544.6	**$1,356.4**
Indirect Economic Output (spending)	$1,179.4	$242.7	$12.6	$2,084.7	$16.1	$109.7	$831.3	$43.3	$85.4	$64.5	$944.9	$140.7	$5.2	$168.8	**$365.5**
Induced Economic Output (spending)	$2,176.6	$303.2	$112.7	$3,682.8	$53.0	$301.4	$1,349.0	$304.8	$120.5	$246.0	$1,701.0	$215.3	$30.2	$369.6	**$655.6**
Total Economic Output (spending)	**$8,442.6**	**$1,253.0**	**$508.1**	**$11,654.0**	**$300.1**	**$932.4**	**$4,270.3**	**$1,495.3**	**$406.6**	**$1,279.8**	**$6,128.2**	**$868.2**	**$86.7**	**$1,083.0**	**$2,377.5**
Direct Employment (jobs)	20	3	3	18	2	4	9	10	1	4	12	3	1	2	**8**
Indirect Employment (jobs)	34	6	5	38	3	2	18	11	3	16	32	3	0	4	**10**
Induced Employment (jobs)	14	2	2	20	1	2	9	4	1	2	10	2	0	2	**5**
Total Employment (jobs)	**67**	**12**	**10**	**76**	**5**	**8**	**36**	**25**	**4**	**22**	**54**	**8**	**1**	**9**	**22**
Direct Labor Income (wages)	$1,342.0	$184.6	$175.3	$1,502.0	$90.9	$274.4	$489.5	$596.4	$45.5	$294.6	$775.2	$161.1	$34.4	$189.6	**$474.6**
Indirect Labor Income Effect (wages)	$1,865.7	$260.8	$117.8	$2,656.1	$70.4	$139.3	$869.8	$339.0	$91.8	$410.7	$1,375.6	$158.3	$5.8	$205.8	**$409.5**
Induced Labor Income Effect (wages)	$719.8	$88.6	$25.9	$1,228.4	$16.0	$107.6	$408.5	$91.9	$37.0	$76.6	$521.6	$64.2	$8.7	$123.3	**$196.1**
Total Labor Income Effect (wages)	**$3,927.5**	**$534.0**	**$318.9**	**$5,386.5**	**$177.3**	**$521.3**	**$1,767.8**	**$1,027.3**	**$174.3**	**$781.9**	**$2,672.5**	**$383.6**	**$48.9**	**$518.6**	**$1,080.2**

Note: "AS" stands for American Samoa, "CNMI" stands for the Commonwealth of the Northern Mariana Islands, "FM" stands for Federated States of Micronesia, and "GU" stands for Guam.

Table D-12. Summary of Research and Monitoring Project Input-Output results by project state or country (continued). All dollar values are in thousands of $2021 dollars.

Economic Impact Category and Type	MA	MD	ME	MS	NC	NH	NJ	NY	OR	PA	PR	RI	SC	TX	USVI	VA	WA	Total
Direct Economic Output (spending)	$5,349.1	$1,070.7	$6,163.5	$1,158.0	$1,981.0	$948.3	$1,000.8	$720.0	$2,228.3	$159.3	$2,134.8	$1,515.3	$607.4	$2,052.8	$860.6	$2,939.3	$3,752.2	**$57,811.3**
Indirect Economic Output (spending)	$1,613.6	$316.5	$2,080.1	$349.2	$737.1	$243.4	$407.0	$165.6	$688.3	$31.6	$327.4	$535.0	$193.0	$681.5	$82.1	$696.0	$1,134.9	**$16,576.7**
Induced Economic Output (spending)	$3,211.9	$493.5	$3,375.7	$423.3	$988.8	$438.5	$556.2	$400.8	$1,204.8	$103.9	$914.0	$682.8	$260.7	$1,280.3	$201.3	$1,487.4	$1,908.6	**$29,554.1**
Total Economic Output (spending)	**$10,174.6**	**$1,880.7**	**$11,619.2**	**$1,930.5**	**$3,707.0**	**$1,630.1**	**$1,964.1**	**$1,286.4**	**$4,121.4**	**$294.7**	**$3,376.2**	**$2,733.1**	**$1,061.1**	**$4,014.6**	**$1,144.1**	**$5,122.7**	**$6,795.7**	**$103,942.1**
Direct Employment (jobs)	16	3	31	6	8	5	2	3	9	1	15	4	2	8	3	18	13	**248**
Indirect Employment (jobs)	40	9	53	11	17	7	6	4	16	1	24	12	7	18	10	21	28	**472**
Induced Employment (jobs)	19	3	23	3	6	3	3	2	8	1	8	4	2	8	2	9	10	**189**
Total Employment (jobs)	**75**	**15**	**108**	**21**	**32**	**14**	**11**	**9**	**33**	**3**	**48**	**21**	**11**	**35**	**15**	**49**	**51**	**910**
Direct Labor Income (wages)	$1,153.4	$230.7	$1,541.1	$298.8	$456.0	$253.0	$156.9	$305.0	$577.7	$54.3	$558.1	$250.5	$108.8	$572.6	$172.4	$1,061.5	$918.9	**$15,299.7**
Indirect Labor Income Effect (wages)	$2,670.3	$466.0	$2,289.8	$356.0	$774.9	$330.0	$564.6	$236.3	$897.0	$62.9	$744.2	$674.9	$260.7	$818.2	$338.5	$993.2	$1,542.4	**$22,996.2**

Economic Impact Category and Type	**MA**	**MD**	**ME**	**MS**	**NC**	**NH**	**NJ**	**NY**	**OR**	**PA**	**PR**	**RI**	**SC**	**TX**	**USVI**	**VA**	**WA**	**Total**
Induced Labor Income Effect (wages)	$1,196.8	$161.9	$1,077.2	$114.7	$303.1	$151.1	$196.1	$146.9	$397.8	$36.3	$229.5	$221.8	$77.3	$414.9	$65.1	$453.1	$630.5	**$9,588.3**
Total Labor Income Effect (wages)	**$5,020.5**	**$858.6**	**$4,908.1**	**$769.5**	**$1,534.0**	**$734.0**	**$917.6**	**$688.2**	**$1,872.5**	**$153.5**	**$1,531.8**	**$1,147.2**	**$446.8**	**$1,805.7**	**$576.0**	**$2,507.8**	**$3,091.8**	**$47,884.2**

Note: "PR" stands for Puerto Rico and "USVI" stands for U.S. Virgin Islands.

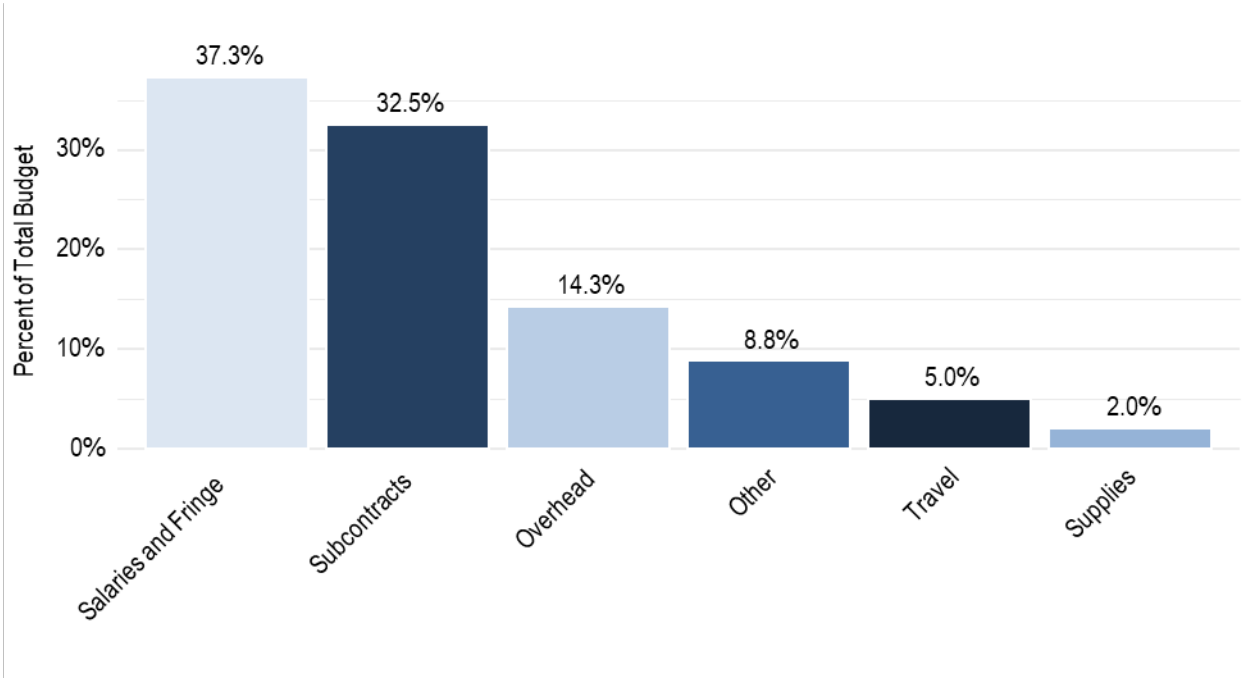
Table D-13. Summary of Research and Monitoring Project Input-Output results by NOAA Fisheries Region. All dollar values are real 2021 dollars.

Effect Category	Impact Type	Alaska	New England/Mid-Atlantic	Pacific Islands	International	Southeast	West Coast	Total
Project Summary	Match	$705,088	$1,258,519	$148,370	$192,239	$840,071	$1,031,002	**$4,175,288**
Project Summary	Number of Projects	21	83	22	4	48	43	**221**
Project Summary	Total Grant	$5,633,358	$22,735,811	$5,875,091	$1,105,202	$14,813,805	$13,202,574	**$63,365,842**
Project Summary	**Total Budget**	**$6,338,446**	**$23,994,330**	**$6,023,461**	**$1,297,441**	**$15,653,876**	**$14,233,576**	**$67,541,130**
Output Effects	Direct Spending	$5,086,702	$21,444,663	$5,065,420	$1,147,234	$13,148,953	$11,918,336	**$57,811,308**
Output Effects	Indirect	$1,179,354	$6,507,784	$1,038,139	$43,259	$3,895,135	$3,913,069	**$16,576,739**
Output Effects	Induced	$2,176,587	$11,636,810	$2,112,672	$304,796	$6,496,774	$6,826,440	**$29,554,078**
Output Effects	**Total**	**$8,442,642**	**$39,589,257**	**$8,216,231**	**$1,495,288**	**$23,540,862**	**$22,657,845**	**$103,942,125**
Employment Effects	Direct	20	93	21	10	64	40	**248**
Employment Effects	Indirect	34	164	56	11	126	82	**472**
Employment Effects	Induced	14	73	15	4	46	38	**189**
Employment Effects	**Total**	**67**	**330**	**91**	**25**	**236**	**161**	**910**
Labor Income Effects	Direct (Wages and Salaries)	$1,342,037	$5,631,441	$1,335,905	$596,362	$3,360,840	$3,033,103	**$15,299,688**
Labor Income Effects	Indirect	$1,865,667	$8,791,263	$1,974,636	$339,000	$4,924,393	$5,101,258	**$22,996,217**
Labor Income Effects	Induced	$719,819	$3,936,267	$640,053	$91,929	$1,934,773	$2,265,422	**$9,588,262**
Labor Income Effects	**Total**	**$3,927,523**	**$18,358,971**	**$3,950,594**	**$1,027,291**	**$10,220,006**	**$10,399,782**	**$47,884,167**

Note: "International" represents non-US territory locations, specifically Palau, Papua New Guinea, and Federated States of Micronesia.

Socioeconomic Research

Figure D-5. Socioeconomic Research - Average Budget Composition.



Note: Percentages are with respect to the total grant budget including any matching funds. "Other" costs include equipment, tuition and fees, construction costs, shipping, and any other goods and services listed.

Table D-14. Socioeconomic Research Project Type Summary and Aggregate IO Analysis Results for each NOAA Fisheries Region ($2021).

Regional Summary	Alaska	New England/ Mid-Atlantic	Pacific Islands	Southeast	West Coast	All Regions
Number of Grants	2	5	0	5	1	13
Average Match	$17,460	$8,423	ND	$0	$0	$5,926
Average Budget	$171,826	$250,315	ND	$199,496	$303,030	$222,749
Average Grant	$154,366	$241,892	ND	$199,496	$303,030	$216,823
Output Effects						**Average**
Total economic output per dollar of budget	$1.54	$2.05	ND	$1.80	$1.93	$1.89
Total economic output per project	$264,146	$512,155	ND	$358,976	$586,273	$420,786
Employment Effects						**Average**
Total employment per project (jobs)	2.61	3.32	ND	3.60	4.22	3.39
Labor Income Effects						**Average**
Total labor income per dollar of budget	$0.79	$0.82	ND	$0.77	$0.96	$0.82
Total labor income per project	$135,270	$206,138	ND	$153,972	$289,744	$181,602

Note: "ND" means no data are available since no projects were categorized as being located in that region.

Table D-15. Summary of Socioeconomic Research Project Input-Output results by project state or country. All dollar values are in thousands of $2021 dollars.

Economic Impact Category and Type	AK	CA	FL	MA	MS	NC	PR	RI	VA	Total
Direct Economic Output (spending)	$321.4	$297.1	$423.2	$596.6	$275.1	$111.7	$133.9	$81.1	$478.1	**$2,718.1**
Indirect Economic Output (spending)	$57.0	$91.1	$241.2	$177.9	$75.2	$10.5	$10.4	$33.8	$117.2	**$814.4**
Induced Economic Output (spending)	$149.9	$198.1	$266.8	$358.6	$102.7	$67.7	$76.5	$41.5	$238.3	**$1,500.0**
Total Economic Output (spending)	**$528.3**	**$586.3**	**$931.2**	**$1,133.1**	**$452.9**	**$189.9**	**$220.8**	**$156.3**	**$833.6**	**$5,032.5**
Direct Employment (jobs)	2	0	1	3	1	1	2	0	3	**14**
Indirect Employment (jobs)	2	3	3	2	4	0	1	1	4	**20**
Induced Employment (jobs)	1	1	2	2	1	0	1	0	1	**9**
Total Employment (jobs)	**5**	**4**	**6**	**8**	**6**	**2**	**4**	**1**	**8**	**44**
Direct Labor Income (wages)	$129.9	$36.2	$53.4	$226.7	$59.7	$71.7	$87.6	$0.0	$164.2	**$829.4**
Indirect Labor Income Effect (wages)	$91.1	$187.5	$215.4	$200.4	$99.3	$12.8	$21.4	$55.1	$164.6	**$1,047.5**
Induced Labor Income Effect (wages)	$49.6	$66.1	$80.8	$133.6	$27.8	$20.8	$19.2	$13.5	$72.6	**$483.9**
Total Labor Income Effect (wages)	**$270.5**	**$289.7**	**$349.6**	**$560.8**	**$186.8**	**$105.2**	**$128.2**	**$68.5**	**$401.4**	**$2,360.8**

Note: "PR" stands for Puerto Rico.

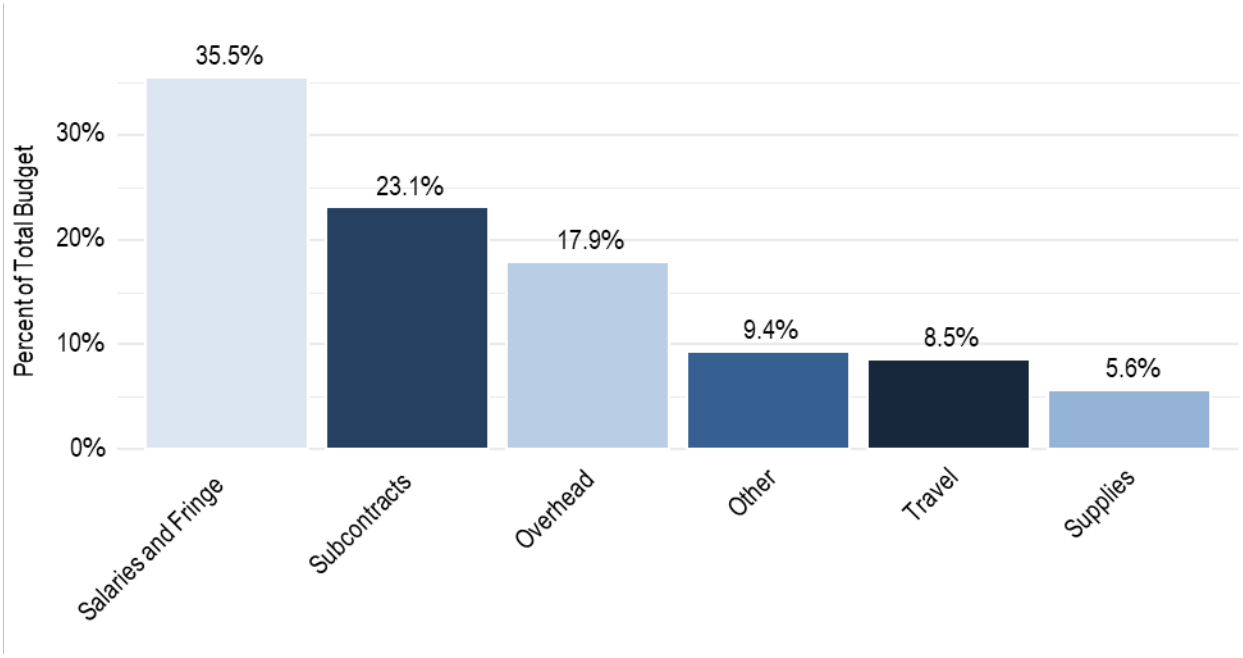
Table D-16. Summary of Socioeconomic Research Project Input-Output results by NOAA Fisheries Region. All dollar values are real 2021 dollars.

Effect Category	Impact Type	Alaska	New England/Mid-Atlantic	Pacific Islands	International	Southeast	West Coast	Total
Project Summary	Match	$34,920	$42,114	$0	$0	$0	$0	**$77,033**
Project Summary	Number of Projects	2	5	0	0	5	1	**13**
Project Summary	Total Grant	$308,732	$1,209,462	$0	$0	$997,478	$303,030	**$2,818,702**
Project Summary	**Total Budget**	**$343,651**	**$1,251,576**	**$0**	**$0**	**$997,478**	**$303,030**	**$2,895,735**
Output Effects	Direct Spending	$321,375	$1,155,754	$0	$0	$943,833	$297,147	**$2,718,108**
Output Effects	Indirect	$56,983	$520,491	$0	$0	$337,366	$91,061	**$1,005,900**
Output Effects	Induced	$149,935	$884,528	$0	$0	$513,680	$198,066	**$1,746,209**
Output Effects	**Total**	**$528,292**	**$2,560,773**	**$0**	**$0**	**$1,794,879**	**$586,273**	**$5,470,217**
Employment Effects	Direct	2	6	0	0	6	0	**14**
Employment Effects	Indirect	2	7	0	0	8	3	**20**
Employment Effects	Induced	1	4	0	0	4	1	**9**
Employment Effects	**Total**	**5**	**17**	**0**	**0**	**18**	**4**	**44**

Note: "International" represents non-US territory locations, specifically Palau, Papua New Guinea, and Federated States of Micronesia.

Outreach, Education, and Planning

Figure D-6. Outreach, Education, and Planning - Average Budget Composition.



Note: Percentages are with respect to the total grant budget including any matching funds. "Other" costs include equipment, tuition and fees, construction costs, shipping, and any other goods and services listed.

Table D-17. Outreach, Education, and Planning Project Type Summary and Aggregate IO Analysis Results for each NOAA Fisheries Region ($2021).

Regional Summary	Alaska	New England/Mid-Atlantic	Pacific Islands	Southeast	West Coast	All Regions
Number of Grants	5	7	6	2	5	25
Average Match	$8,165	$27,176	$16,807	$0	$1,564	$13,589
Average Budget	$225,000	$289,059	$289,059	$269,776	$262,450	$255,576
Average Grant	$216,836	$261,883	$261,883	$269,776	$260,886	$241,987
Output Effects						**Average**
Total economic output per dollar of budget	$1.46	$1.56	$1.56	$1.87	$1.68	$1.55
Total economic output per project	$327,442	$450,596	$312,932	$504,748	$442,100	$395,559
Employment Effects						**Average**
Total employment per project (jobs)	3.02	3.80	3.73	4.33	3.67	3.64
Labor Income Effects						**Average**
Total labor income per dollar of budget	$0.75	$0.72	$0.70	$0.84	$0.85	$0.76
Total labor income per project	$169,305	$207,253	$161,705	$227,026	$222,963	$193,456

Note: Pacific Islands Region includes project locations that are not U.S. states or territories and include Papua New Guinea, Federated States of Micronesia, and Palau.

Table D-18. Summary of Outreach, Education, and Planning Project Input-Output results by project state or country. All dollar values are in thousands of $2021 dollars.

Economic Impact Category and Type	AK	CA	FM	GA	HI	MA	ME	MN	NH	NY	OR	PNG	WA	Total
Direct Economic Output (spending)	$993.8	$555.1	$455.5	$525.6	$567.5	$561.4	$480.7	$374.5	$176.2	$62.3	$332.9	$226.5	$295.2	**$5,607.2**
Indirect Economic Output (spending)	$174.2	$133.4	$26.0	$170.1	$140.7	$156.6	$167.4	$131.7	$65.1	$13.7	$92.6	$17.2	$67.9	**$1,356.8**
Induced Economic Output (spending)	$469.2	$393.2	$109.2	$313.8	$290.7	$354.1	$260.2	$237.2	$81.9	$31.2	$175.7	$44.2	$164.4	**$2,925.0**
Total Economic Output (spending)	**$1,637.2**	**$1,081.7**	**$590.8**	**$1,009.5**	**$998.9**	**$1,072.1**	**$908.3**	**$743.3**	**$323.2**	**$107.2**	**$601.2**	**$287.9**	**$527.6**	**$9,889.0**
Direct Employment (jobs)	6	2	3	1	2	3	3	1	0	0	1	1	2	**25**
Indirect Employment (jobs)	6	3	6	5	4	4	4	4	2	0	3	3	2	**47**
Induced Employment (jobs)	3	2	1	2	2	2	2	1	1	0	1	1	1	**19**
Total Employment (jobs)	**15**	**8**	**10**	**9**	**8**	**8**	**8**	**6**	**3**	**1**	**6**	**5**	**5**	**91**
Direct Labor Income (wages)	$129.9	$36.2	$53.4	$226.7	$59.7	$71.7	$87.6	$0.0	$164.2	$829.4	$129.9	$36.2	$53.4	**$226.7**
Indirect Labor Income Effect (wages)	$91.1	$187.5	$215.4	$200.4	$99.3	$12.8	$21.4	$55.1	$164.6	$1,047.5	$91.1	$187.5	$215.4	**$200.4**
Induced Labor Income Effect (wages)	$49.6	$66.1	$80.8	$133.6	$27.8	$20.8	$19.2	$13.5	$72.6	$483.9	$49.6	$66.1	$80.8	**$133.6**
Total Labor Income Effect (wages)	**$270.5**	**$289.7**	**$349.6**	**$560.8**	**$186.8**	**$105.2**	**$128.2**	**$68.5**	**$401.4**	**$2,360.8**	**$270.5**	**$289.7**	**$349.6**	**$560.8**

Note: "FM" stands for Federated States of Micronesia and "PNG" stands for Papua New Guinea.

Table D-19. Summary of Outreach, Education, and Planning Project Input-Output results by NOAA Fisheries Region. All dollar values are real 2021 dollars.

Effect Category	Impact Type	Alaska	New England/Mid-Atlantic	Pacific Islands	International	Southeast	West Coast	Total
Project Summary	Match	$40,824	$190,232	$0	$100,841	$0	$7,821	**$339,718**
Project Summary	Number of Projects	5	7	3	3	2	5	**25**
Project Summary	Total Grant	$1,084,178	$1,833,178	$623,166	$665,169	$539,552	$1,304,431	**$6,049,673**
Project Summary	**Total Budget**	**$1,125,001**	**$2,023,410**	**$623,166**	**$766,009**	**$539,552**	**$1,312,252**	**$6,389,391**
Output Effects	Direct Spending	$993,802	$1,655,064	$567,464	$682,041	$525,574	$1,183,233	**$5,607,179**
Output Effects	Indirect	$174,221	$534,531	$140,748	$43,217	$170,147	$293,914	**$1,356,778**
Output Effects	Induced	$469,189	$964,578	$290,737	$153,385	$313,775	$733,353	**$2,925,018**
Output Effects	**Total**	**$1,637,212**	**$3,154,174**	**$998,949**	**$878,643**	**$1,009,496**	**$2,210,500**	**$9,888,974**
Employment Effects	Direct	6	7	2	3	1	6	**25**
Employment Effects	Indirect	6	13	4	9	5	9	**47**
Employment Effects	Induced	3	6	2	2	2	4	**19**
Employment Effects	**Total**	**15**	**27**	**8**	**15**	**9**	**18**	**91**
Labor Income Effects	Direct (Wages and Salaries)	$391,179	$451,791	$140,697	$200,546	$61,689	$414,677	**$1,660,580**
Labor Income Effects	Indirect	$300,179	$664,628	$226,852	$266,711	$295,963	$456,675	**$2,211,007**
Labor Income Effects	Induced	$155,169	$334,349	$89,165	$46,262	$96,400	$243,463	**$964,808**
Labor Income Effects	**Total**	**$846,527**	**$1,450,768**	**$456,713**	**$513,520**	**$454,052**	**$1,114,815**	**$4,836,396**

Note: "International" represents non-US territory locations, specifically Palau, Papua New Guinea, and Federated States of Micronesia.

Appendix E: Aquaculture Best Management Practices

Field Research and Assessments of Shellfish

The following list describes appropriate best management practices (BMPs) to ensure that the effects of actions within the Aquaculture project type are insignificant.

Shellfish growers must obtain and maintain in active status all necessary state, federal, and local permits for their business and farming operations.

Shellfish outplanting can disturb existing habitats and resources. Outplanting should be conducted in accordance with existing regulatory requirements and not occur atop or result in negative impacts to existing habitats or resources within proximity of the outplanting activity. Use of this PESI is limited to areas previously disturbed by existing gear on a commercial or research site, thus minimizing the potential for new habitat or resource impacts.

Outplanting activities should avoid the use of chemicals or toxins unless already approved for use in accordance with existing regulations. Any solid waste materials generated during, or as a result of, outplanting activities should be disposed of properly at an upland site.

Shellfish must be sourced and outplanted in accordance with existing regulations and other requirements controlling the movement of shellfish for biosecurity purposes, prevention of introduction of disease or unwanted species, genetic integrity, or otherwise. To prevent spread of disease, any shell or shellfish transported across state lines would be certified disease free and inspected for non-native organisms.

Shellfish seed should be sourced from local hatcheries using local broodstock and appropriate best practices to the greatest extent possible to reduce the risks of importing pathogens and to safeguard genetic integrity of wild populations. All outplanted shellfish seed should be sourced from hatcheries providing disease-free certification. Shellfish seed from non-local sources should be of a genetic background that will not adversely impact local shellfish populations.

Proper stocking densities of outplanted shellfish should be maintained to avoid overcrowding and stress to cultivated organisms, which can increase susceptibility to disease. If suspected disease-infected shellfish are identified, they should be tested by a certified shellfish pathologist and commensurate communication with appropriate authorities and neighboring growers, and corrective actions should be taken.

Laboratory and Rearing Research on Finfish and Shellfish

The following list describes BMPs to ensure that the effects of activities within the Aquaculture project type are minimal. Most of these BMPs are associated with proper design and wastewater treatment systems.

The presence of plants and animals and their associated biological processes (e.g., respiration) in aquaculture facilities can increase the levels of ammonia, nitrite, and nitrate, which must be filtered to control levels of these substances. Filtration typically consists of bacteria that metabolize these chemicals and are suspended in plastic or silica media.

Overfeeding plants or animals in aquaculture facilities may result in nutrient enrichment. This can be avoided by following standardized procedures for feed management to ensure that waste streams are minimized and of minimal environmental concern.

Increased levels of phosphorus and nitrogen in waters of aquaculture facilities may result from plant or animal biological processes. Facilities utilize treatment processes to reduce phosphorus and nitrogen levels before discharge into the facility's waste stream. Local management authorities determine permitting requirements for discharge.

Solids (e.g., uneaten food, fecal material, other materials) management is necessary to limit environmental effects from solid waste discharge as well as water quality impacts associated with build-up of solids within an aquaculture system. Appropriate solids management practices minimize release and build-up of solids. Local management authorities determine permitting requirements for discharge.

The presence of plants and animals in aquaculture systems may attract predators that could cause damage to the facility, unintentional release of organisms, or system failure. This risk of attracting predators can be minimized by ensuring that access to plants and animals is limited through facility design features and maintenance protocols.

Escape or accidental release of plants or animals is possible. Escape can be minimized through facility design features to avoid premature or accidental release of contained animals and plants.

Individuals engaged in activities covered by this PEIS may use certain chemicals and drugs in the course of their activities at aquaculture facilities. Use of chemicals and drugs should be consistent with standard procedures and permitting requirements. Where use of chemicals or drugs may vary from standard procedures, individuals should consult with and vary the use of chemicals or drugs from those standard procedures under the direction of a licensed veterinarian. Adequate water and organism-based treatment protocols limit discharge of chemicals and drugs into the environment.

During the course of aquaculture research, individual plants and animals may perish or become diseased. Removal and disposal of animals and plants and treatment of potentially contaminated organisms, water, or equipment in accordance with the NAAHP and other guidance minimizes impacts.

Appendix F: Glossary and Terms of Reference

Action Setting – Area upon which unique S-K Program projects are implemented, including office or laboratory and field (land, water, or underwater) settings.

Adverse – Harmful or unfavorable.

Affected Environment – The baseline environment of the relative resource components.

Algae – Non-vascular plants that are very small; algae are the main producers of food and oxygen in aquatic environments.

Aquatic – Pertaining to standing and running water; living or growing in or on water.

Beneficial – Favorable or advantageous

Benthic – On the bottom or near the bottom of streams, lakes, or oceans.

Best Management Practices – A practice or combination of practices that is determined to be the most effective, practicable (including technological, economic, and institutional considerations) means of conducting an activity while preventing or minimizing adverse effects.

Biodiversity – The diversity of life in an area, including the diversity of genes, species, plant and animal communities, ecosystems, and the interaction of these elements.

Biological Diversity – The variety and abundance of life forms, processes, functions, and structures, including the relative complexity of species, communities, gene pools, and ecosystems at spatial scales that range from local through global.

Brackish – Water with a salinity intermediate between seawater and freshwater, often referred to as oligohaline (salinity 0.5 to 5.0 ppt). Interlacing or tangled network of several small branching and reuniting shallow channels are also often present.

Calcareous – Sediment or soil formed of calcium carbonate or magnesium carbonate due to biological deposition or inorganic precipitation.

Coastal United States – Geographic regions of the United States and territories that encompass oceans and coasts, bays, estuaries, rivers, and the Great Lakes.

Code of Federal Regulations – A codification of the general and permanent rules published in the Federal Register by the executive departments and agencies of the Federal Government. The Code is divided into 50 titles that represent broad areas subject to federal regulations. Each title is divided into chapters, which usually bear the name of the issuing agency. Each chapter is further subdivided into parts covering specific regulatory areas.

Community – All the groups of organisms living together in the same area, usually interacting or depending on each other for existence; all the living organisms present in an ecosystem.

Cooperative Agreement – An award of financial assistance that is used to enter into the same kind of relationship as a grant; and is distinguished from a grant in that it provides for substantial involvement between the federal agency and the recipient in carrying out the activity contemplated by the award.

Coral Reef – Highly diverse ecosystems, found in warm, clear, shallow waters of tropical oceans worldwide. They are composed of marine polyps that secrete a hard calcium carbonate skeleton, which serves as a base or substrate for the colony.

Cultural Resources – The tangible and intangible aspects or cultural systems, living or dead, that are valued by a given culture or which contain information about the culture. Cultural resources include but are not limited to sites, structures, buildings, districts, and objects associated with or representative of people, cultures, and human activities and events. Cultural resources are commonly discussed as prehistoric and historic values, but each period represents a part of the full continuum of culture values from the earliest to the most recent.

Cumulative Impacts – The impact on the environment resulting from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such actions. Cumulative impacts can result from individually minor but collectively significant action taking place over a period of time (40 CFR § 1508.7).

Demersal – Bottom-feeding or bottom-dwelling fish, crustaceans, and other free moving organisms.

Ecosystem – A conceptual unit comprising organisms interacting with each other and their environment having the major attributes of structure, function, complexity, interaction and interdependency, temporal change, and no inherent definition of spatial dimension.

EIS – See environmental impact statement.

Endangered Species – Any species that is in danger of extinction throughout all or a significant part of its range. Endangered species must be designated in the Federal Register (see threatened species).

Environment - The surroundings or conditions in which an organism lives or operates; the natural world, as a whole or in a particular geographical area, especially as affected by human activity.

Environmental Assessment – A concise public document that briefly provides sufficient evidence and analysis for determining whether to prepare an Environmental Impact Statement or to return a finding of no significant impact, aids an agency's compliance with NEPA when no Environmental Impact Statement is necessary, or facilitates preparation of a statement when one is necessary (see environmental impact statement).

Environmental Consequences (Effects or Impacts) – The physical, biological, social, and economic results (beneficial or adverse) of implementing a given alternative.

Environmental Impact Statement – A formal document to be filed with the Environmental Protection Agency that considers significant environmental impacts expected from implementation of a major federal action (see environmental assessment).

Erosion – The wearing away of the land surface by running water, wind, ice, and other geological agents. The detachment and removal of soil from the land surface by wind, water, or gravity.

Essential Fish Habitat – Defined in the Magnuson-Stevens Act as "...those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity."

- The rules promulgated by the NMFS in 1997 and 2002 further clarify essential fish habitat with the following definitions:

- *waters* - aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate;

- *substrate* - sediment, hard bottom, structures underlying the waters, and associated biological communities; necessary - the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; *and spawning, breeding, feeding, or growth to maturity* - stages representing a species' full life cycle.

Estuary – A partially enclosed part of a river, stream, or other body of water that has at least a seasonal connection with the open sea or Great Lakes and where the seawater or Great Lakes mixes with the surface or subsurface water flow, regardless of the presence of manmade structures or obstructions.

Fauna – The animal community in a given region or period.

Federal Register – A daily federal publication that publishes regulations and legal notices that have been issued by federal agencies.

Flora – The plant community in a given region or period.

Function – The physical, chemical, and biological processes that occur in a setting that are a result of their physical and biological structure regardless of any human benefit.

Gastropod – Any of a large class (Gastropoda) of mollusks (e.g., snails and slugs) usually with a single shell or no shell and a distinct head bearing sensory organs.

Grant – An award of financial assistance, the principal purpose of which is to transfer a thing of value from a federal agency to a recipient to carry out a public purpose of support or stimulation authorized by a law of the United States (see 31 U.S.C. 6101(3)). A grant is distinguished from a contract, which is used to acquire property or services for the federal government's direct benefit or use.

Habitat – The natural environment of a plant or animal. An animal's habitat includes the total environmental conditions for food, cover, and water within its home range.

Holdfast – Kelp's rootlike structure that wraps around substrate to anchor the growing alga

Infauna – Organisms that live in the sediment.

Intertidal – An area that is alternately flooded and exposed by tides.

Invasive Species – A species that does not naturally occur in a specific area and whose introduction is likely to cause economic or environmental harm.

Lagoon – A shallow stretch of seawater near or open to the sea and partly or completely separated from it by a low, narrow, elongate strip of land.

Landscape – A viewed area of land generally of large size and commonly a mosaic of landforms and plant communities irrespective of ownership or other artificial boundaries.

Macroalgae – Relatively shallow (less than 50 meters deep) subtidal algal communities dominated by very large brown algae. Kelp and other macroalgae grow on hard or consolidated substrates forming extensive three-dimensional structures that support a diversity of other plants and animals.

Management Practice – A specific action or treatment.

Mangroves – Swamps dominated by shrubs that live between the sea and the land in areas inundated by tides. Mangroves thrive along protected shores with fine-grained sediments where the mean temperature during the coldest month is greater than 20 degrees Celsius, limiting their northern distributions.

Marsh – Transitional habitats between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is covered by shallow water tidally or seasonally.

Mitigate – To make less severe through specific actions; to moderate in force or intensity.

Mitigation Measure – An action taken to lessen adverse impacts or enhance beneficial effects.

Mudflat – Bare, flat bottoms of waters, largely filled with organic deposits, freshly exposed by a lowering of the water level; a broad expanse of muddy substrate commonly occurring in estuaries and bays.

National Environmental Policy Act – Establishes a national policy to encourage productive and enjoyable harmony between humankind and the environment, to promote efforts that would prevent or eliminate damage to the environment and stimulate the health and welfare of humans, to enrich the understanding of the ecological systems and natural resources important to the nation, and to establish a Council on Environmental Quality.

Native Species – Any species of flora or fauna that naturally occurs in an area that was not introduced by humans.

Nearshore – The region of the sea or seabed beginning at the shoreline and extending offshore to an indefinite but relatively short distance from shore (defined as 3 nautical miles for this PEIS).

NOAA Trust Resources – Commercial and recreational fishery resources, diadromous species (fish, like salmon, that spawn in freshwater and then migrate to the sea, or species like the American eel, that spawn in sea water and then migrate to freshwater), marine mammals, endangered and threatened marine species, the habitats of the aforementioned species (such as marshes, mangroves, seagrass beds, coral reefs, and other coastal habitats), and resources associated with National Marine Sanctuaries and National Estuarine Research Reserves.

Outreach Activity - An effort to connect ideas or practices to the efforts of other organizations, groups, specific audiences, or the public.

Pelagic – Pertaining to, or living in, open water column.

pH – A scale for measuring the amount of free hydrogen ions in a substance to determine acidity and alkalinity.

Phytoplankton – Microscopic floating plants, mainly algae that are suspended in the water column and are transported by wave currents.

Plankton – Plants and animals, generally microscopic, that float or drift in freshwater or saltwater.

Programmatic Environmental Impact Statement – An EIS that supports site-specific NEPA reviews by narrowing the spectrum of environmental impacts to focus on during project-level reviews.

Program Priorities – Broad topics or subjects identified annually by the S-K Program to guide funding decisions. Proposals for funding by the program must identify a funding priority to which the proposed project relates.

Program Record – The Program Record contains the selection package for a funding solicitation, as well as any memos to the file created when selecting projects or running NOAA's various programs. This is located typically in the NOAA headquarters office.

Project – An organized effort funded under or consistent with the S-K Program to achieve an objective identified by location, activities, outputs, effects, and time period and responsibilities for execution.

Project Activity – Specific actions included as part of a project.

Project Goal – Overarching desired result of a project.

Project Objective – Specific aim or aims of a project to aid in reaching the project goal.

Project Record – The Project Record contains project-specific information such as proposals, progress reports, regulatory compliance information, etc. This is located with NOAA staff person who is primarily responsible for the project.

Project Type - Six primary categories of projects funded under or consistent with the S-K Program based on the project activities conducted.

Receiving Water Bodies –Surface waters that have flowing water delivered to them.

Record of Decision – The decision documentation for an EIS, including the date and a statement of reasons for the decision.

Resource – Anything that is useful for something, be it animal, vegetable, or mineral; a location; a labor force; or other commodity.

Restoration – The process of reestablishing a self-sustaining habitat that in time may come to closely resemble a natural condition in terms of structure and function.

Riparian – A form of wetland transition composed of multiple habitats and located between permanently saturated and upland habitats. These areas exhibit vegetation or physical characteristics reflective of permanent surface or subsurface water influence.

Rocky Intertidal – Extensive littoral habitats on wave-exposed coasts; the substrate is composed of boulders, rocks, or cobble.

Salinity – The concentration of dissolved salts in a body of water, commonly expressed as parts per thousand.

Sediment – Organic matter or soil that settles to the bottom of a liquid.

Semi-Aquatic – an animal living partly on land and partly in water; a plant growing in very wet or waterlogged ground.

Soft Bottom – Loose, unconsolidated substrate characterized by fine- to coarse-grained sediment.

Species – A fundamental category of plant or animal classification.

Standard – A principle requiring a specific level of attainment; a rule to measure against.

Stream – A channel with defined bed and a bank that carries enough water flow at some time during the year to flush out leaves.

Submerged Aquatic Vegetation (SAV; Marine, Brackish, and Freshwater) – Flowering plants that grow on soft sediments in sheltered shallow waters of estuaries, bays, lagoons, and lakes.

Subtidal – Continuously submerged areas affected by ocean tides.

Surface Water – Estuaries or freshwater bodies that are located above ground.

Threatened Species – Any species which is likely to become endangered within the foreseeable future and which has been designated in the Federal Register as threatened species (see endangered species).

Tide – The rhythmic, alternate rise and fall of the surface (or water level) of the ocean, and connected bodies of water, occurring twice a day over most of the Earth, resulting from the gravitational attraction of the moon, and to a lesser degree, the sun.

Tiering – The coverage of general matters in a broader environmental impact statement (such as national program or policy statements) with subsequent narrower statements or environmental analyses (such as regional or basin-wide program statements or, ultimately, site-specific statements), incorporating by reference the general discussions and concentrating solely on the issues specific to the subsequent statements or analyses as follows: (1) from a program, plan, or policy environmental impact statement to a program, plan, or policy statement or analysis of lesser scope or to a site-specific statement or analysis; or (2) from an environmental impact statement on a specific action at an early stage (such as need and site selection) to a supplement (which is preferred) or a subsequent statement or analysis at a later stage (such as environmental mitigation). Tiering in such cases is appropriate when it helps the lead agency to focus on the issues that are ripe for decision and exclude from consideration issues already decided on or not yet ripe (40 CFR § 1508.28).

Typical – Showing the characteristics expected of or usually associated with a particular person, situation, or thing.

Undertaking – A project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including those carried out by or on behalf of a Federal agency; those carried out with Federal financial assistance; and those requiring a Federal permit, license or approval.

Water Column – A conceptual volume of water extending from the water surface down to, but not including, the substrate.

Watershed – An area of land with a single drainage network.

Wetlands – Those areas that are inundated by surface water or groundwater often enough to support plants and other aquatic life that requires saturated or seasonally saturated soils for growth and reproduction. Wetlands generally include swamps, marshes, and bogs, and similar areas such as sloughs, potholes, wet meadows, river overflows, mud flats, and natural ponds.

Appendix G: Scoping Report

Introduction

The National Oceanic and Atmospheric Administration (NOAA) is preparing a Programmatic Environmental Impact Statement (PEIS) for the implementation of the Saltonstall-Kennedy (S-K) Research and Development Program (S-K Program). The Saltonstall-Kennedy (S-K) Act of 1954 (15 U.S. Code [U.S.C.] 713c-3) established a program to provide financial support for research and development of any aspect of U.S. commercial fisheries (e.g., commercial wild capture, recreational, cultural and subsistence, and marine aquaculture). The S-K Program implements projects that foster the promotion, marketing, research, and development of U.S. fisheries and their associated sectors.

The focus of this PEIS is the activities and projects under the S-K Program, which interface with numerous programs within NOAA. The S-K Program funds projects that address the needs of fishing communities, optimize economic benefits by building and maintaining sustainable fisheries (where the term "fisheries" includes commercial wild capture, recreational fishing, cultural and subsistence fishing, and marine aquaculture), and increase other opportunities to keep working waterfronts viable.

Description of the Public Scoping Process

Scoping is an early and open process designed to determine the scope of issues addressed in depth in the analysis included in the PEIS. On February 23, 2021, NOAA published a Notice of Intent to prepare an EIS in the Federal Register (86 FR 10941). This Notice of Intent (NOI) initiated a 30-day scoping period during which the public and agencies were invited to provide input on the scope of the EIS. In addition, NOAA hosted three virtual public scoping meetings between March 9 and 11, 2021. To help shape the scope of the analysis in this PEIS, NOAA considered the public and agency scoping comments received during the scoping period.

The scoping meeting provided information to stakeholders about the process in which they take part. This report is an overview of substantive comments that NOAA received during the comment period (February 23, 2021, through March 25, 2021).

Public Scoping Meetings

To facilitate the public and agency involvement in the PEIS process, NOAA held three public scoping meetings during the scoping period. The meetings were virtual in format. The scoping meetings solicited input from the public and interested public agencies regarding the scope of environmental impacts to be addressed in the draft PEIS. Three virtual public scoping meetings (in webinar format only) were held in each of three regions, as follows:

- Eastern and Gulf of Mexico Region (includes Atlantic States, Gulf of Mexico States, U.S. Virgin Islands, and Puerto Rico) – March 9, 2021
    - 12:00 p.m.–3:00 p.m. Central Standard Time (CST)
    - 1:00 p.m.– 4:00 p.m. Eastern Standard Time (EST)
- Western Region (includes Pacific States, Idaho, Alaska) – March 10, 2021
    - 10:00 a.m.–1:00 p.m. Pacific Standard Time (PST)
    - 9:00 a.m.–12:00 p.m. Alaska Standard Time (AKST)

- Western Pacific Region (includes Hawaii and Pacific Territories) – March 11, 2021, March 12, 2021
    - March 11, 2021, 2:00 p.m.–5:00 p.m. Hawaii-Aleutian Standard Time (HST)
    - March 12, 2021, 10:00 a.m.–1:00 p.m. Chamorro Standard Time (CHST)

The virtual scoping meetings occurred at times appropriate for each region, as listed above. In advance of the meetings, NOAA provided informational material on the S-K Program and the PEIS process via the project website and shared broadly via outreach efforts and materials. During the meetings, NOAA provided an overview presentation of the S-K Program's history, objectives, and award types. NOAA then provided an overview of the purpose of the S-K Program PEIS, the NEPA and the PEIS scoping process, and the preliminary proposed scope of the PEIS analysis, including the purpose and need, a summary of projects funded under the S-K Program, proposed alternatives, and types of resource assessments included. Following the presentation, the public could ask clarifying questions of NOAA staff. Following the question-and-answer session, the public had an opportunity to provide oral comments on the scope of the PEIS, on the record. NOAA shared how the public could provide comments outside of the virtual scoping meetings via the Federal e-Rulemaking Portal: www.regulations.gov, as described in the NOI.

Comment Issue Summary

A multi-stage process was used to analyze public scoping comments that included sorting and summarizing public comment submissions into categories based on common themes. The goal of this process was to ensure that NOAA reviewed and synthesized each substantive comment that was pertinent to the proposed action. Substantive comments constitute assertions, suggested alternatives or actions, data, background information, or clarifications relating to development of the Draft PEIS document. NOAA then assigned each substantive comment to an issue category listed in the Source of Scoping Comments Section below. NOAA synthesized comments into succinct comment summary statements that are intended to capture the particular concern within each issue category. Comment summary statements capture the range of concerns received on a specific issue.

- NOAA received six distinct written comments through the public scoping process. The public may review these comments received at https://www.regulations.gov/document/NOAA-NMFS-2021-0012-0001.

- NOAA received one distinct verbal comment through the public scoping process. The public may review this comment in Table G-1 below.

Table G-1. Oral Comment Received During Public Scoping Meetings on the Saltonstall-Kennedy Research and Development Program Programmatic Environmental Impact Statement

Name	Role	Affiliation	Location	Comment Date	Comment
Jeff Kaelin	Director of Sustainability and Government Relations	Lund's Fisheries	Cape May, NJ	03/09/2021	Our fishing company was started in '54. We have 17 boats. We range from Paris to the Gulf of Maine and out to Georges. And like I said earlier, after fishing, I worked on the Hill. And over the years, I have been a Council member and a reviewer of S-K Projects. And we actually are involved with our Science Center for Marine Fisheries, which is an industry funded / university partnership with the National Science Foundation—has a project that was approved by S-K to do an offshore survey of the Menhaden Fishery. So, it's an extremely important project, or program for us, and we're in support of the proposed federal action to fund project consistent with the scope of the S-K Program as outlined in the Federal Register. I jumped on today just to kind of understand exactly where you're headed. As I mentioned in my question period, I would like to see the funding history of the Program over the 10-year period capture, because I personally would just like to see it myself. But I think it would help the public understand the kind of the changes. We've had—we've had some good years, and we've had some bad years relative to the availability of funds. So, I'm speaking in support of the review and the determination to fund project consistent with the historic scope of the Program. Thank You.

Source of Scoping Comments

Scoping comments submitted during preparation of the PEIS came from the following sources:

- Electronic submission via the Federal e-Rulemaking Portal (www.regulations.gov).
- Oral comments submitted at scoping meetings held by NOAA.
- Written comments submitted at a scoping meeting held by NOAA.

Issues Identified During Scoping

NOAA received comments supporting and opposing the preparation of a Programmatic Environmental Impact Statement for the implementation of the Saltonstall-Kennedy Research and Development Program. In general, portions of the five summarized comments received were opposed to specific parts of the action. These comments fell into two categories – opposition to inclusion of offshore finfish aquaculture projects in the PEIS for the S-K Program, and comments about the implementation of S-K Program funding – as summarized below. Rationale, when provided, included concerns for impacts from offshore finfish aquaculture, and concerns about the use of S-K Program funding, respectively. Additional detail is captured in the topic summaries below.

Opposition to inclusion of offshore finfish aquaculture projects in the PEIS for the S-K Program

- Offshore finfish aquaculture projects should not be included in the PEIS for the S-K Program, because of potential environmental and socio-economic harms of supporting industrial finfish aquaculture facilities, which include, but are not limited to: escapes, use of pesticides and other

chemicals, discharge of pollutants, harm to wild marine life, harm to forage fish and environment for feed, and socio-economic impacts to communities.

Implementation of S-K Program funding

- Providing additional resources for aquaculture, should come from a separate grant program devoted to truly sustainable production methods that do not harm domestic fisheries.
- The Promotion, Marketing, Research and Development (PMRD) Alternative should be properly capitalized with funds from the S-K Fund. Internal budgeting priority needs to shift in order to successfully implement the PMRD Alternative.
- Comments from the industry and communities should be included in developing funding priorities for the PMRD Alternative which will shift over time as new challenges and opportunities arise.
- A timely annual S-K Fund report should be completed, which includes a list and summary of the prior 10 years of S-K Grant funded projects and priorities, as well as a list of other projects funded by S-K Act funding.
- Funds from trade tariffs/import duties on marine products imported into the USA, and which compete with US-produced seafood products, should be used to help the US seafood industry compete against imported seafood.

Formulation of Alternatives

NOAA developed preliminary alternatives for presentation to agencies and the public during scoping. These alternatives included Proposed Action alternative (Promotion, Marketing, Research, and Development Alternative) which allows for funding actions for all possible types of projects that meet the needs of U.S fishing communities, consistent with the scope of the S-K Program and a No Action alternative (No Action Alternative) under which the S-K Program would not fund projects as described under the Proposed Action

NOAA preliminarily prepared to analyze two program-level alternatives: (1) A No Action Alternative, and (2) the proposed action, which NOAA is referring to as the Promotion, Marketing, Research and Development Alternative. Under the No Action Alternative, the S– K Program would not fund projects that address the needs of fishing communities, optimize economic benefits by building and maintaining sustainable fisheries, and/or increase other opportunities to keep working waterfronts viable. Although the No Action Alternative would not meet the purpose and need, it serves as a baseline against which the impacts of the Promotion, Marketing, Research and Development Alternative will be compared and contrasted. Implementation of the Promotion, Marketing, Research and Development Alternative, will allow for funding actions through federal financial assistance for all possible types of projects that meet the needs of U.S. fishing communities, consistent with the scope of the S–K Program. This alternative would provide the S–K Program with flexibility in choosing priorities each year while also considering the funding environment.

Contact

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Appendix H: Public Comments

Table H-1. Draft PEIS Comments and Responses

Comment #	Section	Submitter	Comment	Response
1-1	Section 3.4.1	Prentiss-Jane Fabela, Environmental Science major at Portland State University	This one caught my interest not just as a student but as someone that grew up in Astoria, Oregon, a town that relies heavily on its fishing culture and history. I noticed that in the Draft PEIS there is brief reference to GHG emissions as being anthropogenic (Protected Species, 2nd paragraph, p. 113) and its cumulative effects on a changing environment. This is viewed through the lens of its impacts on Protected Species (Sea Turtles, Marine Mammals, and Marine Birds). Prior to this, GHG is also mentioned in section 3.4.1 (beginning in 1st paragraph, p.49) as part of the Air Quality impacts generated by S-K funded projects. They are referred to as negligible due to their relatively small contribution to ocean traffic and are, “generally expected to be imperceptible or nondetectable and are not analyzed further.” While I understand that this is a programmatic EIS and individual projects will be analyzed on a case-by-case basis, this also provides a unique opportunity to create stricter mitigation for any GHG emissions being contributed from an S-K project.	Comment relates to emissions from greenhouse gases related to S-K Program projects with an indirect request to set stricter standards and prioritize S-K projects that use fewer fossil fuels. The request is beyond the scope of the S-K PEIS as the request relates to setting stricter standards for greenhouse gas emissions. The draft S-K PEIS analyzes the environmental impacts of S-K Program projects but does not influence the S-K Program project selection process In general this comment is addressed in Section 3.4.1, "NOAA Fisheries and subsequent S-K Program funded projects adhere to NOAA’s environmental procedures that comply with MARPOL 73/78 and relevant air quality implementing legislation, regulations, and guidance. In addition, projects funded through the S-K Program are dispersed throughout the action area, which would minimize any impact from air emissions from a single vessel or aircraft. S-K Program funded project vessels also represent only a negligible portion of total oceanic vessel traffic, and any resulting impacts produced would be indistinguishable from those produced by all other vessels within the action area. Therefore, potential impacts from emissions on air quality are generally expected to be imperceptible or nondetectable and are not analyzed further."

Comment #	Section	Submitter	Comment	Response
1-2	Section 3.4.1	Prentiss-Jane Fabela, Environmental Science major at Portland State University	Fishing industry has a reputation for a high-fossil fuel energy input, and while it may not be the primary source of those emissions, fuel use efficiency and lowering emissions rates are worth addressing regardless (1). All contributions to GHG emissions will be affecting the environment of those protected species mentioned. I understand that focus on fisheries is primarily coming from an economic perspective, asking the question of, "how can we continue to take, while maintaining a population that will continue to produce?" Management decisions surrounding rebuilding stocks where they have been depleted and opting for a short-term 'no-take' scenario could aid in reduction of fuel consumption/use and GHG emissions made by S-K programs (1). By prioritizing programs with long-term conservation and technological improvements geared toward lowered GHG emissions as part of their plans, it can aid in long-term economic stability for fisheries and communities dependent on them.	Same response as above for Comment 1-1.
1-3	Section 3.4.2	Prentiss-Jane Fabela, Environmental Science major at Portland State University	Being from the Pacific NW, raised in a town that was notable for its salmon and canneries, I understand the need for maintaining a healthy fishery and keeping local economies vital. I was raised during the recovery period from an economic downturn that hit when overfishing closed the last major cannery in the area. Overfishing had been impacting the local fisheries for over a century by that time, causing multiple salmon species to become endangered and some salmon runs becoming extinct (2). Again, I understand that as a programmatic EIS all projects referenced were generalized and so the analysis of impacts was also generalized. I also understand however that as a program choosing to fund individual projects there is an opportunity to set stricter guidelines than the minimum legal requirements for best practices. I hope that you take these comments into consideration when addressing the goals of the program as well as any future analysis.	Same response as above for Comment 1-1.

Comment #	Section	Submitter	Comment	Response
2-1	Sections 4.5.2, 4.5.3, and 4.5.4	Catherine Kilduff Center for Biological Diversity	Please revise the draft programmatic EIS to consider the impact of fishing, and thus the S-K grant program, on the global plastic pollution crisis. The draft EIS purports to provide "a framework for programmatically assessing the environmental impacts of projects that are consistent with the scope of the S-K Program." Nowhere does the draft EIS discuss plastic pollution from fishing gear, despite that globally derelict fishing gear is considered to be the largest plastic pollution by volume. By analyzing the plastic pollution problem and including mitigation in the alternatives in the EIS, the S-K grant program not only will fulfill its responsibilities under the National Environmental Policy Act (NEPA), but also the Marine Debris Act. Pollution from derelict or abandoned fishing gear is ubiquitous on U.S. coastlines. The NOAA Marine Debris Program annually documents copious volumes of fishing gear removed from many states. In 2018, for example, the report highlights crab pot recovery programs in North Carolina (over 8,500 crab pots), lobster trap removal in Long Island Sound in New York (8.6 metric tons of marine debris), crab pots and lines removed on Washington's outer coast (1,300 pots), Hawai'i (155 metric tones of marine debris), and Alaska (125 metric tons of marine debris).4 The scope of the problem demands prevention at the national, programmatic level – like the S-K grant program – in addition to changing individual behaviors. The wasteful loss of marine life due to incidental entanglement in active and derelict gear is staggering. (Sometimes it is impossible to know whether the gear was active or abandoned.) As one example, citizen science surveys from coastal California from 1997 to 2017 showed that 97 percent of seabird species were found entangled.5 The results showed that results indicate that "entanglement is chronic among diving birds (i.e. alcids, cormorants) and surface-feeding seabirds (i.e. gulls, tubenoses) with > 61% cases represented by five species."6 As compared to the marine debris removal efforts discussed above that focus on large fishing nets and traps/pots, this study found that the "primary source of entanglements was from monofilament line with and without hooks/lures – which are either ingested, or wrapped around the birds' bodies, wings, or legs, impairing mobility and perhaps ultimately leading to starvation or drowning."7 This shows that the problem of fishing gear pollution can be more extensive than what is recorded; the monofilament line is less obvious and difficult to recover than a trap or pot. There is an extensive amount of research and effort toward this problem of plastic pollution from the fishing industry and much of it is NOAA-funded. I have provided a cursory list of references below to aid in NOAA's analysis in the EIS. It is past time that NOAA consider plastic pollution be considered in every NEPA document regarding fisheries research, funding and management. Please consider these comments in the final EIS. Thank you.	The draft S-K PEIS analyzes the impacts of S-K Program projects. The S-K PEIS analyzes six project types, three of which include projects that can be implemented in the physical and biological environments and thus can potentially have impacts on resources within these environments. (Research and Monitoring; Gear Testing, Bycatch Reduction, and Processing Studies; and Aquaculture). Due to the programmatic nature S-K PEIS, the implementation of S-K Program projects is broadly analyzed. Within the list of previously funded S-K Projects (Appendix B, Table B-1) are projects that have implemented sampling technologies and operations such as deploying anchors or other instruments to measure oceanographic, bathymetric, and water quality conditions, or tagging fish to better understand their distributions and behavior. It is only these S-K projects that are programmatically analyzed within this PEIS, not the "impact of fishing" as a whole, as it relates to the global plastic pollution crisis from fishing gear. The draft S-K PEIS already includes project specific responsibilities as they relate to NEPA and ESA (Section 4.1 and Section 3.5). Additional analysis has been added to the Research and Monitoring (Section 4.5.2), Gear Testing, Bycatch Reduction, and Processing Studies (Section 4.5.3), and Aquaculture (Section 4.5.4) project types as it relates to any impacts of plastic pollution from fishing and research/monitoring gear employed to carry out S-K Program project objectives.